Final Dredged Material Management Plan and
Final Programmatic Environmental Impact Statement

Long Island Sound
Connecticut, New York and Rhode Island

US ARMY CORPS
OF ENGINEERS
New England District

December 2015

US Army Corps
of Engineers ®
New England District

696 Virginia Road
Concord, MA 01742-2751

Public Notice

In Reply Refer to: Meghan Quinn
Programs & Project
Management Division
Date: January 11, 2016

The U.S. Army Corps of Engineers (USACE) has completed a Final Dredged Material Management Plan (DMMP) and Final Programmatic Environmental Impact Statement (PEIS) for Long Island Sound. The DMMP was requested by the Governors of Connecticut and New York, in their letter of February 8, 2005 to the Chief of Engineers. The need for a DMMP was also identified by the U.S. Environmental Protection Agency's (EPA) June 3, 2005 Rule that designated two of the Sound's historic open-water placement sites, the Central Long Island Sound and Western Long Island Sound Sites (CLDS and WLDS) for continued use. The EPA's rule required preparation of a DMMP to examine alternative placement practices, with the goal of reducing or eliminating open-water placement of dredged material in the waters of Long Island Sound wherever practicable.

USACE is responsible for maintaining 52 Federal Navigation Projects (FNP) in Long Island Sound (LIS) and adjacent waters that include dredged general navigation features (channels, anchorages, and turning basins) requiring periodic maintenance dredging. These include 31 projects in Connecticut, 17 in New York and four in Rhode Island. Dredging is necessary for the continued maintenance, and occasional improvement of these harbors to maintain safe navigation. Other Federal agencies, including the U.S. Navy, U.S. Coast Guard, and the Maritime Administration, operate facilities around Long Island Sound requiring navigational access.

The DMMP and PEIS identify a range of dredged material placement options for all Federal projects in the Long Island Sound region which might be dredged. Options are also identified for consideration by non-Federal dredging proponents. Collectively these Federal, state, local and private dredging activities total about 53 million cubic yards over a 30-year period. However, only a portion of these are likely to be dredged in that period, as future actions are contingent on Federal and non-Federal budget decisions. The DMMP was tasked with identifying options to be considered in the future by those projects that are ultimately funded.

Placement alternatives are identified based on the types of material expected to be dredged for each project. Most sandy materials dredged in and around the Sound are already beneficially used for beach nourishment purposes under Federal/State partnerships, and that practice is expected to grow in the future.

Dredged materials which do not pass the stringent testing requirements and are determined to be toxic are not, and will not in the future, be placed in the open waters of Long Island Sound. These materials presently and in the future will require either containment or treatment.

Fine-grained dredged materials which do pass the stringent testing requirements may be used for beneficial uses such as marsh creation or remediation capping of former disposal areas, should State and Local governments wish to sponsor such projects. Federal cost-sharing may be available for those uses subject to further study. If beneficial uses are not pursued then those materials may be placed in open water sites in the Sound.

The draft DMMP and PEIS were released for a 60 day public comment period beginning on Aug. 17, 2015 and ending on Oct. 16, 2015. During that time, USACE held six public hearings: Aug. 24, 2015; in Port Jefferson, NY; Aug. 25, 2015 in Uniondale, NY; Aug. 26, 2015 in Stamford, CT; Aug. 27, 2015 in New London, CT; Sept. 16, 2015 in Riverhead, NY; and Sept.17, 2015 in New Haven, CT. Over 1,800 comment letters and emails were received during the comment period and were addressed in the Final DMMP/PEIS, in addition to comments made at the public hearings.

Implementation of the DMMP's recommendations to further study and pursue beneficial uses and other alternatives to open water placement of dredged materials in Long Island Sound will require State and Local government sponsorship of such projects. Partnerships between the Federal, State and local governments to share the costs of these beneficial uses may be possible under existing Federal programs. State and local cooperation and involvement will be key to achieving the goals of the DMMP to reduce, where practicable, reliance on open water placement of dredged materials in Long Island Sound.

The Final DMMP and PEIS are available to the public as of today, January 11, 2016, on the Corps of Engineers web site at: http://www.nae.usace.army.mil/Missions/ProjectsTopics/LongIslandSoundDMMP.aspx

7 JAN 16
Date

Christopher J. Barron
Colonel, Corps of Engineers
District Engineer

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, US ARMY CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD MA 01742-2751

December 31, 2015

Programs & Project Management Division
Civil/IIS Project Management Branch

The Honorable Dannel P. Malloy
Governor of Connecticut
State Capitol
210 Capitol Avenue
Hartford, Connecticut 06106

Dear Governor Malloy:

Enclosed please find a CD copy of the Final Dredged Material Management Plan (DMMP) and Final Programmatic Environmental Impact Statement (PEIS) for Long Island Sound. The draft DMMP/PEIS was released for public and agency review on August 17, 2015. Six public hearings were held, three each in Connecticut and New York. Public and agency comments were taken into consideration in preparing the final documents.

The DMMP/PEIS should serve as a guideline for future dredged material management actions in Long Island Sound. Moving forward, a significant level of partnership will be necessary if the DMMP's goal of reducing reliance on open water placement of dredged materials is to be realized. This partnership is needed both among the states (Connecticut, New York and Rhode Island) and between all of the states and the Federal government. The U.S. Army Corps of Engineers (USACE) is prepared to assist the states, where Federal interest in particular solutions is warranted, in achieving this goal, as outlined in the DMMP's recommendations.

These final documents will also be made available to the public and other agencies through the USACE New England District and New York District websites on January 11, 2016.

If you have any questions or comments, please contact Ms. Meghan Quinn, Project Manager, at (978) 318-8179, or Mr. Michael Keegan, Chief, Civil/IIS Project Management Branch, at (978) 318-8087. The USACE looks forward to working with the states and other stakeholders in implementing the recommendations of the DMMP.

Sincerely,

Christopher J. Barron
Colonel, Corps of Engineers
District Engineer

Enclosures

Same Letter Sent to: see attached

SAME LETTER SENT TO:

The Honorable Richard Blumenthal
United States Senate
702 Hart Senate Office Building
Washington, DC 20510

Copy Furnished:
The Honorable Richard Blumenthal
United States Senate
90 State House Square, 10th Floor
Hartford, CT 06103

The Honorable Chris Murphy
United States Senate
Washington, D.C. 20510

Copy Furnished:
The Honorable Chris Murphy
United States Senate
One Constitution Plaza, 7th Floor
Hartford, CT 06103

The Honorable John Larson
United States House of Representatives
1501 Longworth House Office Bldg
Washington, D.C. 20515

Copy Furnished:
The Honorable John Larson
United States Representative
221 Main Street, 2nd Floor
Hartford, CT 06106

The Honorable Joe Courtney
United States House of Representatives
2348 Rayburn House Office Building
Washington, D.C. 20515

Copy Furnished:
The Honorable Joseph Courtney
United States Representatives
55 Main Street, Suite 250
Norwich, CT 06360

The Honorable Joseph Courtney
United States Representative
77 Hazard Avenue, Unit J
Enfield, CT 06082

The Honorable Rosa DeLauro
United States House of Representatives
2413 Rayburn House Office Building
Washington, D.C. 20515

Copy Furnished:
The Honorable Rosa DeLauro
United States Representative
59 Elm Street
New Haven, CT 06510

The Honorable James Himes
United States House of Representatives
119 Cannon House Office Building
Washington, D.C. 20515

Copy Furnished:
The Honorable James Himes
United State Representative
211 State Street, 2nd Floor
Bridgeport, CT 06604

The Honorable James Himes
United State Representative
888 Washington Boulevard, 10th Floor
Stamford, CT 06901

The Honorable Elizabeth Esty
United States House of Representatives
509 Cannon House Office Building
Washington, D.C. 20515

Copy Furnished:
The Honorable Elizabeth Esty
United States Representative
114 West Main Street
Old Post Office Plaza, LLC
New Britain, CT 06051

The Honorable Charles E. Schumer
United States Senate
322 Hart Senate Office Building
Washington, D.C. 20510

Copy Furnished:
The Honorable Charles E. Schumer
United States Senate
780 Third Avenue, Suite 2301
New York, NY 10017

The Honorable Kirsten Gillibrand
United States Senate
478 Russell
Washington, DC 20510

Copy Furnished:
The Honorable Kirsten Gillibrand
United States Senate
780 Third Avenue, Suite 2601
New York, New York 10017

The Honorable Lee Zeldin
United States House of Representatives
1517 Longworth House Office Building
Washington, DC 20515

Copy Furnished:
The Honorable Lee Zeldin
United States Representative
31 Oak Street, Suite 20
Patchogue, NY 11772

The Honorable Steve Israel
United States House of Representatives
2457 Rayburn House Office Building
Washington, DC 20515

Copy Furnished:
The Honorable Steve Israel
United States Representative
534 Broad Hollow Road, Suite 302
Melville, NY 11747

The Honorable Joseph Crowley
United States House of Representatives
1436 Longworth House Office Building
Washington, D.C. 20515

Copy Furnished:
The Honorable Joseph Crowley
United States Representative
82-11 37th Avenue, Suite 402
Queens, NY 11372

The Honorable Eliot L. Engel
United States House of Representatives
2462 Rayburn House Office Building
Washington, DC 20515

Copy Furnished:
The Honorable Eliot L. Engel
United States Representative
6 Gramatan Avenue, Suite 205
Mt. Vernon, NY 10550

The Honorable Nita Lowey
United States House of Representatives
2365 Rayburn House Office Building
Washington, DC 20515

Copy Furnished:
The Honorable Nita Lowey
United States Representative
67 North Main Street, #101
New City, NY 10956

The Honorable Gina M. Raimondo
Governor of Rhode Island
82 Smith Street
Providence, RI 02903

The Honorable Andrew M. Cuomo
Governor of New York State
NYS State Capitol Building
Albany, NY 12224

The Honorable Jack Reed
United States Senate
728 Hart Senate Office Building
Washington, DC 20510

Copy Furnished:
The Honorable Jack Reed
United States Senate
U.S. District Courthouse
One Exchange Terrace, Suite 408
Providence, RI 02903-1744

The Honorable Sheldon Whitehouse
United States Senate
Hart Senate Office Bldg. Room 530
Washington, DC, 20510

Copy Furnished:
The Honorable Sheldon Whitehouse
United States Senate
170 Westminster St. Suite 1100
Providence, RI, 02903

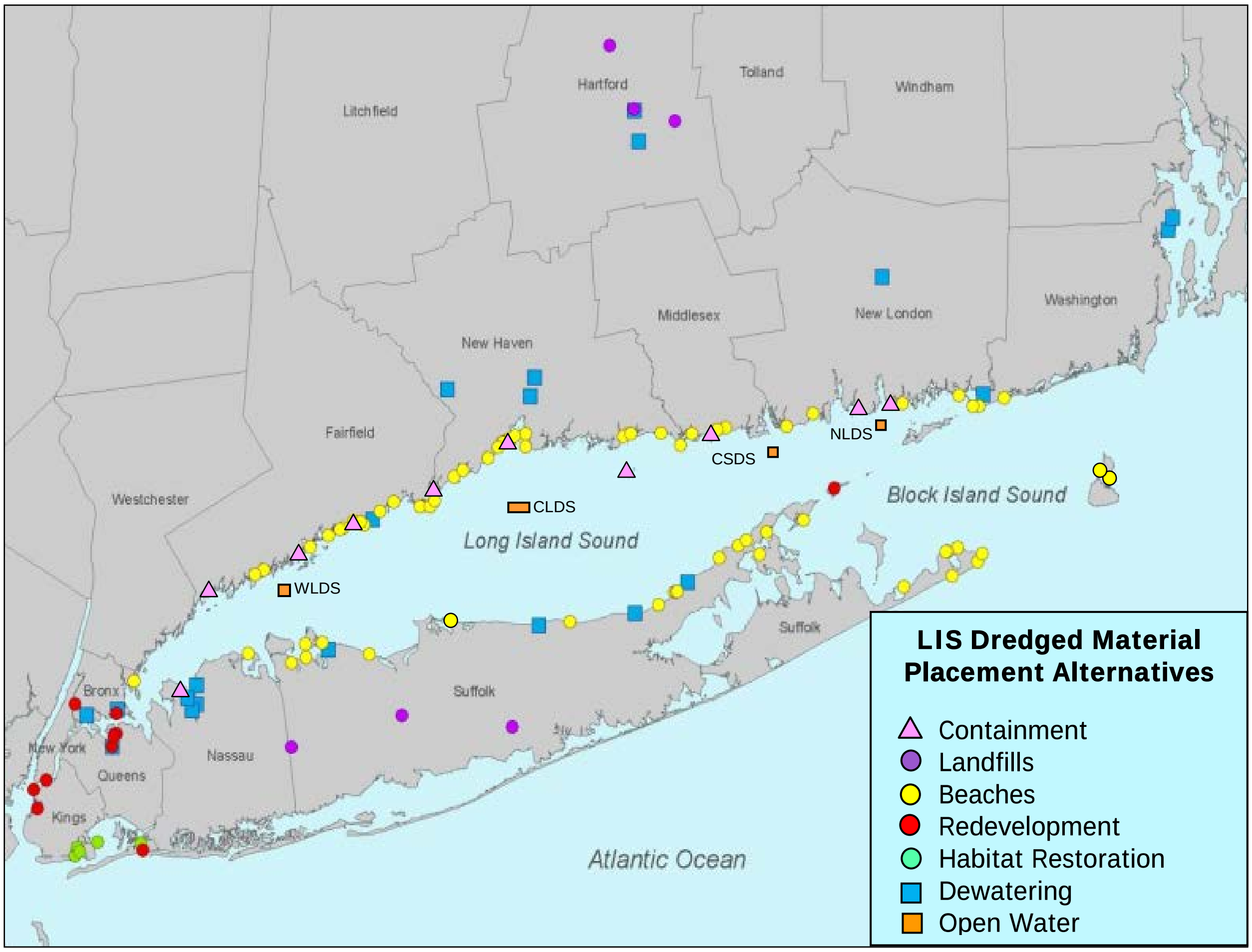
The Honorable James Langevin
United State House of Representatives
109 Cannon House Office Building
Washington, DC 20515

Copy Furnished:
The Honorable James Langevin
United State Representative
300 Centerville Rd, Suite 200 South
Warwick, RI 02886

LONG ISLAND SOUND

FINAL DREDGED MATERIAL MANAGEMENT PLAN AND FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

CONNECTICUT, NEW YORK AND RHODE ISLAND



DECEMBER 2015

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) is responsible for maintaining 55 Federal Navigation Projects (FNP) in Long Island Sound (LIS) and adjacent waters, 52 of which include dredged general navigation features requiring periodic maintenance dredging. Three projects, all in New York, consist only of breakwaters and require no maintenance dredging. The dredged navigation projects include 31 projects in Connecticut, 17 in New York and four in Rhode Island. Fourteen of these projects, all in Connecticut, are deep draft projects with authorized depths of 15 feet or greater, and four have maintained depths of 35 feet or greater. Four projects are harbors of refuge.

These projects consist principally of dredged channels, anchorages, turning basins, and other features including stone jetties and breakwaters. Dredging is necessary for the continued maintenance, and occasional improvement of these harbors to maintain safe navigation. Where to place and how to best use dredged material from harbors in and around the Sound has been an increasingly contentious issue. Periodically, individual projects are also improved to provide greater depths in order to improve navigation and to meet the changing needs of waterborne commerce. Other Federal agencies, including the U.S. Navy, U.S. Coast Guard, Maritime Administration, and the National Marine Fisheries Service, operate facilities around Long Island Sound requiring navigational access.

Historically, the majority of dredged material in the region was placed in open water sites in LIS. Even today most dredged material is found suitable for open water placement in the Sound following extensive physical, chemical, and biological testing. Over the past 30 years, however, local groups and regulatory agencies have increased their efforts to encourage minimizing open water placement of dredged material in LIS, particularly in New York waters, and to encourage maximizing the amount of dredged material that is handled by upland placement or management methods. This Dredged Material Management Plan (DMMP) and the accompanying Programmatic Environmental Impact Statement (PEIS) examine the need for dredging, past dredging history and dredged material placement, and current beneficial use practices. The DMMP identifies and assesses alternatives for future dredged material placement and beneficial use for each Federal project and separable component, and identifies the likely Federal Base Plans for future FNP dredging activities.

The Federal Base Plan for any particular project is defined as the least cost environmentally acceptable alternative for constructing the project. Projects must be planned, designed and constructed in a manner that most efficiently uses Federal fiscal resources (and the non-Federal sponsor's fiscal resources where improvements are included), consistent with Federal law and regulations, and the economic and environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies. The term Federal Standard is often used synonymously with Federal Base Plan, and is defined in USACE regulations as the least costly dredged material placement alternative identified by USACE that is consistent with sound engineering practices and meets all Federal environmental requirements (including those established under the Clean Water Act (CWA) and the Marine Protection Research and Sanctuaries Act (MPRSA). Federal Base Plan is a more accurate operational description of the Federal Standard, because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project.

Establishing the Federal Base Plan for a particular dredging project is not the same as selecting a placement option for that project, nor does it limit potential Federal participation in the project. Other factors beyond cost contribute to decisions on placement options for dredging projects. Ecosystem restoration is recognized as one of the primary missions of the USACE under its budget guidance, and the placement option that is selected for a project should maximize the sum of net economic development and environmental restoration benefits. A beneficial use option may be selected for a project even if it is not the Federal Base Plan (Federal Standard) for that project.

If a beneficial use is selected for a project and that beneficial use happens to be (or be part of) the Federal Base Plan option for the project the costs of that beneficial use are assigned to the navigational purpose of the project. If the project is Federal maintenance dredging then all costs of the Base Plan are Federal. If the project involves improvement dredging the Base Plan costs are shared with the non-Federal sponsor according to the navigation project depth. Beneficial use project costs exceeding the cost of the Federal Base Plan (Federal Standard) option become either a shared Federal and non-Federal responsibility, or entirely a non-Federal responsibility, depending on the type of beneficial use.

This DMMP is not a Decision Document, in that it does not recommend specific dredged material placement solutions for specific Federal Navigation Project activities. This DMMP will act as a framework to guide future investigations and inform decision-making for Federal actions with respect to dredging and dredged material placement. As individual projects come up for their next maintenance cycle, or as feasibility studies for proposed improvement dredging projects are prepared, those studies would reference the evaluations and recommendations in this DMMP in examining placement alternatives and making a final determination as to the Federal Base Plan, and appropriate beneficial use opportunities beyond the base plan. These additional project-specific studies would include preparation of Environmental Assessments (EA) and/or Environmental Impact Statements (EIS) under the requirements of the National Environmental Policy Act (NEPA). Where the projects consist of improvement dredging, or implementation of new placement facilities a feasibility report or other decision document would also be prepared. These individual studies and reports would solicit public input as they are prepared, and would be subject to Federal agency review, public review, and State regulatory reviews before they are finalized and any decision made as to dredging and dredged material placement recommendations.

Long Island Sound is a large coastal estuary located between Long Island, New York on the south, and the shores of New York, Connecticut and southwestern Rhode Island on the north. The Sound is about 105 miles long from Throgs Neck, NY in the west to Westerly, RI in the east. This study included adjacent waters from which dredged material was likely to originate within the draw area of any proposed regional disposal solution, including Block Island Sound, Little Narragansett Bay, Fishers Island Sound, Peconic Bay and Gardiners Bay. A total of nearly 240 harbors, coves, bays and rivers supporting various levels of navigational access are located along these shores. Twelve Congressional districts and 112 municipalities border the Sound and its adjacent waters in the three states. For planning purposes the study area was divided into 27 geographic 'dredging centers' for purposes of defining dredging needs and identifying placement alternatives (see Figure ES-1).

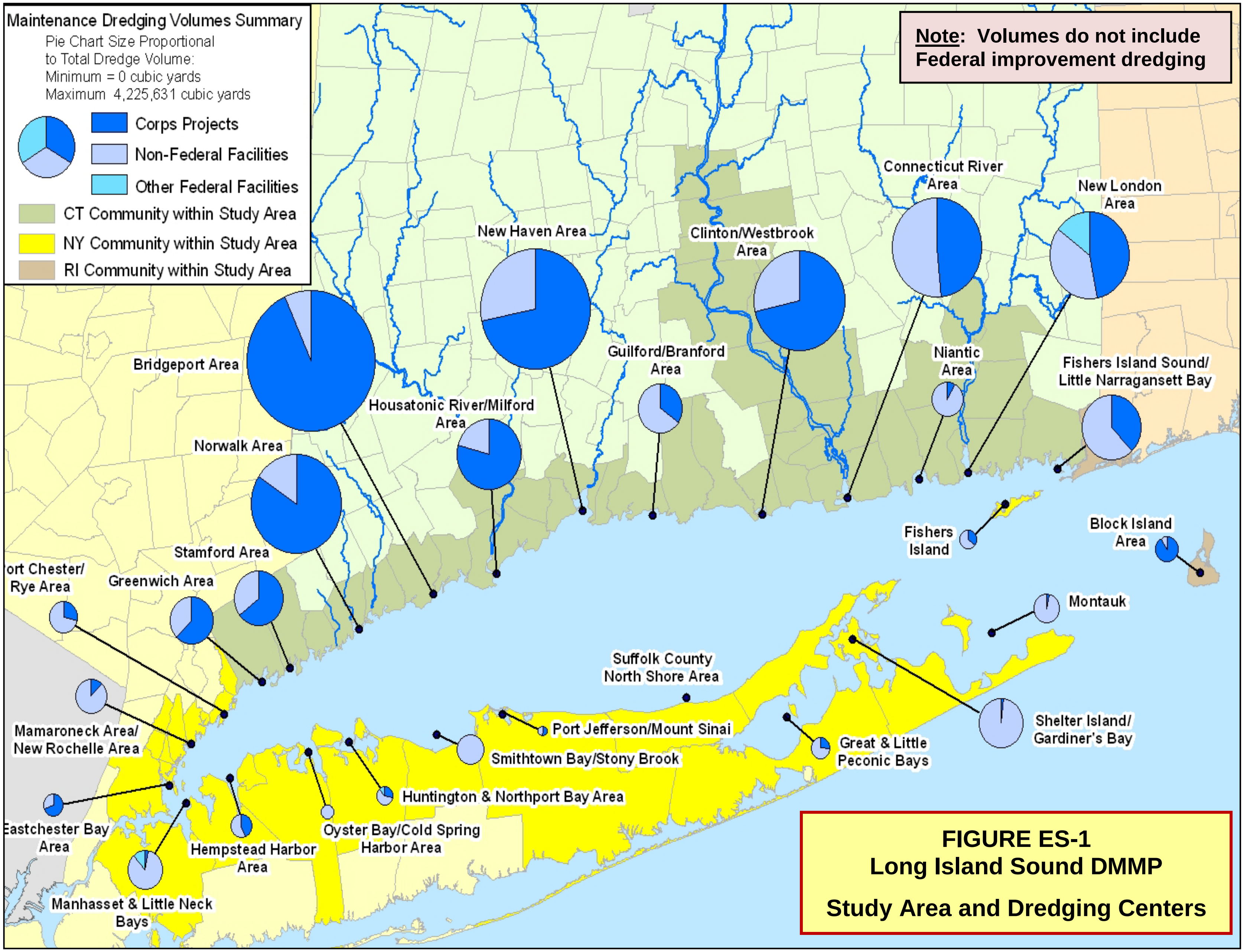


FIGURE ES-1
Long Island Sound DMMP
Study Area and Dredging Centers

Preparation of a DMMP was requested by the Governors of Connecticut and New York, in their letter of February 8, 2005 to the Chief of Engineers, following the U.S. Environmental Protection Agency's (EPA) publication in April 2004 of the Long Island Sound Dredged Material Disposal Site Designation Study Final Environmental Impact Statement (LIS FEIS). The USACE Director of Civil Works, in his response of May 17, 2005 confirmed USACE support for this effort. The LIS FEIS and subsequent June 3, 2005 Rule designated two of the Sound's historic open-water placement sites, the Central Long Island Sound and Western Long Island Sound Sites (CLDS and WLDS) for continued use. The Rule allowed those two sites to be used for eight years pending completion of a DMMP, with provisions for EPA to extend the term of use. The EPA has twice extended use of those two sites, with site closure now projected for April 30, 2016. Relevant sections of the USEPA Final Rule are quoted below:

> *"... each proposed dredging project will be evaluated to determine whether there are practicable, environmentally preferable alternatives to open-water disposal. … Alternatives to open-water disposal that will be considered include upland disposal and beneficial uses such as beach nourishment. If environmentally preferable, practicable disposal alternatives exist, open-water disposal will not be allowed."*

> *"[These restrictions] are designed to support the common goal of New York and Connecticut to reduce or eliminate the disposal of dredged material in Long Island Sound. To support this goal, the Restrictions contemplate that there will be a regional dredged material management plan (DMMP) for Long Island Sound that will guide the use of dredged material for projects which occur after the DMMP is completed. DMMPs are comprehensive studies carried out by the USACE, in consultation with the EPA and the affected states, to help manage dredged material in a cost-effective and environmentally acceptable manner."*

Without completion of a DMMP that identifies practicable cost-effective and environmentally acceptable placement alternatives to meet the dredging needs of LIS's ports and harbors, dredging costs will increase with the result that fewer project will be maintained, economic viability of projects will be reduced, and navigation dependent sectors of the regional economy will be impaired. Further, without a comprehensive DMMP, opportunities to beneficially use dredged material for purposes of coastal resiliency and environmental restoration and enhancement may be forgone.

It is anticipated that upon completion of the final DMMP report by the end of 2015, EPA will revisit the 2005 Rulemaking with respect to continued use of the CLDS and WLDS open water placement sites in LIS. EPA will need to determine whether or not to allow placement of dredged material at those or other sites after the current time extension expires in April 2016. If the sites remain available for use, EPA will also need to consider what conditions may be placed on that use, such as time-of-year restrictions on placement activities, types of material that can be placed, best management practices to be used, and any requirements for further site monitoring and investigations.

The USACE Engineering Regulation (ER) 1105-2-100 mandates that the USACE Districts develop DMMPs for all Federally maintained navigation projects where there is potentially insufficient placement capacity to accommodate maintenance dredging for at least the next 20 years. The DMMP ensures that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, and are economically justified. A DMMP addresses a full range of placement alternatives, leading to recommendation of final plans that ensure sufficient placement capacity is available for the next 20 years.

In June 2006, a Preliminary Assessment (PA) was completed under the USACE operations and maintenance authority for the existing FNPs in LIS. The PA documented the economic viability and navigational need for continued Federal maintenance of the FNPs in the LIS region. By agreement between the USACE, EPA and the states of CT and NY, the scope of the DMMP was developed to include examination of alternatives to open-water placement whether or not the existing open-water placement sites in LIS had sufficient capacity to accommodate all dredging needs for the next twenty years. Negotiations on study scoping began in late 2004, after the LIS FEIS was published in 2004 (before publication of EPA's site designation rule), but limited funding delayed the start of the DMMP until 2008. Uncertainty over funding, the regional nature of the DMMP with planning required for 52 FNPs, and consideration given to the needs of the more than 200 other smaller harbors led the stakeholders to adopt a study period of 30 years so that the placement capacity needs of all the LIS region's projects would fall within the study period.

A PMP for this DMMP was finalized in October 2007, and is provided as Appendix I to this report. As stated in the PMP, the overall goal of the LIS DMMP is to develop a comprehensive plan for dredged material management in Long Island Sound. The DMMP should lead to a continued reduction of the use of the sites over time using a broad based public process that protects the environment based on best scientific data and analysis, while meeting society's need for safe and economically viable navigation for water based commerce, transportation, national security, and other public purposes. The preamble to the EPA site designation rule stated that *"the DMMP for Long Island Sound will include the identification of alternatives to open-water disposal and the development of procedures and standards for the use of practicable alternatives to open-water disposal, so as to reduce wherever practicable the open-water disposal of dredged material. The DMMP also may contain recommendations regarding the use of the sites themselves."*

The first phase of the DMMP updated the literature review, environmental, economic and cultural resource evaluations, and dredging needs study, prepared for EPA's 2004 site designation FEIS. Additional DMMP efforts included:

- Establishing an interagency Project Delivery Team (PDT) of interested Federal and State agencies to assist in defining and guiding the study tasks and reviewing study products.
- Conducting public scoping meetings in CT and NY to solicit public input on the study.
- Preparing a Project Management Plan (PMP) to define the Federal authority for conducting the study, identify the study participants, define the procedures for public involvement, define the study review process, establish the goals and objectives of the DMMP, and define the process to be followed to meet those goals and objectives. In specific response to the 2005 Rule, the PMP also calls for "the development of procedures and standards for the use of practicable alternatives to open-water disposal" in LIS.
- Establishing a technical working group including the PDT members and other local and regional stakeholders, non-governmental organizations (NGOs), universities and marine commercial interests to assist in identifying and evaluating alternatives.

- Formulating a range of alternatives for evaluation including current and historic open water placement sites, beach and nearshore nourishment sites, upland landfills, island and shoreline confined disposal facilities, confined aquatic disposal cells, onshore dewatering/processing areas, marsh creation and enhancement sites, and other applications.
- Developed a dredged material transportation and placement cost matrix to enable cost comparison of the many alternatives for the 52 projects evaluated.
- Further updates to the dredging needs analysis were made in 2015 to include project specific shoaling rates and dredging volume/frequency projections for each individual FNP, and separable project segments and features producing different types of material.
- Categorizing and quantifying the types of dredged material into sandy materials v. fine-grained material, and suitable v. unsuitable (for open water placement) materials.
- Development of alternatives screening tools with public input through a multi-criteria decision analysis, followed up by a weighted evaluation considering environmental impact and benefits, distance of transport, availability and capacity of placement sites.
- Matching sources, volumes, and types of dredged materials with potential alternatives.
- Augmenting the list of top scoring alternatives for each FNP and separable segment and material type to ensure that a range of beneficial use alternatives was represented for each.
- Evaluating the final alternatives for each FNP and separable segment and material type for placement cost.
- Identifying the Federal Base Plans (the least cost environmentally acceptable alternative) consistent with the Federal Standard for each FNP and other Federal agency project.
- Identifying likely beneficial use alternatives to the Base Plan for each FNP and separable segment and potential means and authorities for implementing those alternatives.

An interagency Project Delivery Team of interested Federal and State agencies was established for this DMMP to assist in defining and guiding the study tasks and reviewing study products. Generally, the team conferenced or met on a monthly basis throughout the DMMP study. That team consisted of the following agencies:

USACE New England District	USACE New York District
National Marine Fisheries Service	US EPA Region I
CT Dept. of Energy & Environmental Protection	US EPA Region II
NY Department of Environmental Conservation	NY Department of State
RI Coastal Resources Management Council	CT Department of Transportation

The efforts of the PDT were overseen and guided by a Steering Committee composed of managers of the state and Federal agencies represented on the PDT, and for the USACE also included staff from the North Atlantic Division. The Steering Committee met (in person or by conference call) generally twice a year during the DMMP study.

The first step in soliciting public involvement in the LIS DMMP was the publication of a Notice of Intent in the Federal Register on August 31, 2007. The Notice of Intent listed the agencies involved, the proposed action, a summary of the expected content of the draft PEIS and LIS DMMP, notification of upcoming public scoping meetings, and contact information. Three public scoping meetings each were held in CT and NY in late November 2007.

The PDT worked to formulate a range of alternatives for evaluation including current and historic open water (OW) placement sites, beach and nearshore nourishment sites, upland landfills, island and shoreline confined disposal facilities (CDFs), confined aquatic disposal (CAD) cells, confined open water (COW) sites, onshore dewatering/processing areas, marsh creation and enhancement sites, and other applications for dredged material use. This list of potential alternative types was used to develop scopes of work for a series of contractor investigations to prepare inventories of available sites for each type of placement alternative. Several supporting documents to this DMMP were prepared that collectively form the inventory of available placement alternatives for further screening.

A technical Working Group for the DMMP was established which included the PDT members and other local and regional stakeholders, universities and NGOs (mainly marine commercial interests, and environmental advocacy groups), to assist in identifying and evaluating alternatives. Meetings of the working group were held in both CT and NY during development of the alternatives inventory, the disposal cost matrix, and the site screening criteria.

A dredged material transportation and placement cost matrix was developed by the USACE and its contractors to enable cost comparison of the many alternatives evaluated. With 52 FNPs to examine, several different dredge plant types (bucket, pipeline, hopper, etc.), and an inventory of more than 200 potential placement options, it was determined that it would be unmanageable to develop individual cost estimates for each combination (more than 50,000 possibilities), even with screening for practicable transport distance. A matrix of 14 project sizes, ranging between 1,000 and 4 million cubic yards (CY), was compared to an array of 39 typical placement alternatives, transport distances and dredge plant types. This method reduced the possible combinations to about 550, and the USACE dredge estimating program (CEDEP) was used to develop typical contract costs for each combination. The resulting costs, unit costs and inputs were then used to develop a tool that could estimate and extrapolate individual project costs, and to compute air quality mitigation for larger projects that would exceed air emissions thresholds. Contingencies and non-contract costs, such as sediment sampling and testing, resource analysis, regulatory approvals, project design, contracting, and construction management, as needed for each placement option, were added to yield a total cost/CY for use in the final cost comparison of alternatives for each FNP.

The dredging needs analysis from EPA's 2004 FEIS was updated in 2008-2009. Further updates to the dredging needs analysis were made in 2015 to include project specific shoaling rates and dredging volume/frequency projections for each individual FNP, and separable project segments and features producing different types of material. Sediment test data from each FNP, other Federal agency projects, and some larger non-Federal permit projects was then used to categorize and quantify the types of dredged material from each project into sandy materials v. fine-grained material, and suitable v. unsuitable (for open water placement) materials. An anticipated dredging timeline was then developed for each FNP and separable segment and for other Federal agency projects by material type. Non-Federal project data was derived from permit records and a survey of facility dredging needs.

In LIS over the 30-year study period, a dredging needs volume of 52.9 million CY is anticipated. Of this total about 29.3% is expected to be sand, 64.6% is expected to be fine-grained materials suitable for open water placement, and 6.3% is expected to be unsuitable for open water placement. The distribution of this material and types among the three states is as follows. Of the total volume, 62.9% is from the USACE FNPs, 1.7% is from other Federal agency projects, and 35.4% is from non-Federal dredging activities under permit.

Table ES-1 – Distribution of Dredged Material by Type and State				
Material Type	Volumes in CY	Rhode Island	Connecticut	New York
Total Demand	52,890,300	386,200	39,362,800	13,141,300
Sand	15,497,000	99.4%	18.1%	60.5%
Suitable Fines (including mixed) Materials	34,089,700	0.6%	75.3%	33.8%
Unsuitable	3,303,600	0.0%	6.6%	5.4%

One of the tasks given to the Working Group was collaborative participation in developing a multi-criteria decision model for weighing placement alternatives. The resulting model included general alternatives, criteria, and metrics relevant to stakeholder interests. With the exception of a few outliers, there was some consensus that all of the criteria (economic, environmental and social) were important to the stakeholders and the region. This information was used in developing the scoring metrics for the alternatives site screening, which also considered factors such as environmental impact and benefits, distance of transport, availability and capacity of placement sites.

This process was used to identify the overall top ten scoring placement alternatives for each FNP and separable segment, and other Federal agency projects to matching sources, volumes, and types of dredged materials with potential alternatives. Larger FNPs may have separable segments such as where different project areas have different material types, or where there are for example main ship channels (MSC) that are maintained on a different cycle from tributary channels. The list of alternatives for each project was then expanded where needed to ensure inclusion of a full range of beneficial use options and likely least cost options to carry forward to the final cost-screening. Where different types of dredged materials (sand, suitable fines, or unsuitable) will be produced by a project, different sets of alternatives and likely Federal Base Plans were identified for each material type. In this manner the likely Federal Base Plan consistent with the Federal Standard (the least cost environmentally acceptable alternative) was identified, along with a range of beneficial use alternatives for further consideration in each project's future dredged material management planning. Opportunities for Federal participation in beneficial use options were also identified along with non-Federal responsibilities for study and implementation of the various placement alternatives.

The following table presents each FNP, Federal improvement and other Federal agency action with the identified likely Base Plan identified for each. These likely alternatives are either those involving a lesser cost above the base plan than other alternatives considered, or alternatives that may have additional NED, environmental or other quantifiable benefits that may make implementation eligible for Federal participation under another USACE authority. Each Federal project, as it is considered and funded for dredging, must make its own analysis of the available alternatives, other eligible authorities, and the willingness and capability of non-Federal cost-sharing partners to participate before recommending any final plan for dredged material placement or beneficial use.

Table ES-2 - Federal Projects and Likely Base Plans for Placement		
Project	Material Type	Likely Federal Base Plan
Block Island Harbor of Refuge, RI	Sand	Crescent Beach
	Suitable Fines	Rhode Island Sound (OW)
Great Salt Pond, RI	Sand	West Beach Nearshore
Hay (West) Harbor, NY	Suitable Fines	Upland On-Island or NLDS (OW)
Pawcatuck River and Little Narragansett Bay, RI & CT	Sand	Sandy Point Beach
	Suitable Fines	New London Disposal Site (OW)
Watch Hill Cove, RI	Sand	Watch Hill and Napatree Beaches
Stonington Harbor, CT	Suitable Fines	New London Disposal Site (OW)
Mystic Harbor, CT O&M	Suitable Fines	New London Disposal Site (OW)
Mystic Harbor, CT Improvement	Suitable Fines	New London Disposal Site (OW)
New London Harbor, CT	Suitable Fines	New London Disposal Site (OW)
Shaw's Cove	Unsuitable	In-Harbor CAD Cell
U.S.C.G. Station New London, CT	Suitable Fines	New London Disposal Site (OW)
Thames River, CT – Lower Channel	Suitable Fines	New London Disposal Site (OW)
Upper Channel to Norwich	Suitable Fines	Upland On-Shore
U.S.C.G. Academy, CT	Suitable Fines	New London Disposal Site (OW)
U.S. Navy Lower Thames River, CT Maintenance	Suitable Fines	New London Disposal Site (OW)
	Unsuitable	In-River CAD Cells
U.S. Navy - Improvement	Suitable Fines	New London Disposal Site (OW)
Niantic Bay and Harbor, CT	Sand	New London Disposal Site (OW)
	Suitable Fines	New London Disposal Site (OW)
North Cove, Conn. River, CT	Suitable Fines	Cornfield Shoals Disposal Site (OW)
Essex Cove, Conn. River, CT	Suitable Fines	Cornfield Shoals Disposal Site (OW)
Eightmile River, Conn. River, CT	Suitable Fines	Cornfield Shoals Disposal Site (OW)
Wethersfield Cove, CT River	Sandy	In-River Placement
Connecticut River Entrance Bars	Suitable Fines	Cornfield Shoals Disposal Site (OW)
Lower River Bars	Sand	Cornfield Shoals Disposal Site (OW)
Middle River Bars	Sand	In-River Placement
Upper River Bars	Sand	In-River Placement
Patchogue River, CT	Sand	Grove and Westbrook Beaches
	Suitable Fines	Cornfield Shoals Disposal Site (OW)
Duck Island Harbor, CT	Sand	Area Beaches Nearshore

Project	Material Type	Likely Federal Base Plan
Clinton Harbor, CT	Sand	Clinton or Hammonasset Beaches
	Suitable Fines	Cornfield Shoals Disposal Site (OW)
Guilford Harbor, CT	Sand	Jacobs Beach
	Suitable Fines	Central LIS Disposal Site (OW)
Stony Creek Harbor, CT	Suitable Fines	Central LIS Disposal Site (OW)
Branford Harbor, CT	Suitable Fines	Central LIS Disposal Site (OW)
New Haven Harbor, CT - MSC	Suitable Fines	Central LIS Disposal Site (OW)
Mill & Quinnipiac Rivers	Unsuitable	Morris Cove CAD Cell
West River	Suitable Fines	Central LIS Disposal Site (OW)
New Haven Hbr, CT, Improvement	Suitable Fines	Central LIS Disposal Site (OW)
U.S.C.G. LIS Station, New Haven	Suitable Fines	Central LIS Disposal Site (OW)
Milford Harbor, CT	Sand	Gulf or Silver Sands Beaches
	Suitable Fines	Central LIS Disposal Site (OW)
Housatonic River, Lower Channel	Sand	Short Beach and Central LIS DS
Upper Channel	Sand	In-River, On-Shore, or Central LIS DS (OW), or Sand to Area Beaches
Upper Channel	Suitable Fines	
Bridgeport Harbor, Johnsons River	Unsuitable	Morris Cove CAD Cell
Black Rock Harbor, CT	Suitable Fines	Sherwood Island COW Site
Southport Harbor, CT	Sand	Sasco Hill or Southport Beaches
Inner Harbor	Suitable Fines	Sherwood Island COW Site
Westport Harbor, CT	Suitable Fines	Sherwood Island COW Site
Norwalk Harbor, CT	Suitable Fines	Western LIS Disposal Site (OW)
West Branch I-95 Area	Unsuitable	In-Harbor CAD Cell
Wilsons Point Harbor, CT	Suitable Fines	Sherwood Island or Western LIS DS
Fivemile River, CT	Suitable Fines	Sherwood Island or Western LIS DS
Westcott Cove, CT	Sand	Cummings Park Beaches
	Suitable Fines	Western LIS Disposal Site (OW)
Stamford Harbor, CT	Suitable Fines	Western LIS Disposal Site (OW)
East Branch Channel	Unsuitable	In-Harbor CAD Cell
Mianus River, CT	Suitable Fines	Western LIS Disposal Site (OW)
Greenwich Harbor, CT	Suitable Fines	Western LIS Disposal Site (OW)
Most of Project	Unsuitable	In-Harbor CAD Cell
Port Chester Harbor, NY	Unsuitable	In-Harbor CAD Cell
Milton Harbor, NY	Suitable Fines	Western LIS Disposal Site (OW)
Mamaroneck Harbor, NY	Suitable Fines	Western LIS Disposal Site (OW)
Echo Bay, NY	Suitable Fines	Western LIS Disposal Site (OW)
New Rochelle Harbor, NY	Suitable Fines	Western LIS Disposal Site (OW)

Project	Material Type	Likely Federal Base Plan
Eastchester Creek, NY	Unsuitable	In-Harbor CAD Cell
Little Neck Bay, NY	Suitable Fines	Western LIS Disposal Site (OW)
U.S. Merchant Marine Academy	Suitable Fines	Western LIS Disposal Site (OW)
Hempstead Harbor, NY	Suitable Fines	Western LIS Disposal Site (OW)
Glen Cove Creek, NY	Unsuitable	In-Harbor CAD Cell
Huntington Harbor, NY	Sand	Area Beaches and Western LIS DS
	Suitable Fines	Sherwood Island or Western LIS DS
Northport Harbor, NY	Sand	Sherwood Island or Western LIS DS
	Suitable Fines	Sherwood Island or Western LIS DS
U.S.C.G. Station Eaton's Neck, NY	Sand	Hobart Beach, or Western LIS DS
Port Jefferson Harbor, NY – (Fed O&M Unlikely in 30 Yrs)	Sand	Central LIS DS or East Beach
	Suitable Fines	Central LIS Disposal Site (OW)
Mattituck Harbor, NY	Sand	Bailie's Beach
	Suitable Fines	Cornfield Shoals Disposal Site
Peconic River, NY	Sand	Peconic Bay or North Fork Beaches
	Suitable Fines	Upland Onshore Along the River
Greenport Harbor, NY	Sand	Cornfield Shoals DS or Gull Pond Bch.
U.S. D.H.S. Plum Gut Harbor and Orient Point, NY	Sand	Beach placement at Plum Gut Beach and Orient State Park
Lake Montauk Harbor, NY	Sand	Adjacent Gin and Lake Montauk Beach

Consideration must be given to the capacities of the various placement alternatives in developing a recommended plan for a particular Federal project. Harbor-specific and sub-regional CDFs and CAD cells have limited capacities, and in some cases particular alternatives were identified as base plans or likely alternatives to open water placement for more project volume than they have room to accommodate. While it is not possible at this time to predict which projects will receive funding for maintenance dredging in any period of years, some consideration must be made going forward as to what capacity is to be reserved for particular projects in specific placement sites. The DMMP attempts to outline possible scenarios for allocating the site capacity of such alternatives. Managing change as project funding becomes available will be critical in attempting to make the best placement decisions that will be cost-effective, implement beneficial uses, and divert material from open water placement where practicable. For CAD cells in particular, reserving capacity for the more than 3 million CY of unsuitable materials expected to be generated by Federal projects over the next 30 years is the base plan for most projects yielding those materials.

For beach and nearshore nourishment purposes, a total of more than 7 million CY of sand is anticipated to be dredged in the LIS region over the next 30 years from Federal projects alone. Not all of the more critical eroding shore areas will be proximate to dredging sites. Prioritizing placement will be a matter of cost, needs at the sites, and the cost-sharing capability and willingness of non-Federal sponsors.

Federal projects are expected to generate nearly 21.5 million CY of fine-grained materials classified as suitable for open water placement over the next 30 years. Unlike sandy materials which have many low cost beneficial uses, and unsuitable materials which must be treated or contained, suitable fine-grained materials may be placed in open water at low cost, but otherwise have limited cost effective options. The small grain size of these materials makes them unsuitable for use as structural fill, or in storm damage reduction and flood risk management projects where erosion is a concern. Their salt water content also makes them unsuitable for upland uses such as landscaping without further treatment. Managing suitable fine-grained materials will present the greatest challenge for future dredged material placement in LIS so long as open water placement remains contentious. Distribution of base plans for suitable fine-grained materials from Federal projects is 76.5% open water, 13.6% upland (nearly all from the upper Connecticut River), 0.5% in-river, and 9.4% in CDFs and CAD cells. Other than CDF construction, alternatives to open water placement of fine-grained materials are limited to marsh creation and enhancement projects.

Potentially, fine-grained parent materials from improvement dredging projects and CAD cell construction could be used for remediation capping of historic open water sites that received materials from more industrial harbors in the years before sediment testing was required. Further research would be required to determine the sites where such beneficial capping would be most effective.

CDF construction is costly and requires a trade-off between filling large tidal and subtidal areas of the Sound's waters, against the benefits from diverting large volumes of dredged material from open water placement, and the benefits that would accrue from the site's post-fill use as habitat, parkland or other purposes. Regional and sub-regional CDF sites proposed in prior studies were all included in this DMMP's site inventory for consideration by future projects.

USACE authorities that could be applied to study and implement Federal participation in non-Base Plan alternatives in support of ecosystem restoration, hurricane and storm damage reduction, flood risk management, shore damage mitigation, and the general authority for regional sediment management are all outlined in the DMMP. Non-Federal requirements for participation, and the studies required to demonstrate Federal interest are described. Where state and local sponsors desire to pursue alternatives beyond the Federal Base Plan these authorities could provide a means to share that incremental cost. When Federal projects are funded for dredging, and their NEPA analysis or feasibility studies are conducted, these additional USACE authorities should be considered in determining a final placement recommendation.

Examples of other USACE authorities are detailed in the DMMP conclusions and recommendations. As an example, the most commonly used authority for beneficial use of dredged materials is Section 204 of the Water Resources Development Act (WRDA) of 1992 (33 USC Sec. 2326), as amended. Section 204 allows Federal participation in the incremental cost (above the Base Plan) design and construction of beneficial use projects such as ecosystem restoration and enhancement, beach nourishment for storm damage reduction, flood control, and other purposes. Benefits from the beneficial use must outweigh incremental costs to justify Federal participation. A non-Federal sponsor must share in the increment project cost (typically 35 percent for storm damage reduction and ecosystem restoration). Study costs are also subject to cost sharing if a project is recommended. Each authority has specified cost-sharing and justification requirements.

In response to the 2005 Rule, and in accordance with the PMP, the DMMP recommends procedures to be followed and standards to be applied in evaluating and recommending dredged material placement options, tracking dredged material placement, pursuing opportunities for alternative and beneficial uses of dredged material in LIS, and researching and monitoring impacts of placement past and future placement activities. This recommendation will first address the issue of Standards; the alternatives identified as likely cost-effective and environmentally acceptable for dredged material placement.

There are also several ongoing long-term efforts to promote beneficial uses of dredged material and monitor dredged material placement in LIS and the New England region. These efforts should be continued and could be improved to help in understanding the impacts of dredged material placement and assist in the goal of reducing the need for open water placement in LIS.

<u>Standards</u>: To address the Designation Rule provision with respect to “standards”, and as described above, the LIS DMMP identified all potential dredging needs, both Federal and non-Federal for all of the harbors in Long Island Sound and vicinity, through a comprehensive dredging needs survey in 2009 and updated that work in 2014-2015.

The LIS DMMP also identifies a wide range of potential environmentally acceptable, practicable management plans that can be utilized by various dredging proponents in their analysis of options to manage dredging projects. Recommendations for individual Federal projects include those alternatives identified as the likely Federal Base Plans for each Federal project, and other environmentally acceptable alternatives that are either very close in cost to the Base Plan or represent opportunities for beneficial use and reduction in open water placement. Although it was not the intention of the LIS DMMP to identify an alternative for every potential non-Federal project in the study area, the DMMP provides project proponents with an array of suitable/feasible options that they can use in their future alternative analyses that will meet or exceed their needs. Also the States may use the DMMP findings to take whatever actions are necessary to establish or expand State programs to assist in implementing reductions in open water placement.

Actual decisions on the Federal Base Plan and any alternative Recommended Plan would be made as projects are funded and investigated in the future. These projects would each need to conduct investigations on sediment suitability and placement site acceptability, prepare any NEPA and decision documents, provide for adequate public involvement and review, secure any necessary Federal and state agency regulatory approvals, and secure Federal and sponsor funds for implementation. The Base Plan may also involve beneficial use of the dredged material so long as it is the least costly plan. The cost of implementing the Base Plan is either (1) a 100% Federal cost for maintenance of projects with design depths of no greater than 50 feet, or (2) for improvement dredging placement is cost-shared with the non-Federal sponsor as part of the navigation project. Recommendation and implementation of a placement alternative more costly than the Base Plan would require either (1) a non-Federal sponsor willing to fund the entire difference in project cost over the Base Plan, or (2) in the case of beneficial use, non-

Federal sponsorship and applicability of another USACE program authority (including benefit-cost analysis and environmental acceptability), that would allow Federal participation in a share of the difference in cost over the Base Plan.

The LIS DMMP is intended to help achieve the goal of "reducing or eliminating the disposal of dredged material in Long Island Sound." EPA and state environmental agencies have extensive authorities under the Clean Water Act (CWA) and associated state laws to reduce sediment and contaminant loading to the watersheds that drain to LIS, and they have a long and successful track record of reducing these loads since these laws came into effect in the 1970s. Permitting of storm water discharges under the CWA National Pollutant Discharge Elimination System, pretreatment of commercial wastewater before entering a municipal wastewater conveyance system, and nonpoint source management programs have led to significant reductions in both sediment and contaminant loading to Long Island Sound and its tributaries. Section 4.9.2 of the DMMP details the programs in place towards this goal within the LIS watersheds.

Efforts to control sediment entering the waterways can reduce the need for maintenance dredging of harbor features and facilities by reducing shoaling rates. This could either reduce the volumes dredged in each maintenance operation or reduce the frequency of maintenance. Efforts to prevent introduction of contaminants into the watershed can result in reduced contaminant levels in sediments which can increase the range of options available to beneficially use those sediments. Continued source reduction efforts for both sediment and contaminants will assist in further reducing the need for open water placement of dredged material in LIS. Federal, State and local agencies tasked with regulating those discharges into the watershed should continue to pursue and strengthen those efforts.

<u>Procedures</u>: The 2005 Rule's requirement for developing procedures for using placement alternatives can best be advanced through continuation of the Long Island Sound Regional Dredging Team (LIS RDT) and expansion of its geographic scope to cover placement opportunities in the entire LIS region.

The Federal-state agency partnership that is the LIS RDT, originally established pursuant to EPA's 2005 rule-making designating the CLDS and WLDS, should be continued. Under the Rule, and its charter, the RDT was to operate for the duration of the DMMP. However it will be critical for successful implementation of the DMMP's recommendations for the RDT to continue its collaborative efforts. Regional dredging teams are important tools in managing dredged material placement on a regional basis and in developing practicable cost-effective beneficial use alternatives and building the case for the partnerships and funding needed to implement those alternatives. From a Federal agency perspective (due to the requirements of the Federal Advisory Committee Act) an RDT cannot exercise regulatory authority, advise, make recommendations, or supplant the authority of its member agencies. However, the collaborative nature of the team should provide the agencies with more information and greater options for their evaluations and decision-making on the projects and applications for approval before them for action. For efforts to reduce the need for open water placement to be successful, the member agencies must be committed to a robust Sound-wide RDT. Each agency should program sufficient funding to enable its active participation in the RDT. Specific recommendations for the RDT to meet its charge to reduce wherever practicable the open-water disposal of dredged material, are outlined below. The first four recommendations cover RDT membership and outreach, and the scope of the RDT's review of projects both geographically and by project type. The other recommendations cover long-term tasks assigned to the RDT and its state agency members.

- The RDT's geographic scope has been limited to projects subject to MPRSA (Ambro Amendment) restrictions seeking to use the CLDS and WLDS. If the EPA does, as is expected, designate one or more open water placement sites in eastern LIS waters, then the geographic range of the LIS RDT for projects subject to MPRSA should be expanded to include all of LIS and adjacent waters inside the territorial sea (3 mile limit), or in other words from Throgs Neck to a line three miles east of the baseline across western Block Island Sound. That would encompass all harbors and areas included in this study except Block Island.

- The RDT should make efforts to engage those agencies which have not actively participated in the RDT to this point; the U.S. Navy, U.S. Coast Guard, U.S. Fish and Wildlife Service, County level public works and environment officials in New York, and the new Connecticut State Port Authority. These agencies should be encouraged to join the RDT, or at a minimum participate in RDT investigation of alternatives that may apply to their own actions. The Commander, Naval Submarine Base New London, in a letter dated October 9, 2015 stated that the Navy welcomed the opportunity to engage with the RDT.

- The RDT should seek input from the member organizations of the Technical Working Group for the DMMP, as well as the Long Island Sound Study (LISS, part of EPA's National Estuary Program) Science and Technical Advisory Committee (STAC) and Citizens Advisory Committee (CAC), in examining the potential costs and practicability of the many placement alternatives and beneficial uses identified in the DMMP, and help identify and evaluate other alternatives that may come up.

- The LIS RDT might also consider retaining the Working Group as a means of apprising Non-Government Organizations (NGOs) and interest groups in the progress being made on identifying and implementing beneficial use alternatives, aiding in soliciting public views on new alternatives that may arise, and in general showing a collaborative interstate and interagency public face to dredged material management issues and practices in LIS. The LISS CAC could also be used in this regard, whether or not the DMMP Technical Working Group is retained.

- The RDT should review the alternatives analysis for all projects submitted for its consideration and input, to help ensure that practicable alternatives as described in the DMMP for each harbor and dredging center have been thoroughly evaluated and are implemented where practicable. The Corps and EPA should consult with and consider the views of the RDT member agencies when preparing NEPA and decision documents for dredged material placement, placement site management and monitoring plans (SMMPs), and future investigations of dredged material placement issues and beneficial use opportunities.

- The member agencies of the RDT, particularly at the state level, should develop proposals for implementation and prioritization of beneficial use options and other non-open water alternatives. The RDT and its member agencies should examine strategies for making these alternatives more affordable (cost-effective). The agencies should present their ideas and findings to the RDT for discussion.

- The RDT's state agency members should investigate those placement opportunities which consensus shows have merit and are practicable cost-effective solutions. The states should champion funding to pursue cost-sharing opportunities for implementing such alternatives.

- The RDT should further investigate and develop, where practicable, opportunities for approving and funding long-term regional CDFs which could accommodate suitable and unsuitable dredged materials and provide environmental and social benefits such as parkland and habitat once filled and closed.

- The LIS RDT must also have a central role in each of the four following long-term recommendations. However, even in the event the RDT is not continued, the USACE and EPA should work cooperatively to implement these recommendations.

<u>Continue and Improve Ongoing Activities</u>: There are a number of ongoing activities concerning dredged material placement supported by the USACE and EPA, some which include state participation, which should be continued. The LIS RDT and its member agencies can assist in promoting and improving these activities.

- The USACE-NAE database for FNP dredging and placement activity should be continued and improved, with the assistance of the RDT and its member agencies, to provide a means of collecting, reporting on and maintaining information on all dredging and dredged material placement and use activities in Long Island Sound from all three states, whether approved under Federal or state procedures. This will serve as a regional tracking system of dredged material, and provide examples of real-world application of placement alternatives. The USACE (NAE) maintains records of all FNP dredging and placement, but only tracks non-USACE activities if a Federal permit is required. Non-USACE projects that are not placed in the water are not presently tracked.

- The USACE and EPA ongoing efforts through the DAMOS Program and SMMP updates should continue. These efforts should also be improved, with the assistance of the RDT, its member agencies, and universities to target data collection and studies to better address the question of the long-term impacts and acceptability of past and continued open water placement of dredged materials in Long Island Sound. As this is the key point of disagreement between the agencies and the states, closer inspection may yield a better understanding of the matter. Chemical and biological data and information, whether from the current literature or collected in the near term, should be compiled to evaluate the health of the Sound at the active and historic placement sites, the Sound as a whole, and adjacent waters for comparison.

- The USACE and EPA should continue their ongoing practice in New England waters of considering opportunities for beneficial use of parent materials removed in future major improvement dredging projects, and CAD cell construction projects, with a focus on capping of historic open water placement sites.

- The USACE and the states should continue their recent ongoing efforts to reduce open water placement through implementation of beneficial use opportunities. Efforts should be made to examine the additional opportunities for beneficial use identified in this study, evaluate those opportunities, prioritize them according to the states willingness and capability to approve and implement, and work with the Corps to determine what opportunities for Federal cost-sharing participation may exist.

- Non-Federal dredging project proponents (non-Federal applicants for permits under the CWA and MPRSA) should use this DMMP as a framework for scoping their own investigation of placement alternatives as their projects are planned, designed and submitted to the Federal and state regulatory processes.

In summary, the USACE preferred alternative is to implement the recommendations of the Long Island Sound Dredged Material Management Plan. The several recommendations made by the LIS DMMP, as described above, for the development of procedures and standards for evaluating the use of practicable alternatives to open water placement in LIS, and for continuation and improvement of ongoing activities concerning dredged material placement in LIS, all contribute to the goal of reducing or eliminating the need for open water placement of dredged material in LIS. While the USACE may be able to pursue some of these alternatives on its own when maintaining existing Federal navigation projects, the majority of the DMMP recommendations will require continued partnership, including cost-sharing, with state and local agencies to achieve the goals of the DMMP.

LONG ISLAND SOUND
FINAL DREDGED MATERIAL MANAGEMENT PLAN

TABLE OF CONTENTS

SUPPORTING TECHNICAL INVESTIGATIONS REPORTS

1 Literature Review Update
2 Dredging Needs Assessment Update
3 Economic Impact Assessment Update
4 Federal, State, and Local Regulations and Programs Applicable to Dredge Material Management
5 Upland, Beneficial Use, and Sediment Dewatering Sites Identification – Phase I
6 Follow-on Characterization of Small Site Management Alternatives for Potential Non-Federal Project Consideration – Phase IA
7 Upland, Beneficial Use, and Sediment Dewatering Sites Identification – Phase II
8 Nearshore Placement Alternatives
9 Containment Alternatives Report
10 Environmental Resources Update
11 Cultural Resources
12 Multi-Criteria Decision Analysis
13 Air Quality Impact Analysis and Estimating Tool
14 Public Scoping Meeting Summary

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ASA (CW): Assistant Secretary of the Army for Civil Works
BIS: Block Island Sound
CAA: Consolidated Appropriations Act or also Clean Air Act
CAAA: Clean Air Act Amendments
CAD: Confined Aquatic Disposal (CAD Cell)
CAC: Citizens Advisory Committee
CCMA: Connecticut Coastal Management Act
CDF: Confined Disposal Facility
CEDEP: Corps of Engineers Dredge Estimating Program
CEQ: Council on Environmental Quality
CFR: Code of Federal Regulations
CLDS: Central Long Island Sound Dredged Material Placement Site (formerly CLIS)
CO: Carbon Monoxide
COW: Confined Open Water (Placement Site Alternatives)
CSDS: Cornfield Shoals Dredged Material Placement Site
CT DEEP: Connecticut Department of Energy and Environmental Protection (formerly DEP)
CT DOT: Connecticut Department of Transportation
CWA: Clean Water Act
CY: Cubic Yard
CZM: Coastal Zone Management
DAMOS: Disposal Area Monitoring System
DC: Dredging Center
DHS: Department of Homeland Security
DIN: Dissolved Inorganic Nitrogen
DMMP: Dredged Material Management Plan
DO: Dissolved Oxygen
DS: Disposal Site
DW: Dry Weight
EA: Environmental Assessment
EFH: Essential Fisheries Habitat
EIS: Environmental Impact Statement
EPA: U.S. Environmental Protection Agency
ERDC: Engineering Research and Development Center (USACE)
ESA: Endangered Species Act
FNP: Federal Navigation Project
FEIS: Final Environmental Impact Statement
FONSI: Finding of No Significant Impact
FVP: Field Verification Program
FW: Forwarded

FY: Fiscal Year
GCR: General Conformity Rule (Air Quality)
GNF: General Navigation Features (Channels, Anchorages, Breakwaters, etc.)
GSP: Gross State Product
HARS: Historic Area Remediation Site (Former Mud Dump)
HP: Horsepower
HQUSACE: Headquarters, U.S. Army Corps of Engineers
KCY: Thousand Cubic Yards
LERRD: Lands, Easements, Rights of Way, Relocations, and Disposal Areas
LF: Linear Foot
LIS: Long Island Sound
LISS: Long Island Sound Study (EPA National Estuary Program)
LSF: Local Service Facilities (Piers, Docks, Berths, Slips, etc.)
MHW: Mean High Water
MLW: Mean Low Water
MLLW: Mean Lower Low Water
MPA: Marine Protected Area
MPH: Miles per Hour
MPRSA: The Marine Protection, Research and Sanctuaries Act (1972, as amended) aka ODA
NAAQS: National Ambient Air Quality Standards
NAD: The North Atlantic Division of the U.S. Army Corps of Engineers
NAE: The New England District of the U.S. Army Corps of Engineers
NAN: The New York District of the U.S. Army Corps of Engineers
NCA: National Coastal Assessment (EPA)
NDT: National Dredging Team
NEPA: National Environmental Policy Act
NLDS: New London Dredged Material Placement Site
NM: Nautical Mile
NMFS: The National Marine Fisheries Service (NOAA)
NOAA: National Oceanographic and Atmospheric Administration (Dept of Commerce)
NOx: Nitrogen Oxide
NR/SR: National Register/State Register (Historic Properties)
NWR: National Wildlife Refuge
NY DEC: The New York Department of Environmental Conservation
NY DOS: The New York State Department of State
O_3: Ozone
OCS: Outer Continental Shelf
ODA: Ocean Dumping Act, aka MPRSA
ODMDS: Ocean Dredged Material Disposal Site
P&G: Principals and Guidelines for Water and Related Land Resources Implementation Studies (1983)

PAL: Public Archaeology Laboratory
PDT: Project Delivery Team
PEIS: Programmatic Environmental Impact Statement
PM: Particulate Matter (Air Quality) or Postmark (Correspondence)
R&H Act: River and Harbor Act
RDT: Regional Dredging Team
RICRMC: Rhode Island Coastal Resources Management Council
RIDEM: Rhode Island Department of Environmental Management
RIM: Regional Implementation Manual (Sediment/Water Sampling and Testing)
RIS: Rhode Island Sound
ROD: Record of Decision
ROM: Rough Order of Magnitude
SAV: Submerged Aquatic Vegetation (Seagrass)
SEIS: Supplemental Environmental Impact Statement
SIP: State Implementation Plan (Air Quality)
SLR: Sea Level Rise
STAC: Science and Technical Advisory Committee (EPA LISS)
TIP: Transportation Improvement Program (Air Quality)
TOC: Total Organic Carbon
TSD: Technical Supporting Documents (Included on CD Accompanying this Report)
TWG: Technical Working Group
UConn: University of Connecticut
USACE: U.S. Army Corps of Engineers
US EPA (or EPA): The Environmental Protection Agency
USCG: United States Coast Guard
USF&WS: United States Fisher and Wildlife Service, Department of the Interior
USGS: United States Geological Survey, Department of the Interior
VOC: Volatile Organic Compounds
WLDS: Western Long Island Sound Dredged Material Placement Site (formerly WLIS)
WQC: Water Quality Certificate
WRDA: Water Resources Development Act (1974 through 2007)
WRRDA: Water Resources Reform and Development Act (2014)

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LONG ISLAND SOUND
FINAL DREDGED MATERIAL MANAGEMENT PLAN

1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) Engineering Regulation (ER) 1105-2-100 requires the development of Dredged Material Management Plans (DMMP) for all USACE maintained navigation projects where there is an indication of insufficient dredged material placement capacity to accommodate maintenance dredging needs for the next 20 years. The DMMP is a planning document that ensures maintenance dredging activities are performed in an environmentally acceptable and cost-effective manner, use sound engineering techniques, and are economically justified. A DMMP addresses a full range of placement alternatives, leading to the identification of a Federal Base Plan (defined below) that ensures that sufficient placement capacity is available for at least the next 20 years.

The USACE New England and New York Districts maintain 55 authorized and constructed Federal Navigation Projects (FNP) in Long Island Sound (LIS) and adjacent waters. Historically, dredged material from these projects has been placed in a variety of locations; on beaches when compatible, upland, and on-shore as fill. But the predominant means of dredged material placement has been at open water sites in Long Island Sound. Since the 1970s dredged material placement has become an often contentious issue, and the practice has become highly regulated at both the Federal and state level. In recent years, local groups and regulatory agencies have increased their efforts to encourage minimizing open water placement of dredged material in Long Island Sound, particularly in New York waters, and to encourage maximizing the amount of dredged material that is handled by upland placement or other management methods.

Maintenance of adequate navigation depth in Federally dredged general navigation features (GNF – Federal channels, anchorages, maneuvering and turning basins), and non-Federally dredged local service facilities (LSF - marine terminals, berths, port facilities, and private marinas and boat yards, public landings, etc.), are vital to the national and regional economy. Commercial shipping and recreational boating industries throughout New England rely on the continued viability of these facilities. To ensure continued use, economic viability, and safety of the region’s navigation channels and navigation-dependent facilities, periodic dredging must be performed to remove accumulated sediment, and when warranted, to periodically improve navigation infrastructure.

This DMMP was prepared to examine possible alternatives to open water placement of dredged material in Long Island Sound and compare the costs and benefits of such alternatives with that current practice. The intent is to determine the Base Plan which meets the Federal Standard for Federal maintenance dredging (and improvement dredging where projected) for each of the FNPs; identify practicable alternatives to the Base Plan; determine what programs and methods could be used to implement such alternatives; and provide non-Federal interests with an inventory of potential alternatives to consider when planning their own dredging projects. The 2005 U.S. EPA rule designating two open water placement sites in LIS, which is discussed in detail in later sections, also stated that a DMMP for LIS would also include the identification of alternatives to open water placement, so as to reduce, wherever practicable the open water placement of dredged material.

The Federal Base Plan for any particular project is defined as the least cost environmentally acceptable alternative identified by USACE for constructing the project. Projects must be planned, designed and constructed in a manner that most efficiently uses Federal fiscal resources (and non-Federal sponsor fiscal resources where improvements are included), consistent with sound engineering practices and meeting all Federal environmental requirements (including those established under the CWA and the MPRSA). The term Federal Standard is often used synonymously with Federal Base Plan. Federal Base Plan is a more accurate operational description of the Federal Standard, because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project.

Establishing the Federal Base Plan for a particular dredging project is not the same as selecting a placement option for that project, nor does it limit potential Federal participation in the project. Other factors beyond cost contribute to decisions on placement options for dredging projects. Ecosystem restoration is recognized as one of the primary missions of the USACE under its planning guidance, and the placement option that is selected for a project should maximize the sum of net economic development and environmental restoration benefits. A beneficial use option may be selected for a project even if it is not the Federal Base Plan (Federal Standard) for that project.

If a beneficial use is selected for a project and that beneficial use happens to be (or be part of) the Federal Base Plan option for the project the costs of that beneficial use are assigned to the navigational purpose of the project. If the project is Federal maintenance dredging then all costs of the Base Plan are Federal. If the project involves improvement dredging then Base Plan costs are shared with the non-Federal sponsor according to the navigation project depth. Beneficial use project costs exceeding the cost of the Federal Base Plan (Federal Standard) option become either a shared Federal and non-Federal responsibility, or entirely a non-Federal responsibility, depending on the type of beneficial use and whether the beneficial use is justified under other Corps programs.

This DMMP is not a Decision Document, in that it does not recommend specific dredged material placement solutions for specific Federal Navigation Project activities. This DMMP will act as a framework to guide future investigations and inform decision-making for Federal actions with respect to dredging and dredged material placement. As individual projects come up for their next maintenance cycle, or as feasibility studies for proposed improvement dredging projects are prepared, those studies would reference the evaluations and recommendations in this DMMP in examining placement alternatives and making a final determination as to the Federal Base Plan, appropriate beneficial use opportunities beyond the base plan. These additional project-specific studies would include preparation of Environmental Assessments (EA) and/or Environmental Impact Statements (EIS) under the requirements of the National Environmental Policy Act (NEPA). Where the projects consist of improvement dredging, or implementation of new placement facilities a feasibility report or other decision document would also be prepared. These individual studies and reports would solicit public input as they are prepared, and would be subject to Federal agency review, public review, and State regulatory reviews before they are finalized and any decision made as to dredging and dredged material placement recommendations.

Non-Federal dredging project proponents (non-Federal applicants for permits under the CWA and MPRSA) should use this DMMP as a framework for scoping their own investigation of placement alternatives as their projects are planned, designed and submitted to the Federal and state regulatory processes.

This DMMP and its accompanying Programmatic Environmental Impact Statement (PEIS) include eight appendices and several technical supporting documents covering a range of topics and describing the various investigations undertaken as part of the DMMP study. All of these documents are included on the compact disk accompanying this report. The DMMP and PEIS also build upon and rely on the U.S. EPA's 2004 FEIS on the designation of dredged material placement sites in Central and Western LIS and the 2005 Record of Decision and Final Rule.

<u>Appendices</u>

A Pertinent Correspondence and Public Involvement
B Federal Navigation Project Authorization and History
C Harbor Characterization Report
D Dredging and Disposal Alternatives Cost Analysis and Cost Matrix
E Sediment Reduction Report
F US EPA Final Rulemaking, Site Designations, June 2005
G Alternative Site Evaluation and Screening Process
H Treatment Technologies and New York District Experience
I LIS DMMP Project Management Plan
J U.S. EPA Annual Reports on Long Island Sound
K USACE October 21, 2015 Memorandum on the Federal Standard

<u>Supporting Technical Investigation Reports</u>

1 Literature Review Update
2 Dredging Needs Assessment Update
3 Economic Impact Assessment Update
4 Federal, State, and Local Regulations and Programs Applicable to Dredge Material Management
5 Upland, Beneficial Use, and Sediment Dewatering Sites Identification – Phase I
6 Upland, Beneficial Use, and Sediment Dewatering Sites Identification – Phase IA
7 Upland, Beneficial Use, and Sediment Dewatering Sites Identification – Phase II
8 Follow-on Characterization of Small Site Management Alternatives for Potential Non-Federal Project Consideration
9 Nearshore Placement Alternatives
10 Containment Alternatives Report
11 Environmental Resources Update
12 Cultural Resources
13 Multi-Criteria Decision Analysis
14 Air Quality Impact Analysis and Estimating Tool
15 Public Scoping Meeting Summary

1.1 Study Authority

1.1.1 Operations and Maintenance Responsibility for Federal Projects

As stated above, basic authority for preparation of a DMMP comes from the USACE authority to maintain the 55 authorized Federal Navigation Projects in the Long Island Sound region. The region was defined as the waters and shores of LIS easterly of Throgs Neck, NY and their tributaries, including Fishers Island Sound, Gardiners Bay, Shelter Island Sound, Peconic Bay and Block Island Sound. Also included are the major tributaries to these waters to the head of their navigable channels, including the Pawcatuck, Thames, Connecticut, Housatonic and Peconic Rivers. Bridgeport Harbor, CT was excluded, except for its Johnsons River tributary, as that port is the subject of an ongoing project specific DMMP. Point Judith Harbor, RI was excluded as that harbor has just begun an improvement study under Section 107 (River and Harbor Act of 1960) authority that will include development of a project-specific DMMP.

The FNPs in the study are described in subsequent sections, with detail on their authorization and work history provided in Appendix B. Three of the projects in New York do not include any Federally-maintained dredged project features (Larchmont, Glen Cove, and Sag Harbors). The 52 FNPs that do require maintenance dredging are listed in Table 1-1 (counter clockwise from the northeast).

1.1.2 The U.S. EPA Site Designation Requirements and the States' Request for a DMMP

In April 2004 the U.S. Environmental Protection Agency (EPA) published a final Environmental Impact Statement (FEIS), prepared jointly by EPA and USACE, on the designation of two open water dredged material placement sites in Central and Western Long Island Sound. The New York Department of State (NYDOS) did not concur with EPA's determination that the CLDS and WLDS dredged material placement site designations would be consistent with the enforceable policies of the state's coastal zone management (CZM) program. Discussions between the Federal agencies and the States of CT and NY led to a joint letter from the Governors of New York and Connecticut to USACE, dated February 8, 2005, requesting the development of the DMMP for LIS. In separate letters both Governors also asked their respective Congressional delegations to seek appropriations to initiate that study. The USACE Director of Civil Works, in his response to the two governors on March 17, 2005 committed to preparation of a DMMP for Long Island Sound.

Table 1-1 **Federal Navigation Projects Requiring Dredging in the LIS Region**	
USACE New England District FNPs	
Block Island Harbor of Refuge, RI	Southport Harbor, CT
Great Salt Pond, RI	Westport Harbor, CT
Watch Hill Cove, RI	Norwalk Harbor, CT
Pawcatuck River and Little Narragansett	Wilsons Point Harbor, CT
Bay, RI & CT	Fivemile River, CT
Stonington Harbor, CT	Westcott Cove, CT
Mystic River and Harbor, CT	Stamford Harbor, CT
Fishers Island Harbor, NY	Mianus River, CT
New London Harbor, CT	Greenwich Harbor, CT
Thames River, CT	
Niantic Bay and Harbor, CT	
Connecticut River below Hartford, CT	USACE New York District FNPs
North Cove, CT	Port Chester Harbor, CT & NY
Essex Cove Harbor, CT	Milton Harbor, NY
Eightmile River, CT	Mamaroneck Harbor, NY
Wethersfield Cove, CT	Echo Bay, NY
Patchogue River, CT	New Rochelle Harbor, NY
Duck Island Harbor of Refuge, CT	East Chester Creek, NY
Clinton Harbor, CT	Little Neck Bay, NY
Guilford Harbor, CT	Hempstead Harbor, NY
Stony Creek Harbor, CT	Glen Cove Creek, NY
Branford Harbor, CT	Huntington Harbor, NY
New Haven Harbor, CT	Northport Harbor, NY
West River, CT	Port Jefferson Harbor, NY
Milford Harbor, CT	Mattituck Harbor, NY
Housatonic River, CT	Greenport Harbor, NY
Bridgeport Harbor, CT	Peconic River, NY
Black Rock Harbor, CT	Lake Montauk Harbor, NY

On June 3, 2005 EPA published its final rulemaking/Record of Decision designating the Central and Western Long Island Sound disposal sites (CLDS and WLDS), effective July 3, 2005. In the rule EPA addressed the need to complete a DMMP for LIS, as requested by the states of CT and NY, as one of several restrictions on the long-term use of the two designated placement sites. Also included in the final rule was a requirement that a DMMP address the issue of procedures and standards for evaluating placement alternatives under the Marine Protection, Research, and Sanctuaries Act (MPRSA, also known as the Ocean Dumping Act or ODA), the Clean Water Act (CWA), and other relevant statutes and regulations, for dredging projects in LIS. The rule's text on the requirement for a DMMP is as follows:

> *"The Restrictions in paragraphs 3–14 were added by the EPA (in response to comments) in order to enhance compliance with the MPRSA, and to address the issues raised by New York under the CZMA. The EPA consulted with both affected states, and the conditions have been agreed to by both the NY DOS and the CT DEP. They are designed to support the common goal of New York and Connecticut to reduce or eliminate the disposal of dredged material in Long Island Sound. To support this goal, the Restrictions contemplate that there will be a regional dredged material management plan (DMMP) for Long Island Sound that will guide the use of dredged material for projects which occur after the DMMP is completed. DMMPs are comprehensive studies carried out by the USACE, in consultation with the EPA and the affected states, to help manage dredged material in a cost-effective and environmentally acceptable manner. The Governors of New York and Connecticut have jointly requested the USACE to develop a DMMP for Long Island Sound. Consistent with the two states' requests, today's rule contemplates that the DMMP for Long Island Sound will include the identification of alternatives to open water disposal and the development of procedures and standards for the use of practicable alternatives to open-water disposal, so as to reduce wherever practicable the open-water disposal of dredged material. The DMMP also may contain recommendations regarding the use of the sites themselves. In addition, the final rule contemplates that a Regional Dredging Team will be established to identify practicable alternatives to open-water disposal and recommend their use to the extent practicable, for projects proposed while the DMMP is being prepared (other than three already permitted and authorized projects)."*

Under ER 1105-2-100, the role of the USACE with respect to navigation is to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for movement of commerce, national security needs, and recreation. The 52 Federal Navigation Projects in the LIS region that need periodic maintenance dredging require feasible, cost-effective and environmentally acceptable placement alternatives for dredged material. In this capacity, the USACE is responsible for dredged material management planning for all USACE FNPs and therefore agreed to work with the states and other agencies on development of a DMMP for the Long Island Sound region. Minimal funds to initiate the DMMP ($25,000) were provided in the Federal fiscal year (FY) 2007 appropriation for scoping purposes. Funding needed to conduct the DMMP was first received in FY 2008.

1.1.3 Preliminary Assessment Findings

A Preliminary Assessment (PA) was published by the USACE on June 14, 2006 recommending development of a DMMP for the Long Island Sound region. The PA found a need for dredging of about 1 to 1.5 million cubic yards (CY) annually in LIS, based principally on USACE-NAE FNP needs. That estimate did not include all FNP shoal volumes as survey data was not readily available for some projects. The estimate also did not include the needs of other Federal agencies or the many non-Federal project sources, which were determined through surveys during preparation of the DMMP.

1.1.4 Prior Federal EISs on Dredged Material Disposal in LIS

Prior to EPA's 2004 FEIS designating the Central and Western LIS placement sites, the USACE prepared numerous documents required by the National Environmental Policy Act (NEPA), including Environmental Impact Statements (EISs) and Environmental Assessments (EAs) on dredging projects and current and potential placement sites in LIS. The three documents listed below were EISs covering designation of the existing placement sites. The USACE New England District also has a long-term program called Disposal Area Monitoring System (DAMOS), which was initiated in 1979, and monitors all in-water placement activities and sites in New England waters. The DAMOS program periodically conducts condition and resource surveys at the sites, develops long-term recommendations for monitoring and management, and publishes the results of its surveys and recommendations.

Final Programmatic Environmental Impact Statement for the Disposal of Dredged Material in the Long Island Sound Region (1982): The USACE prepared this document as a result of a 1976 agreement with the Natural Resources Defense Council. It evaluated seven proposed open water placement sites in LIS and identified generic impacts associated with a range of placement alternatives for dredged materials. This document also sought to provide an informational basis upon which future NEPA documents could be developed for site-specific projects in the LIS region. The Programmatic EIS concluded that open-water, upland, containment, beach restoration, incineration, and resource reclamation were viable alternatives, and that the most appropriate alternative chosen for dredged material placement would be determined on a case-by-case basis depending on the conditions prevalent at the time a project was proposed. The EIS also found that three of the seven sites in LIS were the least environmentally damaging practicable alternative open water placement sites. These three sites were the Central LIS (CLDS), Cornfield Shoals (CSDS), and New London (NLDS) disposal sites.

Final Supplemental Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound – WLIS III (1982): This document addressed open-water placement of dredged material in the western LIS region. This EIS concluded that there was an economic and navigational need for a dredged material placement site in the western region of LIS. The Western Long Island Sound disposal site (WLDS) was selected as the least environmentally damaging and practicable alternative for open-water placement in the western region of LIS.

Final Supplemental Environmental Impact Statement for a Dredged Material Disposal Site in Western Long Island Sound (1991): This supplement was prepared to address deficiencies in the first WLIS EIS, as found by the U.S. Court of Appeals (*Town of Huntington v. Marsh*, 859 F.2d 1134 (2nd Cir. 1988)). In particular, the supplemental EIS applied the criteria described in MPRSA Section 102 in evaluating potential new placement sites and addressed the types, quantities, and cumulative effects of dredged material placement at the WLDS. As a result of this analysis, the USACE reiterated its earlier conclusion that the WLDS was the least environmentally damaging and practicable alternative for open-water placement in the western region of Long Island Sound.

1.2 Purpose and Need for the Study

The limited number of suitable placement options for dredged material inhibits dredging operations required for maintaining safe navigation, harbor accessibility, and port operations, which in turn adversely affects commerce and economic development in the region. This Dredged Material Management Plan was developed to provide a 30 year management strategy to add certainty to dredging and placement activities from navigation channels and Port facilities within the region in an environmentally acceptable and economically practicable manner, and to develop alternatives to reduce or eliminate open water placement where practicable. .

1.2.1 Site Designation and the DMMP

The EPA published notice of their FEIS designating the Central and Western Long Island Sound placement sites on 9 April 2004, with notice of their Response to Comments and Final Rulemaking/Record of Decision published 19 May 2005. The Final Rule/Record of Decision was published in the Federal Register, Volume 70, Number 106, Friday, June 3, 2005, Rules and Regulations, page 32498. The Final Rule contained a number or restrictions on the use of the two sites, including closure of the sites if a DMMP was not completed within eight years, with limited opportunities for extension of that time. These restrictions are discussed in EPA's 2005 Federal Register notice concerning the site designations. The pertinent text of the time restriction is provided below. The full text of the Final Rule from the Federal Register is provided in Appendix F.

> *"In order to ensure that long-term disposal does not occur at the sites pursuant to today's designation absent restrictions to be developed by the DMMP, the final rule specifies that the use of the sites must be suspended or terminated under certain circumstances. First, paragraph 3 provides that, except as provided in paragraphs 4 and 5, the disposal of dredged material may not occur at the sites beginning eight years after the effective date of today's designations, unless a DMMP has been completed by the USACE. This eight year deadline is subject to extension under paragraph 4 by agreement of various parties expected to participate in the development of the DMMP, namely the USACE, the EPA, the state of Connecticut and the state of New York. This deadline also is subject to extension by the EPA under paragraph 5, without agreement from other parties, if the EPA determines that the parties participating in the development of the DMMP have attempted in good faith to meet the deadline, but that the deadline has not been met due to factors beyond the parties' control (including funding). Such an extension may occur in addition to any extensions granted under paragraph 4, but may be only for one additional year. For example, if all parties agree to a one year extension, and the EPA later grants a one year extension, then the DMMP process could take a total of ten years (without the use of the sites being suspended or terminated)."*

Under the basic timeline, use of the Central and Western Long Island Sound disposal sites would have ceased eight years from the date the final rule became effective, or on July 3, 2013. A single extension, agreed to by the two states, extended the closure date to April 30, 2015. EPA then exercised its single unilateral one-year extension on April 28, 2015, which will keep the sites open until April 30, 2016. At that point unless the required DMMP is prepared in a timely way and the site restrictions are amended accordingly, use of the two sites would cease for all Federal projects and for all non-Federal projects greater than 25,000 CY.

Use of the two open water placement sites in eastern Long Island Sound, the Cornfield Shoals and New London disposal sites, was extended by Congress in the consolidated appropriations act for fiscal year 2012 for a period of five years from the date of that act (December 2011). Those sites will therefore close in December 2016.

It is anticipated that upon completion of the final DMMP report by the end of 2015, EPA will revisit the 2005 Rulemaking with respect to continued use of the CLDS and WLDS open water placement sites in LIS. EPA will need to determine whether or not to allow placement of dredged material at those or other sites after the current time extension expires in April 2016. If the sites remain available for use, EPA will also need to consider what conditions may be placed on that use, such as time-of-year restrictions on placement activities, types of material that can be placed, best management practices to be used, and any requirements for further site monitoring and investigations.

1.2.2 Navigation Need for Dredging

To address the 2004 Designation Rule provision with respect to “standards” and the request of the governors of New York and Connecticut, the Long Island Sound DMMP has attempted to identify all the dredging needs, both USACE and non-USACE, for all of the harbors in LIS. In 2009 the USACE completed a dredging needs assessment to estimate future dredging needs over the next 30 years. To assist in compiling data on dredging needs and placement options, the LIS region was divided geographically into 27 dredging centers, each centered on a major port or group of harbors. The study involved a survey of the navigation-dependent facilities located in each center. Of the 731 facilities identified, 451 completed the dredging needs survey (61.7%). From 2009 to 2013, maintenance and improvement of Federal, state and local navigation projects have produced approximately 7.1 million CY of dredged material.

In early 2015 the needs estimates were re-visited to account for the projects completed, since the prior survey. Additional data were gathered from both districts, new survey and shoaling rate information developed, and for the first time the dredged material was divided into three classifications: sandy material suitable for nourishment purposes, silty material suitable for open water placement or beneficial use, and material unsuitable for open water placement that may have limited beneficial use and may need treatment or containment. The material classifications were based on current and historical test data, and further testing would need to be conducted as individual projects are proposed and investigated. The updated dredging needs analysis showed that more than 52.9 million CY is projected to be dredged over the next 30 years in the LIS region, about 65 percent of which would be fine-grained material likely suitable for open water placement. The USACE FNPs would generate 62.9 percent of all the material to be dredged, with other Federal agency dredging needs (U.S. Navy, U.S. Coast Guard, and the U.S. Merchant Marine Academy) accounting for 1.7 percent, and non-Federal permittees accounting for 35.4 percent.

1.2.3 Economic Need for Dredging

It is not the purpose of this programmatic DMMP to develop economic cost-benefit analyses for dredging projects and placement alternatives. The DMMP seeks to identify the most likely Federal Base Plan for placement of material from each FNP by examining the cost of dredging and placement for project and alternative, and weighing the environmental acceptability of each combination. Future evaluation of FNP maintenance actions and preparation of decision documents for improvement dredging projects and those projects recommending new placement facilities and Federal participation in beneficial uses will need to undertake their own project-specific detailed investigations including evaluation of economic justification and environmental acceptability.

The DMMP includes an update to the report on the economic need for dredging prepared for the 2004 EPA FEIS. The Economic Update Report (included on the compact disk accompanying this report as Supporting Technical Investigation Report #3) utilized input-output modeling to characterize the economic importance of navigation-dependent activities in LIS. The Economic Update Report also estimated the regional economic impacts of the DMMP's No Action Alternative, defined as the failure to implement a plan for dredged material management in Long Island Sound, one result of which would be closure of the current open water placement sites. The analysis modeled these impacts over a 20-year period, with the assumption of a complete cessation in dredging activity during that time.

The contribution of navigation-dependent activity to economic output in the LIS region is approximately $9.4 billion per year. Navigation-dependent activity is estimated to contribute $5.5 billion per year and 55,720 jobs to the regional economy of the three states whose harbors depend on the Sound. This navigation-dependent activity accounts for an estimated $1.6 billion per year in Federal and State tax revenues.

The navigation-dependent economic activities evaluated in the update are marine transportation (including commercial shipping, scenic water transportation, and ship-building activities), commercial fishing, recreational boating, ferry-dependent tourism, and activity associated with the U.S. Navy Submarine Base in New London, CT. Marine transportation provides the largest contribution to Gross State Product (GSP), accounting for 59 percent of the total for all activities analyzed. Recreational boating accounts for an additional 22 percent, while the submarine base accounts for 17 percent. Commercial fishing and ferry-dependent tourism each account for approximately one percent of the contribution of navigation-dependent activities to GSP.

Without implementation of the DMMP recommendations for long-term management, cost-effective and environmentally acceptable placement alternatives would not be identified, and under EPA's 2005 rule all open water placement would cease. Dredging and dredged material placement would continue to take place on a project-by-project basis without agreement by Federal and State partners to pursue practicable alternatives that would reduce future reliance on open water placement. In that event dredging would become far more costly. Projects that today are dredged and maintained would be less likely to receive funding, either due to restrictive budgets or because a higher cost of maintenance makes them no longer economically viable. Dredging activity would decline. The impacts of this alternative would accumulate over time, as shoaling continued unaddressed, and vessels access to harbors and waterways was curtailed, and in some cases lost.

Impacts on marine transportation and recreational boating would account for the greatest loss in economic activity, together representing 93 percent of the estimated reduction in GSP. In addition, ferry-dependent tourism would be expected to bear a somewhat disproportionate impact, accounting for four percent of the estimated loss in annual GSP for the study region. Other impacts not quantified in the analysis include increased costs related to tidal delays for cargo traffic and an increased likelihood of vessel collisions and oil spills. In addition, loss of access to ports could cause commercial and recreational fisherman to abandon fishing altogether, which would have negative social and cultural impacts on the communities that rely on such activity. Losses in the 20^{th} year of the No Action Alternative are anticipated to be approximately $853 million, or approximately 15 percent of the current regional GSP from navigation-dependent economic activities.

The impacts to commercial marine transportation, and the cost to consumers for the goods carried would increase over time without efficient waterborne transportation, continued demand would most likely result in a shift to transport by other means. The volume and types of goods now carried by water would decline as such transport became more costly relative to other means of carriage. Truck traffic over the region's highways would likely increase as landside transport became competitive in cost and delivery time with waterborne transport. The overall cost of transporting cargo, and the cost to shippers, distributors and consumers, would increase. Since the main cargoes carried are fuels, the impacts of less efficient cargo transport would likely be felt in most economic sectors throughout the region.

The LIS DMMP documents the availability of sufficient dredged material placement capacity for maintenance dredging of 52 Federal navigation projects that exist in the study area. The rate of shoaling varies considerably over the array of harbors that depend on Long Island Sound's open water placement areas. As of 2010, eleven channels were already impassable to the vessels normally using those harbors. Based on estimated shoaling rates for facilities responding to the survey, as soon as three years from now, channels may become impassable to vessels having drafts of five feet or more. For all vessels drafting ten feet or more, several of the harbors surveyed contain channels that are at risk of becoming impassable within the next year. Maintenance dredging would become cost prohibitive if the option of placing dredged material within the waters of Long Island Sound is no longer available.

The most significant impact of shoaling is the prevention of vessels from using the harbor and/or channel. Before this point is reached, there will be loss of recreation value and inefficiencies of delays and damages experienced by commercial vessels engaged in fishing and transporting cargo. The net income of fishermen will decline due to higher cost of harvesting. Transportation cost will increase due to light loading, lightering and utilization of smaller less efficient vessels to carry goods.

This DMMP for LIS identifies cost-effective and environmentally acceptable alternatives for placement of dredged material from FNPs and other Federal agency activities. The DMMP also provides a wide range of potential placement options for consideration by non-Federal dredging proponents. Future projects considering these options in their planning and design process should find opportunities for cost-effective means of maintaining and improving their navigation dependent operations. Waterborne commercial cargo transportation can remain competitive. Recreational boating, fishing and other water-dependent navigation uses of LIS can be retained.

During the public review of the draft DMMP/PEIS many comments were received from marine trades interests (particularly marinas and boaters) about the importance of cost-effective dredged material placement options to the continued economic viability of the recreational boating industry in both Connecticut and New York. Other larger navigation dependent corporations, such as General Dynamics Electric Boat, Motiva, and Gulf Oil, also commented on the importance of continued access to cost-effective options as necessary to their operations. Other commenters took issue with those views, contending that increasing costs to those industries would not impact their economic viability.

Dredged material itself can have an economic and/or ecological value. While such benefits cannot be quantified unless a specific dredging project, with known materials, and matched against specific placement opportunities, the types of benefits can be outlined similar to the benefits from dredging. Dredged materials that are predominantly sand have an economic value when used for nourishing eroding beaches, as structural fill in development projects, or when placed in feeder bars along the shore. Most sandy material in New England, including around LIS, is used in coastal resiliency applications.

More fine-grained dredged materials can have ecological benefits when used in such applications as marsh creation. In such projects the benefits are weighed in terms of habitat units created or restored with the goal of achieving a “best buy” in terms of habitat v. incremental cost. In this analysis, it is recognized that certain habitat types, such as coastal wetlands, provide a benefit beyond ecological value in terms of the health of fisheries which depend on those habitats, and the recreational and commercial benefits that flow from those resources. As with all beneficial use applications, project specific analysis is required to determine any Federal interest in their implementation and the appropriate level of non-Federal partnership required.

1.2.4 Other Federal Agency Dredging Activity

The U.S. Navy’s submarine base in Groton, CT relies on dredging to maintain and improve access to its facilities on the Thames River. The General Dynamics Shipyard (Electric Boat), located downstream of the Navy facility, also relies on maintenance of deepwater access for delivery of construction materials, submarine hull components and finished warships to the Navy. Assuring continued adequate and cost-effective disposal options for dredged material generated by the military and military contractor facilities is in the Federal interest.

Portions of three U.S. Coast Guard Sectors, all within the First Coast Guard District, are located within the DMMP study area. These include U.S. Coast Guard Sectors New York, Long Island Sound and Southeastern New England. The U.S. Coast Guard Academy at New London requires periodic maintenance for its vessel access. Within the study area Sector Southeastern New England has stations at Point Judith and a seasonal facility at Great Salt Pond on Block Island. Sector Long Island Sound has stations at New London, New Haven and Montauk, and seasonal stations at Eaton's Neck and Fishers Island, NY, all of which require periodic maintenance dredging. Sector New York, which covers all areas west of and including Milton Harbor and Glen Cove Harbor NY, has a station at Kings Point. The Kings Point station is co-located with the Maritime Administration's (MARAD) Merchant Marine Academy at King Point, NY, a facility which also undertakes periodic maintenance dredging.

Other Federal agencies such as the Department of Homeland Security (Plum Island Laboratory), and the National Marine Fisheries Service laboratory at Milford, CT periodically perform dredging to maintain access to their facilities though the Plum Island facility is being closed and prepared for sale.

1.3 Legislative, Regulatory and Policy Overview

Long Island Sound and its tributary waters, and areas of Block Island Sound lying westerly of a line extending north from Montauk Point, NY to Watch Hill Point in Westerly, RI, are landward of the territorial sea baseline. The band of waters that extend out from the baseline of the territorial sea to a distance of three miles seaward constitute the territorial sea. Generally, placement of dredged material into waters landward of the baseline is subject to the requirements of the Clean Water Act, while placement into waters seaward of the baseline is subject to MPRSA (the ODA). Amendments to MPRSA made in 1980 and 1990 make placement of dredged material in the waters of LIS subject to MPRSA for certain types and sizes of dredging projects (all Federal projects regardless of size, and all non-Federal projects of more than 25,000 CY). A number of USACE regulations and policies also govern and guide the management and placement of dredged material. Brief descriptions of the more significant laws, regulations and policies are provided.

1.3.1 The Clean Water Act (CWA)

The CWA §404, 33 U.S.C. §1344, governs the discharges into the waters of the United States, including the disposal of dredged or fill material into waters landward of the territorial sea (the 3-mile limit). The baseline of the territorial sea generally follows the coastline, but may cut from a point of land across the mouth of bays, and other like bodies of water, to another point of land, thus leaving potentially significant areas of coastal waters landward of the baseline. The location of the Territorial Sea Baseline and the limit of the Territorial Sea are shown in Figure 1-1. All of the waters of LIS lie landward of the baseline. Under the CWA, any lawful disposal of dredged material into waters landward of the territorial sea must first be authorized by the USACE through the issuance of a CWA §404 permit and must be conducted in compliance with the conditions of such authorization. It should be noted that for Federal dredged material disposal projects undertaken by the USACE itself, the USACE does not issue permits to itself, but rather applies the same standards and general procedures under the CWA, to determine whether the disposal should be authorized.

In making its permit decisions and recommendations under its civil works program, the USACE applies the standards and criteria set forth in EPA regulations commonly referred to as the "CWA § 404(b)(1) Guidelines," which are promulgated at 40 CFR Part 230. The USACE also applies its own regulations promulgated at 33 CFR Parts 320 to 338. In addition, other provisions of applicable law must also be satisfied (*e.g.*, applicable State water quality standards, applicable requirements of State coastal zone management plans, the Endangered Species Act). USACE permits and civil works decisions under CWA § 404 are subject to review, and potential veto, by EPA.

1.3.2 The Marine Protection, Research and Sanctuaries Act (MPRSA)

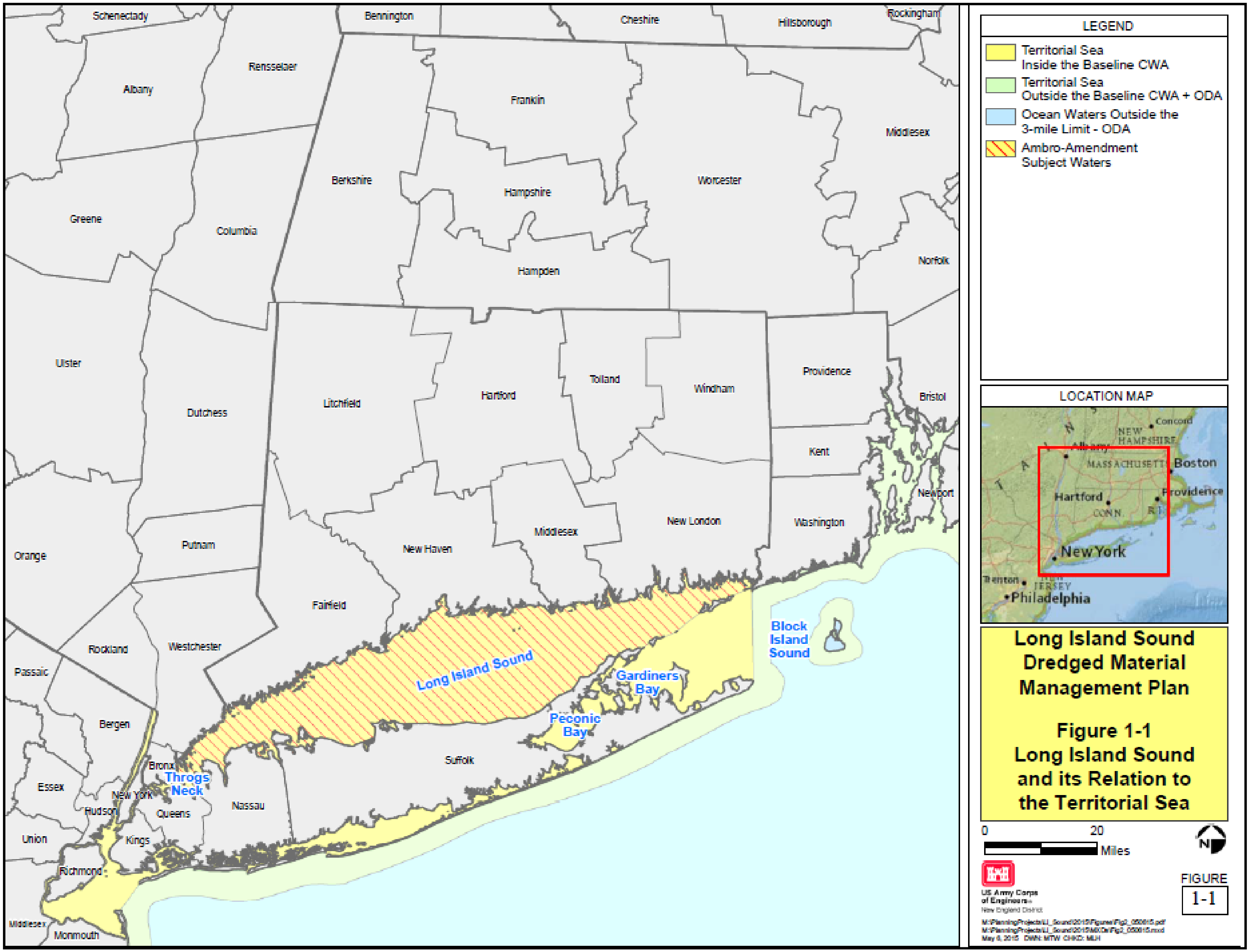
The Marine Protection, Research, and Sanctuaries Act (MPRSA), also known as the Ocean Dumping Act (ODA), regulates the placement of dredged material, and other materials, in ocean waters. MPRSA applies to all areas seaward of the territorial sea baseline (see Figure 1-1). Areas lying between the baseline and the three mile limit are regulated under both the CWA and MPRSA. Areas seaward of the baseline are referred to as "ocean waters" under the statute. EPA regulations direct that only the MPRSA program will be applied to regulate dredged material disposal in the territorial sea, while the CWA program will be applied to discharges of fill material.

As stated above the waters of Long Island Sound lie landward of the Baseline and, thus, would be expected to be subject to regulation under CWA §404 and *not* the MPRSA. However, in 1980, the MPRSA was amended to add Section 106(f) to the statute. This provision is commonly referred to as the "Ambro Amendment," named after the late Congressman Jerome Ambro who championed the provision. MPRSA §106(f), 33 U.S.C. §1416(f) was itself amended in 1990, and as currently enacted it reads as follows:

> *"In addition to other provisions of law and not with-standing the specific exclusion relating to dredged material in the first sentence of this title, the dumping of dredged material in Long Island Sound from any Federal Project (or pursuant to Federal authorization) or from a dredging project by a non-Federal applicant exceeding 25,000 cubic yards shall comply with the requirements of this subchapter."*

As a result of this provision, the disposal in LIS of dredged material from Federal projects (both projects carried out under the USACE civil works program or the actions of other Federal agencies), or from non-Federal projects involving more than 25,000 cubic yards (19,114 cubic meters) of material, must satisfy the requirements of both CWA §404 and the MPRSA. Dredged material placement in open water in LIS from non-Federal projects involving less than 25,000 cubic yards of material, however, is subject only to CWA §404.

Like the CWA, the MPRSA prohibits the placement of dredged materials into water under its jurisdiction unless conducted in compliance with a permit issued by the USACE or approval under the USACE civil works program. USACE dredged material placement permits and authorizations are issued under MPRSA §103 and may include conditions deemed necessary by the USACE related to the type of material to be placed, time of placement, and other matters. EPA is responsible for review and permitting of any proposals to place anything other than dredged material into ocean waters. The USACE issues a permit, or approves a project under its civil works authority, only if it has determined that dredged material placement "will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."


LEGEND
Territorial Sea Inside the Baseline CWA
Territorial Sea Outside the Baseline CWA + ODA
Ocean Waters Outside the 3-mile Limit - ODA
Ambro-Amendment Subject Waters
LOCATION MAP
Concord
NEW HAMPSHIRE
Albany
MASSACHUSETTS
Boston
Hartford
Providence
CONN
R.I.
New York
Trenton
NEW JERSEY
Philadelphia
Long Island Sound
Dredged Material
Management Plan
Figure 1-1
Long Island Sound
and its Relation to
the Territorial Sea
0
20
Miles
N
US Army Corps of Engineers
New England District
FIGURE
1-1
Schenectady
Bennington
Cheshire
Hillsborough
Rockingham
Rensselaer
Albany
Franklin
Middlesex
Berkshire
Hampshire
Worcester
Greene
Columbia
Hampden
Norfolk
Ulster
Litchfield
Hartford
Tolland
Windham
Providence
Bristol
Dutchess
Kent
Newport
Orange
Putnam
New Haven
Middlesex
New London
Washington
Fairfield
Block Island Sound
Rockland
Westchester
Passaic
Long Island Sound
Gardiners Bay
Bergen
Peconic Bay
Suffolk
Bronx
Throgs Neck
Essex
New York
Hudson
Queens
Nassau
Union
Kings
Richmond
Middlesex
Monmouth

Similar to the CWA §404 program, however, the USACE is to make MPRSA §103 determinations by the standards set forth in EPA regulations. EPA has promulgated its ocean dumping regulations pursuant to MPRSA §102(a), at 40 CFR Parts 220 to 229. USACE permit determinations and civil works approvals are also subject to any applicable requirements of other laws (*e.g.*, the Endangered Species Act, the Coastal Zone Management Act). In addition, USACE authorizations under MPRSA §103 are also subject to EPA review and concurrence, and the potential for EPA to either veto or add conditions to the permit or civil works approval. As with the CWA § 404 program, the USACE does not issue permits under MPRSA for USACE dredged material disposal projects under its civil works authority; rather, it authorizes its own disposal projects by applying the same substantive and procedural requirements "in lieu of" the permit procedures. Such USACE authorizations for USACE projects are subject to the same EPA review and concurrence process as described above.

The USACE and EPA are required to review and evaluate authorizations for dredged material placement using criteria that include the following:

- The need for the proposed dredged material placement;
- The effect of the placement on human health and welfare; fisheries resources, plankton, fish, shellfish, wildlife, shorelines, and beaches; and marine ecosystems;
- The persistence and permanence of the effects of the placement;
- The effect of placing particular volumes and concentrations of such materials;
- Appropriate locations and methods of placement or recycling, including land-based alternatives;
- The effect on alternate uses of oceans.

Under CWA §404, dredged material at a particular site is authorized on a project-specific basis, subject to the terms of the authorization. Under the MPRSA, however, the identification of sites for the potential placement of dredged material is handled differently.

MPRSA §102(c) authorizes EPA to "designate" sites for long-term use for dredged material placement. Such long-term site designation by EPA is conducted apart from consideration of any particular project's dredged material. Material from particular projects is instead evaluated under the USACE authorization program under MPRSA §103. As stated above, material from non-Federal projects involving less than 25,000 cubic yards (19,114 cubic meters) of dredged material are evaluated under the CWA §404 requirements and not MPRSA. EPA is to designate placement sites using its site designation criteria regulations promulgated at 40 CFR Part 228. EPA is to designate sites and time periods for placement, and can restrict site use, as necessary to "mitigate adverse impact on the environment to the greatest extent practicable."

For each designated placement site, EPA and the USACE must develop a site management plan that includes a baseline assessment of conditions of the site, a program for monitoring the site, special management conditions or practices to be implemented at the site to protect the environment, consideration of the quantity of material to be placed at the site and the presence of contaminants in the material, consideration of the anticipated use of the site over the long term, and a schedule for review and revision of the plan. A designated placement site may not be used until a site management plan has been developed for the site.

In determining whether to issue an authorization consistent with Section 103 of the MPRSA, the MPRSA directs the USACE to evaluate the "potential effect of a permit [or USACE project authorization] denial on navigation, economic and industrial development, and foreign and domestic commerce of the United States, [in order to] . . . make an independent determination as to the need for the dumping." Related to this, the statute also directs the USACE to "make an independent determination as to the other possible methods of disposal and as to appropriate locations for the dumping." With respect to locations for dredged material placement, the statute requires the USACE to utilize EPA-designated placement sites to the "maximum extent feasible." Where use of an EPA-designated site is infeasible, however, the USACE is authorized to "select an alternative site." Thus, USACE selection of an alternative site is conducted in conjunction with a specific project. In considering "selection" of an alternative site, the USACE must use the same site selection criteria that EPA uses in designating placement sites (*i.e.*, 40 CFR Part 228). USACE selection of an alternative placement site is subject to EPA review and concurrence. While EPA-designated placement sites are specified for long-term use, and the statute does not specify a specific term of years to which such use must be limited, the statute does place a specific time limit on the use of USACE-selected sites. MPRSA §103(b) provides that "disposal at or in the vicinity of an alternative site shall be limited to a period of not greater than 5 years unless the site is subsequently designated [by EPA] . . .; except that an alternative site [selected by the USACE] may continue to be used for an additional period of time that shall not exceed 5 years if – (1) no feasible disposal site has been designated by the Administrator [of EPA]; (2) the continued use of the alternative site is necessary to maintain navigation and facilitate interstate or international commerce; and (3) the Administrator [of EPA] determines that the continued use of the site does not pose an unacceptable risk to human health, aquatic resources, or the environment."

The time limits for use of a USACE-selected placement site (*i.e.*, the five-year period, with potential for a five-year extension) were added to the MPRSA by an amendment to 33 U.S.C. §103(b) made by Section 506(b) of the Water Resources Development Act of October 31, 1992 (WRDA92 – P.L. 102-580). The time limits did not apply prior to that date. Thus, EPA and the USACE interpret Section 103(b) to mean that these time limits began to apply to USACE-selected sites used for placement after the October 31, 1992, amendments to the statute. Furthermore, EPA and the USACE interpret any second term of (up to) five years for use of a USACE-selected site to commence upon proper approval to extend the time for use of that site. Therefore, if there is a gap in time between the end of the first five-year term and the beginning of any second term, that time is not counted against the second term because it is the *use* of the site for disposal that is limited by the statute and the site is not being used during any such gap. The time period for any second term of use begins to run with the approval extending use of the site, thus ensuring that the site will not be used for dredged material placement for any more than ten years.

Prior to issuing an authorization for a specific project, the USACE must notify EPA, which must review the proposal and related materials, determine compliance with the site designation criteria, and decide whether to concur with the authorization issuance. If EPA declines to concur, the authorization will not be issued.

The USACE also prepares DMMPs on a project-specific basis where a continued need for maintenance dredging is demonstrated and available dredged material placement site capacity is determined insufficient to meet the project's needs for at least a 20 year period, for the quantity and quality of materials to be dredged. A DMMP is not required for designating or selecting dredged material placement sites under MPRSA. However, the designation of placement sites under MPRSA does require the development of Site Management and Monitoring Plans (SMMPs) by EPA.

1.3.3 Water Resources Development Act 1992 Amendments to MPRSA

The Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580) made a number of changes to the MPRSA. As amended by Section 506 of WRDA 92, Section 102 (c) of the MPRSA provides that, in the case of dredged material ocean disposal sites:

- *After January 1, 1995, no site shall receive a final designation unless a management plan has been developed.*
- *For sites that received a final designation prior to January 1, 1995, management plans shall be developed as expeditiously as practicable, but no later than January 1, 1997, giving priority to sites with the greatest potential impact on the environment.*
- *Beginning on January 1, 1997, no permit or authorization for dumping shall be issued for a site unless it has received a final designation or it is an alternate site selected by the CE under MPRSA Section 103(b).*

The amendment goes on to state that, the Administrator, in conjunction with the Secretary, shall develop a site management plan for each site designated pursuant to this section. In developing such plans, the Administrator and the Secretary shall provide opportunity for public comment. Such plans shall include, but not be limited to:

(A) A baseline assessment of conditions at the site;
(B) A program for monitoring the site;
(C) Special management conditions or practices to be implemented at each site that are necessary for protection of the environment;
(D) Consideration of the quantity of the material to be disposed of at the site, and the presence, nature, and bioavailability of the contaminants in the material;
(E) consideration of the anticipated use of the site over the long term, including the anticipated closure date for the site, if applicable, and any need for management of the site after the closure of the site; and
(F) A schedule for review and revision of the plan (which shall not be reviewed and revised less frequently than 10 years after adoption of the plan, and every 10 years thereafter). Management of ocean dredged material disposal sites (ODMDS) involves regulating the times, the quantity, and the physical/chemical characteristics of dredged material that is dumped at the site; establishing disposal controls, conditions, and requirements to avoid and minimize potential impacts to the marine environment; and monitoring the site environs to verify that unanticipated or significant adverse effects are not occurring from past or continued use of the disposal site and that permit terms are met.

Appropriate management of ODMDS is aimed at assuring that dredged material placement activities will not unreasonably degrade or endanger human health, welfare, the marine environment or economic potentialities (see MPRSA §103(a)). ODMDS management is a continuum that begins with site designation. At the site designation stage, the emphasis is on selecting a site where dredged material placement will not have a significant adverse impact on various amenities such as fisheries, coral reefs, historic sites (e.g., shipwrecks), or endangered species, or on other uses of the marine environment. The site designation criteria are set forth at 40 CFR 228.5 and 228.6. The ODMDS designation documents should identify any topics of special concern and, as appropriate, identify constraints and conditions on the use of the site for inclusion in the site management plan or permits authorizing site usage. The EPA Region and USACE District also must establish appropriate monitoring plans, as required by MPRSA §102(c)(3)(B).

1.3.4 The Coastal Zone Management Act

In 1972, the Coastal Zone Management (CZM) Act established a national program to encourage coastal states to develop and implement coastal zone management plans. Both Connecticut and New York have developed Coastal Zone Management plans and programs that were Federally approved under CZM. Section 307 of CZM 1972, as amended, requires Federal agencies proposing activities within or outside the coastal zone that may have a reasonably foreseeable affect on land or water use or natural resource of the coastal zone to ensure that those activities are conducted in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State coastal management programs.

In LIS the boundary between the states of CT and NY runs across the middle of the Sound from Greenwich,, CT to Fishers Island, NY, and then through the middle of Fishers Island Sound to the point where CT, NY and RI meet off the entrance to Little Narragansett Bay. For CZM jurisdictional purpose both CT and NY have extended their coast zone to the 20-foot contour offshore of each others' coast. Both states use their CZM programs to regulate use of the open water placement sites in LIS.

Connecticut Coastal Zone Consistency: Pursuant to Section 22a-100 of Connecticut General Statutes (CGS), each state department, institution or agency responsible for the primary recommendation or initiation of actions within the Coastal Boundary that may significantly affect the environment must demonstrate that those actions are consistent with all applicable policies and standards contained in the Connecticut Coastal Management Act (CCMA).

Coastal management in Connecticut is a comprehensive, cooperative program that functions at all levels of government. Connecticut's Coastal Management Program is administered by the Department of Energy and Environmental Protection (DEEP) and is approved by NOAA (National Oceanic and Atmospheric Administration) under the federal Coastal Zone Management Act. Under the statutory umbrella of the CCMA, enacted in 1980, the Program ensures balanced growth along the coast, restores coastal habitat, improves public access, protects water-dependent uses, public trust waters and submerged lands, promotes harbor management, and facilitates research. The Coastal Management Program also regulates work in tidal, coastal and navigable waters and tidal wetlands under the CCMA, the Structures Dredging and Fill statutes and the Tidal Wetlands Act.

New York Coastal Zone Consistency: The New York Coastal Management Program (NYCMP) was approved by NOAA in 1982 and is a comprehensive program that incorporates State-wide, regional Long Island Sound, and Local Waterfront Revitalization Programs (LWRP) enforceable coastal policies to conduct federal consistency reviews in accordance with 15 CFR Part 930.

The NYCMP provides for the review of federal actions and activities, utilizing program coordination at all levels of government, for consistency with coastal policies concerning Development (land use, coastal uses, maritime uses, commercial shipping); Fish and Wildlife (habitat protection, recreational and commercial fisheries, ecosystem resiliency); Flooding and Erosion (climate change, erosion, resilience, land use planning); Public Access and Recreation (public access, underwater lands, recreational boating, navigation); Historic, Scenic and Agricultural (socioeconomic, historic and archeological preservation, visual impacts); Energy and Ice Management (energy generation and transmission); and Water Quality, Air Quality and Wetlands Protection (ecosystem services, watershed management, water quality compliance).

The Long Island Sound CMP is the regional refinement of the NYCMP for activities proposed within or affecting Long Island Sound and the 13 coastal policies of the LIS CMP are the applicable coastal policies for reviewing dredged material disposal projects in Long Island Sound. The coastal policies of an LWRP are used to review a project for consistency if the activity will occur within or affecting that LWRP. New York also has interstate consistency review (15 CFR part 930 subpart I) over federal agency actions and activities occurring in Connecticut state waters up to the -20' bathymetric mark and within the boundaries of Long Island Sound; which include actions and activities within the jurisdiction of the Marine Protection, Research and Sanctuaries Act (MPRSA) (33 USC 1401 et seq.) and the Clean Water Act (CWA) (33 USC 1344 et seq.).

Rhode Island Coastal Zone Consistency: In 1978, with the adoption of the Rhode Island Coastal Resources Management Program (RICRMP) into the Federal coastal management program established by the Coastal Zone Management Act (CZMA) (16 USC §§ 1451-1464), federal activities affecting any Rhode Island coastal use or resources became subject to the consistency provisions of CZMA section 307. The agency responsible for overseeing implementation of the RICRMP is the Rhode Island Coastal Resources Management Council (CRMC). The CRMC was created in 1971 pursuant to § 46-23 of the Rhode Island General Laws (R.I.G.L.) for the purpose of managing the coastal resources of the state. CRMC is charged with the responsibility "to preserve, protect, and, where possible, to restore the coastal resources of the state for this and succeeding generations through comprehensive and long range planning and management designed to produce the maximum benefits for society from such coastal resources; preservation and restoration shall be the guiding principle upon which environmental alterations will be measured, judged and regulated (R.I.G.L. §46-23-1)". The CRMC adopted the RICRMP in 1976 and received its federal program approval pursuant to the CZMA in 1978. The RICRMP was substantially revised in 1983 and 1990. The RICRMP is regulatory in nature and is largely structured as a strategic plan for the state's coastal areas.

1.3.5 Corps of Engineers Environmental Operating Principals

The USACE has reaffirmed its commitment to the environment in a set of "Environmental Operating Principles". These principles foster unity of purpose on environmental issues and reflect a positive tone and direction for dialogue on environmental matters. By implementing these principles within the framework of USACE regulations, the USACE continues its efforts to evaluate the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions in partnership with stakeholders. The seven "Environmental Operating Principles" are as follows:

1. Foster sustainability as a way of life throughout the organization.
2. Proactively consider environmental consequences of all USACE activities and act accordingly.
3. Create mutually supporting economic and environmentally sustainable solutions.
4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments.
5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
6. Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
7. Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

1.3.6 The Federal Standard

The Federal Standard is defined in USACE regulations as the least costly dredged material disposal or placement alternative (or alternatives) identified by USACE that is consistent with sound engineering practices and meets all Federal environmental requirements, including those established under the CWA and the MPRSA. The applicability of the Federal Standard to USACE decision-making, state reviews under the CWA and MPRSA (ODA), and non-Federal partnership, was recently re-emphasized in an October 21, 2015 memorandum by the USACE Director of Civil Works.

The term "Base Plan" is a more accurate operational description of the Federal Standard, because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project. The costs assigned to the navigational purpose of the project are shared with the non-Federal sponsor of the project, with the ratio of Federal to non-Federal costs depending on the nature and depth of the project, as provided for in WRDA 1986, as amended. Navigation project cost-sharing is shown in Table 1-2 below.

Table 1-2 **Project Cost Sharing for Navigation Improvements and Disposal Facilities**			
Project Design Depth	Federal Share	Non-Federal Up-Front Share	Non-Federal Additional Share
Projects up to 20 Feet	90%	10%	10%
Projects >20 feet up to 45 feet	75%	25%	10%
Project over 45 feet	50%	50%	10%

This cost-sharing applies to improvement dredging projects, and development and use of dredged material placement facilities for both improvement and maintenance dredging projects. Maintenance dredging of projects with authorized depths of up to 45 feet is at 100 percent Federal cost, while any maintenance costs attributed to project depths greater than 50 feet are non-Federal. Where an improvement project requires a dredge cut that includes more than one of the depth increments shown in the table above, then cost-sharing is apportioned by depth at more than one rate. Cost-sharing of allowable overdepth volumes is included with the costs for the design depth. (For example in an improvement project dredging an area now at 15 feet to a depth of 45 feet, where typical allowable overdepth is 2 feet. the increment from 15 to 22 feet is cost-shared 90/10/10 and from 22 to 47 feet is shared 75/25/10).

Implementation of placement or beneficial use options more costly than the Base Plan for either maintenance or improvement dredging requires non-Federal funding of the amount above the base plan, or requires cost-sharing in accordance with another Federal purpose applicable to that placement option. In all cases, maintenance of vessel berths, including slip space, is entirely a non-Federal responsibility regardless of project depth.

Establishing the Federal Standard for a particular dredging project is not the same as selecting a placement option for that project, nor does it limit potential Federal participation in the project. Other factors beyond cost contribute to decisions on placement options for dredging projects. Ecosystem restoration is recognized as one of the primary missions of the USACE under its planning guidance, and the placement option that is selected for a project should maximize the sum of net economic development and national environmental restoration benefits. Therefore, a beneficial use option may be selected for a project even if it is not the Federal Standard for that project. Additionally, a project may have more than one purpose, such as navigation and flood risk management. The placement option preferred when two project purposes are considered jointly may be different from those resulting from separate considerations of navigation and flood risk management options.

If a beneficial use is selected for a project and that beneficial use happens to be (or be part of) the Federal Standard or base plan option for the project (because it is the least costly alternative that is consistent with sound engineering practices and meets all federal environmental requirements), the costs of that beneficial use are assigned to the navigational purpose of the project and are shared with the non-Federal sponsor according to the navigation project depth.

Beneficial use project costs exceeding the cost of the Federal Standard (or "base plan") option become either a shared Federal and non-Federal responsibility, or entirely a non-Federal responsibility, depending on the type of beneficial use. Beneficial uses will be discussed in greater detail, as applicable to LIS, in this report's conclusions.

1.4 Project Management Plan

A PMP for this DMMP was finalized in October 2007, and is provided as Appendix I to this report. The PMP defined the Federal authority for conducting the study, identified the study participants, defined the procedures for public involvement, established the goals and objectives of the DMMP, and define the process to be followed to meet those goals and objectives. In specific response to the 2005 Rule, the PMP also calls for "the development of procedures and standards for the use of practicable alternatives to open-water disposal" in LISAs stated in the PMP, the overall goal of the LIS DMMP is to develop a comprehensive plan for dredged material management in Long Island Sound. The DMMP should lead to a continued reduction of the use of the sites over time using a broad based public process that protects the environment based on best scientific data and analysis, while meeting society's need for safe and economically viable navigation for water based commerce, transportation, national security, and other public purposes. The preamble to the EPA site designation rule stated that *"the DMMP for Long Island Sound will include the identification of alternatives to open-water disposal and the development of procedures and standards for the use of practicable alternatives to open-water disposal, so as to reduce wherever practicable the open-water disposal of dredged material. The DMMP also may contain recommendations regarding the use of the sites themselves."*

The PMP specified the scope of the DMMP, including the following process and investigations:

- Updating the literature review, environmental, economic and cultural resource evaluations, and dredging needs study, prepared for EPA's 2004 site designation FEIS
- Establishing an interagency Project Delivery Team (PDT) of interested Federal and State agencies to assist in defining and guiding the study tasks and reviewing study products.
- Conducting public scoping meetings in CT and NY to solicit public input on the study.
- Establishing a technical working group including the PDT members and other local and regional stakeholders, non-governmental organizations (NGOs), universities and marine commercial interests to assist in identifying and evaluating alternatives.
- Formulating a range of alternatives for evaluation including current and historic open water placement sites, beach and nearshore nourishment sites, upland landfills, island and shoreline confined disposal facilities, confined aquatic disposal cells, onshore dewatering/processing areas, marsh creation and enhancement sites, and other applications.
- Developed a dredged material transportation and placement cost matrix to enable cost comparison of the many alternatives for the 52 projects evaluated.
- Further updates to the dredging needs analysis were made in 2015 to include project specific shoaling rates and dredging volume/frequency projections for each individual FNP, and separable project segments and features producing different types of material.
- Categorizing and quantifying the types of dredged material into sandy materials v. fine-grained material, and suitable v. unsuitable (for open water placement) materials.

- Development of alternatives screening tools with public input through a multi-criteria decision analysis, followed up by a weighted evaluation considering environmental impact and benefits, distance of transport, availability and capacity of placement sites.
- Matching sources, volumes, and types of dredged materials with potential alternatives.
- Augmenting the list of top scoring alternatives for each FNP and separable segment and material type to ensure that a range of beneficial use alternatives was represented for each.
- Evaluating the final alternatives for each FNP and separable segment and material type for placement cost.
- Identifying the Federal Base Plans (the least cost environmentally acceptable alternative) consistent with the Federal Standard for each FNP and other Federal agency project.
- Identifying likely beneficial use alternatives to the Base Plan for each FNP and separable segment and potential means and authorities for implementing those alternatives.

An interagency Project Delivery Team of interested Federal and State agencies was established for this DMMP to assist in defining and guiding the study tasks and reviewing study products. Generally, the team conferenced or met on a monthly basis throughout the DMMP study. That team consisted of the following agencies:

USACE New England District	USACE New York District
National Marine Fisheries Service	US EPA Region I
CT Dept. of Energy & Environmental Protection	US EPA Region II
NY Department of Environmental Conservation	NY Department of State
RI Coastal Resources Management Council	CT Department of Transportation

The efforts of the PDT were overseen and guided by a Steering Committee composed of managers of the state and Federal agencies represented on the PDT, and for the USACE also included staff from the North Atlantic Division. The Steering Committee met (in person or by conference call) generally twice a year during the DMMP study.

The first step in soliciting public involvement in the LIS DMMP was the publication of a Notice of Intent in the Federal Register on August 31, 2007. The Notice of Intent listed the agencies involved, the proposed action, a summary of the expected content of the draft PEIS and LIS DMMP, notification of upcoming public scoping meetings, and contact information. Three public scoping meetings each were held in CT and NY in late November 2007.

A technical Working Group for the DMMP was also established which included the PDT members and other local and regional stakeholders, universities and Non-Governmental Organizations (NGOs - mainly marine commercial interests, and environmental advocacy groups), to assist in identifying and evaluating alternatives. Meetings of the working group were held in both CT and NY during development of the alternatives inventory, the disposal cost matrix, and the site screening criteria.

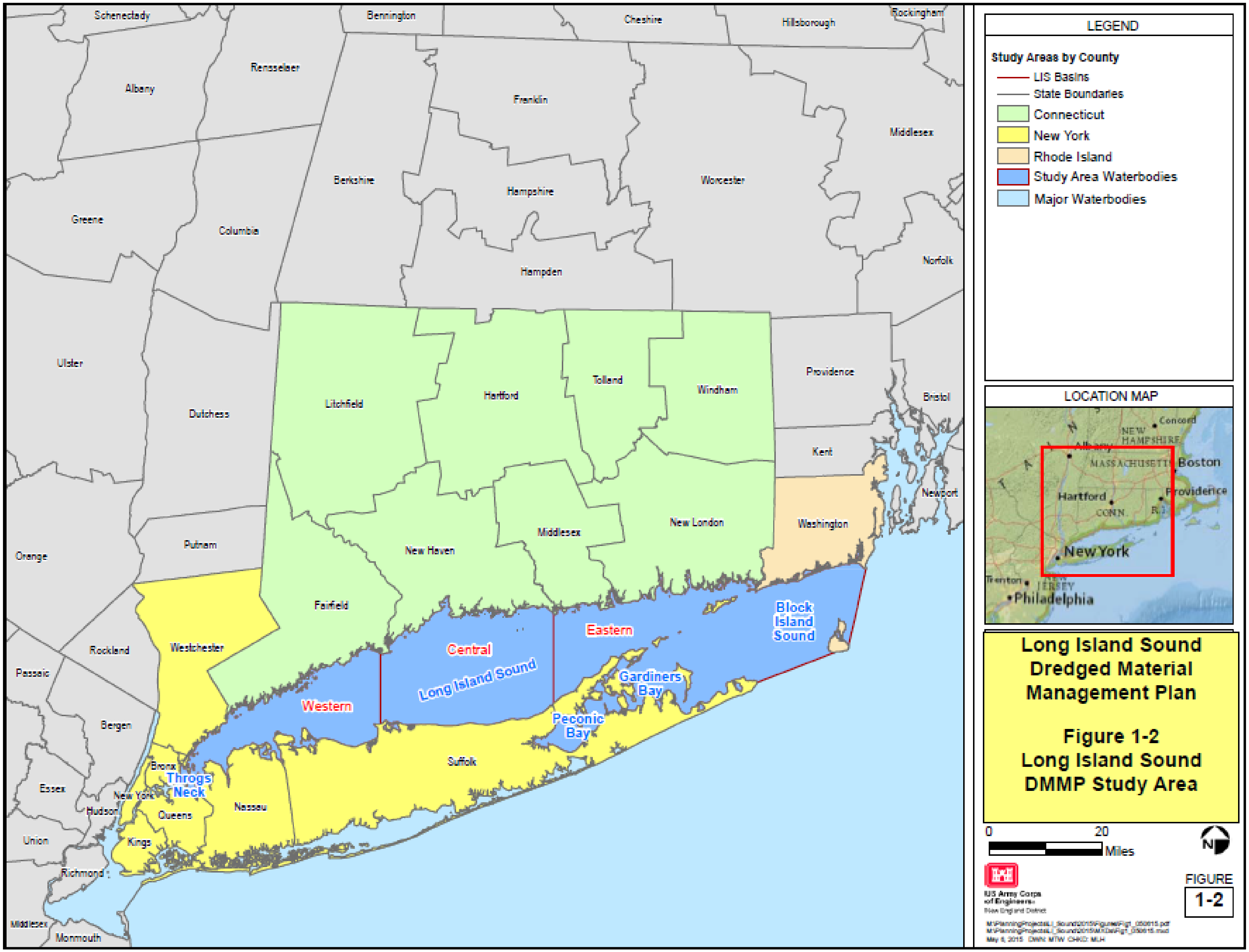
The DMMP was prepared to fulfill the Corps requirements for ensuring feasible, environmental acceptable and cost-effective means of meeting the regions needs for dredged material placement, and to address the requirements in EPA’s 2005 Rule for developing procedures and standards for future dredged material placement in LIS to help achieve the goal of "reducing or eliminating the disposal of dredged material in Long Island Sound.” To address the issue of

Standards, the DMMP identified all potential dredging needs, both Federal and non-Federal for all of the harbors in Long Island Sound, identified a wide range of potential environmentally acceptable, practicable management plans that can be utilized by various dredging proponents in their analysis of options to manage dredging projects, including likely Federal Base Plans for all FNPs in the region. To address the issue of Procedures the DMMP identified a process for continuing use of the LIS Regional Dredging Team to review project proposals, and expanding its role to help advance the beneficial use of dredged material and other alternatives to open water placement. In addition the DMMP examined current ongoing monitoring and management practices in the region to determine how those might be best employed to help meet the Rule's goals.

1.5 Description of the Study Area

The study area for this DMMP is the Long Island Sound Estuary and surrounding watersheds. Long Island Sound is a 110-mile long, semi-enclosed estuary located between the coastline of Connecticut and the northern coastline of Long Island, New York (Figure 1-2). The Connecticut-New York state line runs generally east-west through the middle of Long Island Sound. Unlike most estuaries, LIS is connected to the ocean at both ends. The main entrance to the eastern end of LIS, known as The Race due to its swift currents, presents an open passage to the North Atlantic Ocean through Block Island Sound. There are several smaller passages between the islands extending from the north fork of Long Island northeast across to Watch Hill in Rhode Island. The passage at the western end is more restricted, traveling through the Narrows, along the East River, and around the western tip of Long Island and the east side of Manhattan into New York Harbor.

Long Island Sound's watershed includes an area of more than 16,000 square miles (mi^2), including all of Connecticut and parts of New York, Massachusetts, New Hampshire, Rhode Island, and Vermont. Four major rivers (the Connecticut, Housatonic, Quinnipiac, and Thames) deliver fresh water to the Sound, which is bounded by Connecticut and New York's Westchester County to the north, by New York City to the west, and by Long Island to the south. LIS intersects Washington County, Rhode Island at the easternmost boundaries of Connecticut and New York.


Schenectady
Bennington
Cheshire
Hillsborough
Rockingham
Rensselaer
Albany
Franklin
Middlesex
Berkshire
Hampshire
Worcester
Greene
Columbia
Hampden
Norfolk
Ulster
Dutchess
Litchfield
Hartford
Tolland
Windham
Providence
Bristol
Kent
Newport
Orange
Putnam
New Haven
Middlesex
New London
Washington
Fairfield
Rockland
Westchester
Passaic
Bergen
Bronx
Essex
New York
Hudson
Queens
Nassau
Suffolk
Union
Kings
Richmond
Middlesex
Monmouth
Western
Central
Eastern
Long Island Sound
Block Island Sound
Gardiners Bay
Peconic Bay
Throgs Neck
LEGEND
Study Areas by County
LIS Basins
State Boundaries
Connecticut
New York
Rhode Island
Study Area Waterbodies
Major Waterbodies
LOCATION MAP
Concord
NEW HAMPSHIRE
Albany
MASSACHUSETTS
Boston
Hartford
Providence
CONN.
R.I.
New York
Trenton
JERSEY
Philadelphia
Long Island Sound Dredged Material Management Plan
Figure 1-2
Long Island Sound DMMP Study Area
0
20
Miles
N
US Army Corps of Engineers
New England District
FIGURE
1-2

1.5.1 Dredged Material Source Area

Dredged material in LIS generally comes from the Western, Central, and Eastern Basins. As shown in Figure 1-2, the Western Basin is the area from the Narrows (between Throgs Neck and Willets Point, New York) to the Stratford Shoal (between Stratford Point, Connecticut [near Bridgeport, Connecticut], and Port Jefferson, New York). The Central Basin stretches from the Stratford Shoal to the Mattituck Sill (between Mulberry Point, Connecticut [near Guilford, Connecticut], and Mattituck Point, New York). The Eastern Basin extends from the Mattituck Sill to the Race at the eastern end of LIS and includes Peconic Bay, Gardiners Bay, and Fishers Sound.

The terrestrial portion of the study area includes Washington County in Rhode Island (including Block Island), the entire State of Connecticut, and Westchester, Bronx, Queens, Suffolk, and Nassau counties of New York, as well as the Boroughs of Brooklyn (Kings County) and Manhattan (New York County), New York.

1.5.2. Regional Dredging Centers

The dredging needs of the DMMP study area were updated in 2009, and again in 2015. The dredging needs study area covers a large area, including 55 Federal Navigation Projects (of which 52 include dredged project features requiring maintenance), and several hundred other navigable harbors, inlets, bays, rivers, coves, and other waterways. Navigable portions of the following major rivers were included; the Connecticut River below Hartford, the Thames River to Norwich, Housatonic River to Derby, the Pawcatuck River to Westerly, RI, and the Peconic River to Riverhead, New York. All harbors and all port- or navigation-dependent facilities in this area, whether Federal or not, are included in the study area. In all, these projects are expected to generate more than 53 million CY over the next 30 years. To make development and evaluation of dredged material placement alternatives more manageable, this area was divided into 27 geographical 'dredging centers' centered on major ports or groups of harbors. A list of the dredging centers and the communities included in each dredging center is presented in Table 1-3.

Not all dredging centers have Federal Navigation Projects. In New York, the Oyster Bay-Cold Spring Harbor and the Smithtown-Stony Brook Harbor centers consist of only non-Federal waterways and projects.

Table 1-3
Long Island Sound Dredging Centers

Dredging Center	City/Town	County	State
Block Island Area	Block Island (New Shoreham)	Washington	RI
Fishers Island	Fishers Island (Southold)	Suffolk	NY
Fishers Island Sound and Little Narragansett Bay	Stonington, Groton, Mystic, Noank, and Pawcatuck	New London	CT
	Westerly	Washington	RI
New London Area	Groton, Montville, Norwich, Ledyard, Preston, New London	New London	CT
Niantic Area	Waterford and Niantic (East Lyme)	New London	CT
Connecticut River	Chester, Deep River, East Hampton, Essex, Portland, Middletown, Old Saybrook,	Middlesex	CT
	Cromwell, East Haddam, East Hartford, Glastonbury, Rocky Hill, Hartford, and Wethersfield	Hartford	CT
	Haddam, Lyme, Old Lyme,	New London	CT
Clinton/Westbrook Area	Clinton, and Westbrook	Middlesex	CT
Guilford/Branford Area	Branford, Guilford, and Madison,	New Haven	CT
New Haven Area	East Haven, New Haven, and West Haven	New Haven	CT
Housatonic River/Milford Area	Derby, Orange, Shelton, and Stratford	Fairfield	CT
	Milford	New Haven	CT
Bridgeport Area	Bridgeport and Fairfield	Fairfield	CT
Norwalk Area	Darien, Norwalk, Southport, and Westport	Fairfield	CT
Stamford Area	Stamford	Fairfield	CT
Greenwich Area	Greenwich	Fairfield	CT
Port Chester/Rye Area	Rye	Westchester	NY
Mamaroneck Area/New Rochelle Area	Mamaroneck and New Rochelle	Westchester	NY
Eastchester Bay Area	Mount Vernon and Pelham	Westchester	NY
	Bronx	Bronx	NY

Table 1-3 – Long Island Sound Dredging Centers (Continued)			
Dredging Center	**City/Town**	**County**	**State**
Manhasset & Little Neck Bays	Great Neck, Kings Point, Manhasset and Port Washington	Nassau	NY
	Queens	Queens	NY
Hempstead Harbor Area	North Hempstead and Oyster Bay	Nassau	NY
Oyster Bay/Cold Spring Harbor Area	Huntington	Suffolk	NY
	Oyster Bay	Nassau	NY
Huntington & Northport Bay Area	Huntington	Suffolk	NY
Smithtown Bay/Stony Brook	Brookhaven, Huntington, and Smithtown	Suffolk	NY
Port Jefferson/Mount Sinai	Brookhaven	Suffolk	NY
Suffolk County North Shore Area	Brookhaven, Riverhead and Southold	Suffolk	NY
Great & Little Peconic Bays	Riverhead, Southampton, and Southold	Suffolk	NY
Shelter Island/Gardiner's Bay	East Hampton, Shelter Island, Southampton, and Southold	Suffolk	NY
Montauk	East Hampton	Suffolk	NY

1.5.3. Dredged Material Placement Alternatives Study Area

Placement and beneficial uses of dredged material are discussed in detail by placement type in Chapter 4 by placement type. In most cases, haul distance is the limiting factor for dredged material placement as it is the primary cost input. For example, direct beach placement is typically limited to two miles for most smaller Federal projects as that is the effective distance of a hydraulic pipeline dredge with one or two booster pumps. Nearshore bar/berm placement can occur at any distance for which project proponents are willing to pay hauling costs, however in New England that has never been greater than about 20 miles in recent years.

For upland placement at landfills or brownfield sites an area covering the state of Connecticut, western Rhode Island, the four counties on Long Island, NY, and the New York counties of Westchester, Bronx and Manhattan were included. Only a few landfill sites on Long Island and in upstate Connecticut remain open and were included in the analysis. The US EPA suggested that previously closed landfills in the area might benefit from additional cover using amended dredged material, and this possibility has been suggested to the states in the final DMMP, and should be included in any project-specific alternatives analysis conducted in the future.

In response to comments received at the public scoping sessions to analyze mine reclamation sites in Pennsylvania for receipt of dredged materials, a typical mine site in central Pennsylvania was included in analysis for cost comparison purposes.

Marsh and wetland creation and restoration alternatives were included in the site surveys. However, only two specific sites, both on Long Island NY, were identified by participating agencies. Due to the lack of sites identified by other agencies, additional marsh creation opportunities in Connecticut identified by the USACE were included in the DMMP as suggestions to the states of potential sites.

In summary, the range of disposal alternatives identified and considered in this DMMP was drawn from a number of sources, including surveys of Federal, state and local officials, the members of the LIS Regional Dredging Team (RDT), the LIS DMMP Technical Working Group (TWG) participants, reviews of past studies of Long Island Sound and adjacent areas, and the public scoping meetings.

2 EXISTING FEDERAL NAVIGATION PROJECTS

There are a total of 55 Federal Navigation Projects (FNPs) in the Long Island Sound region that were studied under the LIS Dredged Material Management Plan. Three are located in Rhode Island, one is on the border of Rhode Island and Connecticut, 31 are located wholly in Connecticut, one is on the border of Connecticut and New York, and 19 are located wholly in New York. Three of these projects, all in New York, consist only of breakwaters and do not have any dredged features (Larchmont, Glen Cove and Sag Harbors), and therefore do not require maintenance dredging. This leaves 52 FNPs with dredged project features that require periodic maintenance.

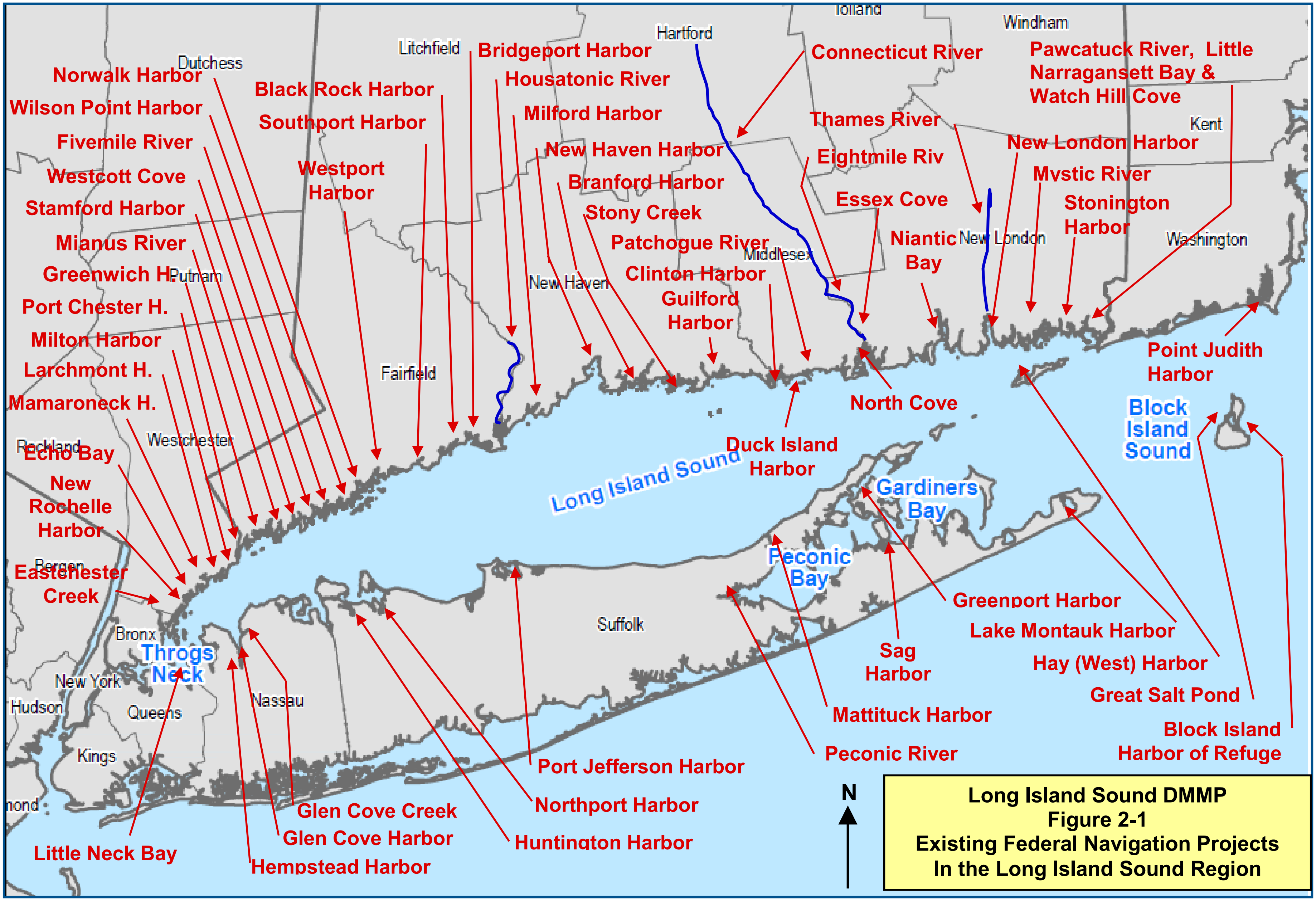
Two projects in the study area were not included. Bridgeport Harbor's main channels and two principal tributaries are the subject of a separate project-specific DMMP, leaving only the Johnsons Creek tributary for consideration in this DMMP. Pont Judith Harbor, RI located at the eastern end of Block Island Sound is currently under study as a Section 107 improvement to modify the existing project and will include a long-term DMMP for that project in the feasibility study.

The complete details of each FNP in this DMMP, including maps, authorization history, as well as past construction and maintenance events are contained in Appendix B. The locations of the FNPs in the DMMP study area are shown in Figure 2-1. The following is a summary of each FNP arranged by dredge center. All dredged depths are referenced to the plane of mean lower low water (MLLW).

2.1 Block Island Dredging Center

2.1.1 Block Island Harbor of Refuge FNP, New Shoreham, RI

The Block Island Harbor of Refuge FNP was first authorized by the River and Harbor (R&H) Act of 1870. The original project was completed in 1877 and consisted of a 500-foot stone breakwater on the east side of the harbor, with a small inner harbor basin surrounded by stone walls. The main breakwater was extended to 1,150 feet in length to make it a harbor of refuge under the same authority. The project was modified multiple times throughout its history with additional features added by various River and Harbor Acts, and some features deauthorized. Major modifications include: construction of the inner basin by enclosing the area with stone filled timber cribs in 1871; increasing the length of the main breakwater to 1,150 linear feet as part of the R&H Act of 1876; adding a 9-foot deep entrance channel and deepening the inner basin to 9 feet by R&H Act in 1880; constructing the West breakwater in dogleg to form the harbor of refuge by R&H Act of 1886; deepening of outer and inner harbors and portion of inner basin to 15 feet by the R&H Act of 1912; and the unconstructed outer harbor anchorage areas from the 1912 Act were deauthorized in 1986. Today, the Block Island Harbor of Refuge consists of two breakwaters, a main breakwater approximately 1,600 feet long, with a top-width of 11 feet and a western breakwater approximately 1,150 feet long in a dog-leg shape that is 20 feet wide at the top; a15-foot channel, 1,500 feet long and 100-175 feet wide; a 2-acre, 15-foot deep inner basin at the southern end of the channel; and a 15-acre, 15-foot deep anchorage to the west of the channel inside the west breakwater.



Long Island Sound DMMP
Figure 2-1
Existing Federal Navigation Projects
In the Long Island Sound Region

The entrance channel is typically maintained every one to four years, either by the USACE hopper dredge *Currituck* or under contract, with the most recent dredging occurring in 2014. The basin and anchorage have a longer frequency between maintenance events.

2.1.2 Great Salt Pond FNP, New Shoreham, RI

The Great Salt Pond FNP was initially authorized by the River and Harbor Act of June 3, 1896 to include an entrance channel with three stepped depths as follows: 12 feet deep by 600 feet wide, a middle cut of 18 feet deep by 300 feet wide, and a center cut of 25 feet deep by 150 feet wide. Also included in the original project was extension of the preexisting South Jetty by 700 feet, and construction of a 510-foot long North Jetty. The South Jetty was extended a further 350 feet in the R&H Act of 1902, and the unconstructed North Jetty was deauthorized in the Water Resources Development Act (WRDA) of 1986. Today, the channel is maintained for a width of 150 feet at an 18-foot depth throughout the channel, although available funds sometimes restrict maintenance to a lesser depth. The entrance channel is typically maintained every one to six years, either by the USACE hopper dredge *Currituck* or under contract, with the most recent dredging occurring in 2013.

2.2 Fishers Island NY Dredging Center

2.2.1 Hay (West) Harbor FNP, Fishers Island, NY

The FNP name of Hay (West) Harbor is a quirk of the Congressional legislation authorizing the study and project. The actual FNP is located at West Harbor. West Harbor and Hay Harbor are two distinctly different harbors both located on Fishers Island. West Harbor (formerly known as Big Hay Harbor), site of the FNP adopted by the R&H Act of 1930, is located along the northern shore of the Island, while Hay Harbor (formerly known as Little Hay Harbor) is located along the western shore. The 1930 authorization provided for a channel 14 feet deep by 100 feet wide from the entrance of Fishers Island Sound into West Harbor. The existing project was completed in 1931 and has not been maintained since that time.

2.3 Fishers Island Sound and Little Narragansett Bay Dredging Center

There are four FNPs within this dredging center. The Federal channel for the Pawcatuck River and Little Narragansett Bay has been authorized and modified under both names at various times. The project for Watch Hill Cove is a geographically separate waterway off of Little Narragansett Bay that was originally authorized under the name: Little Narragansett Bay and Watch Hill Cove. Stonington Harbor consists of a dredged inner harbor, and breakwaters forming a harbor of refuge in the outer harbor. Mystic River and Harbor has been authorized and modified under both names.

2.3.1 Pawcatuck River and Little Narragansett Bay FNP, Stonington, CT and Westerly, RI

The FNP for the Pawcatuck River and Little Narragansett Bay consists of an entrance channel from Stonington Harbor around the northwest end of Sandy Point, into and through Little

Narragansett Bay to the mouth of the Pawcatuck River at the east end of the bar, and then up the river (the border between the States of Rhode Island and Connecticut) to the villages of Westerly and Pawcatuck. The project was initially authorized in the River and Harbor Act of 3 March 1871 which called for a channel, 75 feet wide and 5-foot deep from a point above the river's mouth up to Westerly, RI. The channel into and through Little Narragansett Bay was first adopted by the R&H Act of 1876 which provided for a 7.5-foot deep by 200-foot wide channel that is approximately 2.75 miles long from Stonington Point around Sandy Point to Pawcatuck Point. The combined project was modified by several R&H Acts in 1896 and subsequent years producing the current FNP consisting of a 10-foot channel, 100 feet wide extending from deep water outside Sandy Point, around the Point and easterly through the bay to the mouth of the Pawcatuck River, then at a 10-foot depth in the river from Rhodes Point up the Pawcatuck River for about 3 miles where it decreases to a 7-foot depth for the remaining distance to Westerly.

2.3.2 Watch Hill Cove FNP, Westerly, RI

The River and Harbor Act of 14 August 1876 authorized the removal of boulders from the bay channel and from Watch Hill Cove. Boulder removal operations at Watch Hill Cove were carried out in 1882-1884 and again in 1906. The River and Harbor Act of 2 March 1945 authorized a project at Watch Hill Cove consisting of a 2,000-foot long west jetty; a 10-foot deep by 100-foot wide channel; and a 16-acre, 10-foot deep anchorage. The project was constructed in 1948 to 1949. The R&H Act of 1960 authorized a 1.75-acre expansion of the anchorage area at a 6-foot depth, and extension to the jetty and construction of a stone breakwater. These improvements were never constructed due to lack of local financial support and they were deauthorized in 1979.

2.3.3 Stonington Harbor FNP, Stonington, CT

The Stonington Harbor FNP was first authorized by the Act of 23 May 1828. At that time, a stone breakwater extending approximately 740 feet west from the west shore of Stonington Point with a 12-foot top width and +8.5-foot top elevation was approved for construction. This inner breakwater was constructed between 1828 and 1834. The project was modified by the River and Harbor Act of 1873, which added a 12-foot deep anchorage area above the existing breakwater, which was completed in 1874. The R&H Act of 1875 authorized a stone breakwater with a 12-foot top-width extending about 2,150 linear feet in a southeasterly direction off Wampasset Point which was constructed in 1875-1880. Additionally, the R&H Acts of 1880 and 1884 authorized construction of a second, eastern breakwater 2,900 feet long that extended between the North end of the Middle Ground Shoal and the South end of Bartletts Reef with a top-width of 12 feet to create a harbor of refuge. This eastern breakwater was completed in 1891. The River and Harbor Act of 1894 authorized construction of an 17-foot deep channel across Noyes Shoal to connect the refuge anchorage ground with deeper water in Fishers Island Sound, which was completed in 1895. The R&H Act of 1896 authorized construction of a seawall to protect the lighthouse on Stonington Point, which was completed in 1897. The 1950 R&H Act abandoned the Noyes Shoal channel, the Stonington Point Seawall, and the 1828 inner harbor breakwater. The 1950 R&H Act also authorized two additional anchorages in the inner harbor, a lower one at 10-feet at Penguin Shoal, and an upper one at 6 feet. The 10-foot anchorage was constructed in 1956-1957. The 6-foot deep anchorage was never built and was deauthorized by the WRDA of 1986.

Today the FNP for Stonington Harbor, CT consists of the two harbor of refuge breakwaters (eastern and western), a 10-foot deep anchorage at Penguin Shoal, and a 12-foot deep anchorage to the north in the inner harbor. The anchorages have not been dredged since 1957 and have not significantly shoaled. The east breakwater was repaired in 2012-2013.

2.3.4 Mystic Harbor & River FNP, Groton & Stonington, CT

The FNP at Mystic Harbor was initially authorized by the 1890 River and Harbor Act which provided for a 15-foot deep by 100-foot wide channel, widened at the bends up to 300 feet, extending about 2.5 miles from Fishers Island Sound to the highway bridge at Mystic. The 1913 R&H Act authorized extending the channel upstream 1.25 miles above the highway bridge up to Greenmanville, at 12 feet deep by 100 feet wide, with additional widening in the bend opposite Starr Street. That channel was completed in 1914 except for the additional width in the bend. The R&H Act of 1945 authorized further modifications, including a 9-foot deep turning basin, 200 by 400 feet, located west of the channel below the highway bridge, and an 8.5-acre, 9-foot deep anchorage area east of the channel and north of Mason Island. These features were constructed in 1956-1957. The WRDA of 1986 deauthorized the unconstructed widening of the 12-foot deep channel. The 9-foot deep turning basin was relocated to a position east of the channel at non-Federal expense in 1988 to resolve a marina encroachment issue. Additional deauthorizations of portions of the 15-foot and 12-foot deep channel widths, again to resolve encroachments were made by the WRDAs of 1996 and 2007.

Today the project consists of 15-foot and 12-foot deep channels, a 9-foot deep anchorage, and a 9-foot deep turning basin. All project features were last maintained in 2014-2015.

2.4 New London Dredging Center

The New London Dredging Center includes the FNP for New London Harbor, including Shaw's Cove, and the FNP for the Thames River above New London to Norwich, CT. The Thames River is divided into a lower channel that has been further improved by the U.S. Navy, and an upper channel above that. This dredging center also includes projects of other Federal agencies including the U.S. Navy and U.S. Coast Guard.

2.4.1 New London Harbor FNP, New London and Groton, CT

Main Ship Channel and Turning Basin: The River & Harbor Act of 14 June 1880 authorized the removal of a 'boulder shoal' from between the main channel and the railroad wharf (present State Pier area), which was accomplished in 1880-1886. The main ship channel of the New London Harbor FNP was originally authorized by the R&H Act of 1916. Prior to that time the natural channel had depths in excess of 25 feet. The 1916 authorization was for a channel depth of 33 feet deep by 600 feet wide with an approximate length of 3.25 miles from deep water in the Long Island Sound up to the Groton Power Plant Dock. This channel was constructed between 1903 and 1907. The WRDA of 1976 allowed for the deepening of the main ship channel to a 40-foot depth to above the Hess Pier along with a 40-acre turning basin, at a 30-foot depth, and a 32-foot deep by 4.9-acre maneuvering area, 160 feet wide to the state pier. The USACE did not construct these features, but the channel was deepened to 40 feet by the US Navy, and later the USACE assumed maintenance of the channel at the new depth.

The U.S. Navy has twice deepened the main channel at New London Harbor to accommodate the needs of new classes of submarines entering the fleet, first deepening nearly all of the channel's length to 40 feet, and adding a turning basin south of the state pier at the same depth, all in 1980. In the 1990s the Navy widened and deepened the upper end of the channel above their turning basin to 36 feet, as part of a project to deepen the lower Thames River to that depth. The 36-foot Navy project was later deepened to 40 feet. Under agreement between the two departments, the USACE will maintain the deeper depths and widths provided by the Navy, but the Navy must fund maintenance required for project widths greater than that authorized by the USACE FNP. In the main channel of New London Harbor, the USACE will maintain, using its Civil Works funds, a 600-foot wide channel to a depth of 40 feet, with the Navy funding all dredging required for widths greater than 600 feet.

Waterfront Channels and Anchorages: A 23-foot deep by 400-foot wide channel along the waterfront of New London was authorized by the River and Harbor Act of 1902. The channel would span from deep water in the outer harbor near Fort Trumbull northwest to the mouth of Shaw's Cove then northeast and north along the city waterfront and northeast again to return to deep water in the main channel. Two, 23-foot deep branch channels into Winthrop's Cove and into the area between the Railroad Wharf and the State Pier were also included in the 1902 project and completed in 1907. An additional 23-foot deep maneuvering area south of the State Pier and east of the Waterfront Channel was authorized by the 1937 R&H Act and constructed in 1938-1939.

Shaw's Cove: The River and Harbor Act of 1892 authorized a 12-foot deep by 100-foot wide channel into Shaw's Cove then west and south along the sides of the cove for a total length of 2,000 feet, and a 12-foot deep anchorage basin, 400 by 800 feet in size in the Cove. That project was constructed between 1892 and 1900. The R&H Act of 1910 authorized deepening the project to 15 feet, which was accomplished in 1912-1913.

2.4.2 Thames River FNP, New London & Groton Upriver to Norwich, CT

Similar to New London Harbor, the Navy has deepened and widened the FNP channel in the lower Thames River up to the head of their Groton facility. The USACE FNP calls for a 25-foot deep channel above New London Harbor to the city of Norwich. The U.S. Coast Guard also maintains access to the piers at its Academy in New London.

Federal Navigation Project Features: The first Federal improvements to navigation for the Thames River, made in the Act of 3 March 1821, authorized the removal of obstructions placed in the river by U.S. forces during the War of 1812 to prevent enemy passage of the river. The Act of 4 July 1836 authorized a channel 9 to 11 feet deep by 100 feet wide up to Norwich, with 14 stone training dikes, to increase the efficiency of the channel. The dike work included rehabilitations of old dikes constructed by others, as well new dikes with a top elevation grading from +3.5 feet Mean High Water (MHW) at the upstream end to +1.5 Feet MHW for the downstream-most structures. These works were constructed between 1836 and 1839. The channel was widened at Norwich to 200 feet at the mouth of the Shetucket River to alleviate ice jams in 1869. The River and Harbor Act of 1871 authorized a 14-foot deep MHW channel up to Norwich at 100 to 200 feet wide, and with removal of the middle ground shoal at Norwich to a depth of 9 feet. That work was completed in 1873. The R&H Act of 1879 authorized a 14-foot MLW channel up to Norwich, which was constructed between 1879 and 1883. Another training dike, this time at Trading Cove Flats, was built in 1882 under authority contained in the R&H Act of 1881. A further four stone dikes were constructed between 1883 and 1906 under separate authority from the Chief of Engineers.

The R&H Act of 1888 authorized a 16-foot channel up to Allyns Point, and 14 feet from there to Norwich, with removal of the middle ground at Norwich to 14 feet. The work was completed one feature at a time with the 16-foot deep channel in 1889, the 14-foot deep channel in 1901, and the middle ground removal in 1912. The R&H Act of 1907 authorized deepening the lower channel up to Allyns Point to 20 feet, which was completed in 1908. Deepening the channel above Allyns Point to Norwich to 18 feet deep was authorized by the R&H Act of 1927, and was constructed between 1928 and 1930.

The existing 25-foot deep channel was authorized by the R&H Act of 1930 for the channel reaches up to Allyns Point, and by the R&H Act of 1935 for the reaches above Allyns Point to Norwich, including the turning basin at Norwich. These improvements were constructed between 1932 and 1941, except for an additional width of the upper channel in the bend at Long Reach, which was never constructed and eventually was deauthorized by the 1986 WRDA. The R&H Act of 1945 authorized widening the channel opposite the Naval Base by 350 feet at a depth of 20 feet to create a maneuvering area. This work had already been constructed by the U.S. Navy in 1940, and that feature was now incorporated into the FNP.

The existing FNP for the Thames River, as authorized and constructed under the USACE Civil Works authority, consists of a 25-foot channel from New London Harbor up to Norwich, 250 feet wide below Bartlett Crossover, and 200 feet wide above to Norwich, with a turning basin of that depth at Norwich, a 20-foot deep by 350-foot wide maneuvering area along a 3/4 mile long reach of the lower channel opposite the Naval Base, and a number of stone training dikes along the channel.

<u>U.S. Navy Project Modifications</u>: The U.S. Navy made the changes to the channels in New London Harbor and the lower Thames River beginning in 1973 and continuing to 1996. In 1973 to 1974 the U.S. Navy deepened and widened the channels in the harbor and river to 36 feet. The Navy deepened the harbor channel to 40 feet in 1980. In 1985 to 1986 the Navy performed maintenance on the 36-foot channel and deepened approaches and berths at the base to 42 feet. In 1995 to 1996 the Navy deepened most of the area of the 36-foot channel above the New London turning basin to the upstream end of the Base to 39 feet.

In the Thames River, under the agreement between the USACE and the Navy, the USACE will maintain the Navy's channel depths within the horizontal limits of the FNP. The Navy must pay for any maintenance required from areas outside of the horizontal limits of the FNP.

2.5 Niantic Area Dredging Center

2.5.1 Niantic Bay and Harbor FNP, East Lyme & Waterford, CT

The FNP for Niantic Bay and Harbor authorized by the Chief of Engineers August 24, 1964 under the Continuing Authority of Section 107 of the River and Harbor Act of 1960. The authorized project consists of a channel from deep water in the bay at 8 feet deep by 100 feet wide up to the highway bridge, thence 6 feet deep by 100 feet wide to deep water south of Sandy Point in the river. The project was constructed in 1970 and no maintenance dredging has been performed since that time.

2.6 Connecticut River Dredging Center

The Connecticut River dredging center consists mainly of the FNP for the Connecticut River below Hartford, with its several separate tributary projects constructed under the authority of various acts and continuing authorities. The river is tidal for more than 60 miles from the Sound. The project consists of the 15-foot deep main river channel from Long Island Sound up to Hartford, divided into 38 separate channels through various bars and shoals, arranged into four reaches; entrance bars, lower bars, middle bars and upper bars. The main channel includes the two stone jetties at the river's mouth at Old Saybrook, and several revetments, training dikes and bank protection measures, mostly along the upper river reaches, intended to prevent erosion of the river banks and deposition of material into the channel, and to train the river flow into the dredged channels to extend their maintenance frequency. The main channel project also includes the two remaining 12-foot deep channel segments at Deep River (Devil's Reef Bar) and Chester (Chester Creek Bar) that were not included in the 15-foot deepening when that channel was realigned to the east across Potash Bar but were retained for access to the steamer wharf at Chester. The project also includes separate sub-projects for the North Cove, Essex Cove Harbor, Eightmile River and Hamburg Cove, Salmon River Cove, and Wethersfield Cove. Descriptions of the separable sub-projects and the bar channels and will begin at the Sound and extend upstream to Hartford.

2.6.1 North Cove, Old Saybrook, CT

The River and Harbor Act of 1945 adopted the project for North Cove consisting of a channel from Connecticut River into North Cove, 11-feet deep by 100 feet wide to a stepped anchorage that is 650 feet wide, 11 Feet MLLW by 12 Acres and 6 feet deep by 17 acres, and a total of 1,150 feet long. The Federal project was constructed in 1965, and has remained unmodified since its initial authorization. The project was most recently maintained in 2008-2009.

2.6.2 Essex Cove Harbor, Essex, CT

This project for Essex Cove Harbor was authorized by the Chief of Engineers on October 18, 1961 under the continuing authority of Section 107 of the R&H Act of 1960. The Essex Cove FNP consists of two anchorages (one 8-foot deep by 19 acres and the other 10-foot deep by 15 acres), and a 4,400-foot long branch loop channel, 10-foot deep by 100 feet wide, connecting at each end to the main channel of the Connecticut River at Essex Shoals. The project was completed in 1963 and has not been dredged since that time.

2.6.3 Eightmile River and Hamburg Cove, Hamburg, CT

The River and Harbor Act of 1910 authorized an 8-foot deep channel by 75 feet wide from the Connecticut River upstream to a turning basin, 150 by 300 feet long in the Eightmile River up to the landing at Hamburg. The project was constructed in 1910-1911. The addition of two 6-foot deep anchorage areas at the head of navigation, totaling 6.5 acres, was authorized by the R&H Act of 1950. These anchorages were never constructed and were deauthorized by the 1986 WRDA.

2.6.4 Salmon River Cove, Haddam, CT

Salmon River Cove was originally authorized by the River and Harbor Act of June 18, 1878 to consist of a 7-foot deep channel at the mouth of the Salmon River. The channel was extended up to the Moodus Wharves by the R&H Act of 1882 and deepened to 8.5 feet and widened to 75 feet across the bar into the mouth of the Salmon River by the R&H Act of 1902. The channel has not been dredged since 1902, and the landing it served does not appear to be functional. Maintenance of this project feature is not expected during the 30-year DMMP planning horizon.

2.6.5 Wethersfield Cove, Wethersfield, CT

The project for Wethersfield Cove was authorized by the Chief of Engineers on November 15, 1960 under the continuing authority of Section 107 of the River and Harbor Act of 1960. The Wethersfield Cove FNP consists of a 6-foot channel 60 feet wide, leading 1,200 feet west off the Connecticut River into Wethersfield Cove, to a 6-foot deep anchorage basin, 30-acres in area. The project was constructed in 1962-1963 and was most recently maintained in 2014.

2.6.6 Main Channel - Entrance Bars (below the Railroad Bridge)

Due to the widening of the river's mouth as it enters the Sound, the three entrance bar channels contain mostly silty materials not suited for nourishment purposes. These three channels, located in the towns of Old Saybrook and Old Lyme are described as follows.

<u>Saybrook Outer Bar and Saybrook Shoals Channels</u>: The channel through the Saybrook Outer Bar is the entrance channel to the Connecticut River. The two stone jetties (east and west) were the first parts of the FNP to be built with a top elevation of 5 feet MLLW. The Annual Report for 1873 states that they were approved for construction that year. Over time the project was modified to include: an extension of the east jetty by 200 linear feet southerly under authority of the River and Harbor Act of 1880; an extension of the west jetty seaward for a total length of 1,934 linear feet and extending the east jetty to the 12-foot contour; raising the top elevation of the east jetty to +6 feet MLW, all as recommended in the Annual Report for 1885.

The outer bar and Saybrook Shoals were originally treated as one channel. The Act of 4 July 1836 authorized a 1,500-foot-long channel, 500 feet wide and 11 to 12 feet MLW. But dredging in 1838 to 1840 only achieved a 50-foot width. The R&H Act of 1870 changed the configuration of the channel by decreasing the depth to -8.5 feet and the width to 200 feet, work which was accomplished in 1871-1872. After initial construction of the jetties the R&H Act of 1880 authorized a 12-foot deep channel at the entrance bars, work that was accomplished in 1884-1885, but only to a width of 120 feet. The R&H Act of 1911 authorized a 15-foot deep channel at the river's mouth and 12 feet deep up to Harford. The 15-foot deep entrance channel was constructed in 1911-1912. And finally the R&H Act of 1935 authorized a 15-foot deep channel 300 feet wide across the bars and up to the Railroad Bridge, then 15 feet deep by 150 feet wide up to Hartford. Construction of these channels was accomplished between 1936 and 1937. The outer bar channel was last maintained in 1991 and the Saybrook Shoals reach in 1984.

<u>Saybrook Railroad Reach</u>: Because of its natural depth and location somewhat upriver from the outer bar, he Saybrook Railroad Reach channel did not require dredging until adoption of the 15-foot project depth. There is also no record of maintenance of this reach before 1984, the last time it was dredged. This reach consists of a 15 foot deep channel, 300 feet wide along the northern slope of the bar.

2.6.7 Main Chanel – Lower Bars (Bridges up to Essex and Lyme)

The lower river bar channels are those channels upstream of the railroad and highway bridges above the river's mouth, and extending upriver as far as Essex and Lyme. The three bar channels are Calves Island Bar, Essex Shoals, and Brockway Bar. The first mention of dredging improvements at these bars is from the 1899 Annual Report which describes a cut-off channel at Brockway Bar. At that time the river bar channels had authorized depths of 9-1/2 feet by 100 feet wide, and the first experiments were being tried with a 12-foot depth. The general 12-foot river channel depth authorized in 1911, and the 15-foot depth with 150-foot width authorized in 1935, would have included all three bars in this reach of the river.

<u>Calves Island Bar</u>: The Calves Island Bar is located immediately upstream of the bridges. The channel dimensions today, as authorized in 1935 and completed in 1937 are 15 feet deep by 150 feet wide. This bar was last maintained in 1991.

<u>Essex Shoal</u>: The main channel at Essex Shoal lies east of Essex Cove Harbor. The two dredged areas are separated by a narrow shoal. The channel dimensions today, as authorized in 1935 and completed in 1937 are 15 feet deep by 150 feet wide. This bar was last maintained in 1991.

<u>Brockway Bar</u>: Brockway Bar is located about mid-way between the Eightmile River confluence and the landing at Deep River. The channel dimensions today, as authorized in 1935 and completed in 1937 are 15 feet deep by 150 feet wide. This bar was last maintained in 1987.

2.6.8 Main Channel – Middle Bars (Essex and Lyme to Middletown)

This section of the Connecticut River below Hartford project consists of 15 separate bar channel segments of the 15-foot deep by 150-foot wide main channel between Essex and Middletown, Connecticut, including: Potash Bar (East Channel), Eddy Rock Shoal, Salmon River Bar, Warners Quarry Bar, Haddam Island Bar, Rock Landing Bar, Higganum Creek

Shoal, Scoville Rock Bar, Sears Shoal, Sears Shoal Upper Bar, Cobalt Shoal, Paper Rock Shoal, Bodkin Rock Shoal, Mouse Island Bar and Portland Bar. This section of the river also includes the two remaining segments of the prior 12-foot deep channel at Devils Reef Bar, Chester Bar (West Channel) which provide navigation access to the landings at Deep River and Chester. These 17 bar channels are in the towns of Lyme, Chester, Haddam, East Haddam, East Hampton, Portland and Middletown.

The Mouse Island Bar was included in the 1870 R&H Act authorization for an 8-foot deep river channel, and the 9.5-foot deep channel project of 1872. The other bars would have been added to the work when the general improvement for a 12-foot deep river channel was authorized in 1911. All but the Chester and Devil's Reef bars were deepened to 15 feet deep by 150 feet wide under the 1935 authorization. The last general maintenance of the middle bars was conducted in 1982-1984, with maintenance of the Higganum Creek Shoal and Sears Shoals also conducted in 1993-1994.

2.6.9 Main Channel – Upper Bars (Middletown to Hartford)

This section of the Connecticut River below Hartford project consists of 16 separate bar channel segments of the 15-foot deep by 150-foot wide main channel between Middletown and Hartford, Connecticut, including: Portland Bar, Cromwell Bar, Gildersleeve Island Shoal, Pistol Point Bar, Brownstone Bar, Dividend Bar, Glastonbury Two Piers, Glastonbury Upper Bar, Press Barn Bar, Crow Point Bar, Naubuc (Pratts Ferry) Bar, Cys Hollow Bar, Wethersfield Bar, Claybanks Bar, Claybanks Upper Bar, and Hartford Bar. These 16 bar channels are in the towns of Middletown, Portland, Cromwell, North Cromwell, Gildersleeve, South Glastonbury, Glastonbury, Wethersfield, East Hartford and Hartford.

The bar channels at Hartford, Clay Banks, Pratt's Ferry and Glastonbury were included in the 1870 River and Harbor Act authorization for an 8-foot deep river channel, with those bars and the channels at Dividend and Press Barn added for the 9.5-foot deep channel project of 1872. Under the 1880 River and Harbor Act attempts were made to establish a 12-foot channel depth at Glastonbury but that effort was abandoned. A number of the bar channels were widened in 1905. The other bars would have been added to the work when the general improvement for a 12-foot deep river channel was authorized in 1911, and then deepened to 15 feet deep by 150 feet wide under the 1935 authorization. The last general maintenance of the middle bars was conducted in 1981-1984. The Pistol Point Bar was maintained in 1988, 1994 and 2002.

2.7 Clinton-Westbrook Dredging Center

There are three FNPs in the Clinton-Westbrook dredging center; Patchogue River, Duck Island Harbor of Refuge, and Clinton Harbor.

2.7.1 Patchogue River FNP, Westbrook, CT

The River and Harbor Act of 3 September 1954 authorized the Patchogue River FNP in Westbrook, Connecticut consisting of an 8-foot deep channel, 75 feet wide extending 5,100 feet from deep water in Long Island Sound to the U.S. Route 1 Bride; a stone jetty 600 feet long on the west side of the inlet; and an anchorage area, 8 feet deep by 75 feet wide by 500 feet long opposite the Town Wharf. Jetty construction and improvement dredging were completed in 1956. The project was modified April 12, 1983 by the Chief of Engineers under the continuing authority of Section 107 of the R&H Act of 1960 to widen the entrance channel 125 feet from the Sound for a distance of 1,800 feet upstream to the confluence of the Patchogue and Menunketesuck Rivers. That work was completed in December 1983 in conjunction with maintenance of the entire project. The WRDA of 1996 deauthorized a portion of the 8-foot Federal channel downstream of the Town Wharf and re-designated a portion of the 8-foot Federal anchorage as part of the 8-foot channel. The project was last maintained in 2012.

2.7.2 Duck Island Harbor of Refuge FNP, Westbrook, CT

The Duck Island Harbor of Refuge was originally authorized by the River and Harbor Act of 1890 which provided for the three stone breakwaters, one extending 3,000 linear feet west from Duck Island, the second extending northeast 1,750 linear feet from Duck Island, and the third extending 1,130 linear feet west from Menunketesuck Point. All three breakwaters were to have a top elevation of +10 feet and 10-foot top width. The West breakwater was built to a lesser section and length between 1891 and 1898, and the other two breakwaters (East and Menunksetesuck) were never built.. The R&H Act of 1910 authorized completion of the West Breakwater and construction of two additional breakwaters. Under that authorization the West Breakwater was completed to a length of 2,700 feet. The two remaining breakwaters were constructed between 1910 and 1914, one extending 1,100 feet north from Duck Island and the other 3,750 feet southerly from Kelsey Point. The R&H Act of 1916 authorized dredging a 16-foot deep anchorage in the lee of the Duck Island breakwaters, which was completed in November 1916. The breakwaters were last repaired in 1939 and the anchorage was last maintained in 1949.

2.7.3 Clinton Harbor FNP, Clinton, CT

The Federal navigation project at Clinton Harbor was initially authorized by the River and Harbor Act of 1882. At that time, a stone dike to close a breach in the beach and a 6-foot deep by 100-foot wide channel into the harbor was authorized. The dike was completed in 1883 and the channel in 1893. The 1945 R&H Act deepened the channel to 8 feet, widened the section of the channel at the approach to the Town Wharf to 150 feet, and added an anchorage 8 feet deep by 50 to 250 feet wide by 600 feet long south of the channel opposite the Town Landing. Those improvements were constructed between 1949 and 1951. The 1999 WRDA re-designated a portion of the inner channel as anchorage area to bring about the current project as seen today. The project was last maintained in 2012-2013.

2.8 Guilford-Branford Dredging Center

There are three FNPs in the Clinton-Westbrook dredging center; Guilford Harbor, Stony Creek Harbor, and Branford Harbor.

2.8.1 Guilford Harbor FNP, Guilford, CT

Guilford Harbor was initially authorized by the River and Harbor Act of 1945, which provided for an entrance channel 6 feet deep by 100 feet wide from the outer harbor into the East River to a 6-foot deep anchorage, 200 feet wide by 1,500 feet long, and at its head and a spur channel 6 feet deep by 600 feet wide into Sluice Creek. That project was constructed in 1957-1958. The 1996 WRDA deauthorized a portion of the channel into Sluice Creek and realigned the remaining channel within the project footprint. The project was last maintained in 2015.

2.82 Stony Creek Harbor FNP, Branford, CT

Stony Creek Harbor FNP was authorized by the Chief of Engineers December 4, 1967, under the continuing authority of Section 107 of the River and Harbor Act of 1960. The authorized project consisted of a channel, 6 feet deep by 100 feet wide from Long Island Sound to the Stony Creek town dock with an anchorage, 6 feet deep by 3.5-acres above the head of the channel. That project was constructed in 1969-1970. The WRDA of 1996 deauthorized a small triangular portion of the 6-foot anchorage. The project was last maintained in 1995.

2.8.3 Branford Harbor FNP, Branford, CT

The FNP at Branford Harbor was authorized by the River and Harbor Act of 1902 which provided for a channel 8.5 feet deep by 100 feet wide from deep water into the inner harbor upstream to the upper docks. In 1907, the R&H Act of that year extended the channel 2,900 feet seaward from the inner harbor to deep water in the outer harbor with the same dimensions as the inner channel. The 8.5-foot deep channel was completed in 1907. In 1916, it was recommended and approved that the channel through the inner harbor be reduced in depth to 7.5 feet for future maintenance. The Water Resources Development Act of 1996 deauthorized a portion of the inner channel near its upper end to resolve encroachments. The project was last maintained in 1989-1990.

2.9 New Haven Dredging Center

The New Haven dredging center includes one FNP; New Haven Harbor, in the towns of New Haven, East Haven, and West Haven. That project has five principal segments: the main ship channel and associated deep-draft maneuvering area and anchorage, the Mill River, the Quinnipiac River, the West River, and the three harbor of refuge breakwaters in the outer harbor.

2.9.1 New Haven Harbor FNP- Main Ship Channel, New Haven, CT

The New Haven Harbor FNP dates back to August 1852 when the Act of 1852 called for the removal of middle rock from the eastern entrance to New Haven Harbor to bring the channel to a 17-foot depth. Additional rock removal was authorized and accomplished in 1870. The first dredging was authorized by the River and Harbor Act of 1871 for a 14-foot deep by 200-foot wide channel across the middle bar up to the wharves at New Haven, increased to a depth of 16 feet for a distance of 5,000 across the Fort Hale Bar in 1872, and that depth extended up to Long Wharf authorized by the R&H Act of 1878. That project was completed in 1897, including a widening of the upper channel reaches to 400 to 600 feet. A stone jetty from the beach south of Fort Hale was authorized by the R&H Act of 1873 and completed in 1875. Under the authority of the R&H Act of 1882 a stone and timber crib dike was built along the outer end (2,160 LF) of Sandy Point Bar, with a 3,200-foot long stone "T" parallel to the bar channel, as completed in 1889. The jetty and dike were intended to reduce shoaling of the bar channel and increase currents flushing across the bar to reduce channel shoaling rates.

The R&H Act of 1899 increased the main channel dimensions to 20 feet deep by 400 feet wide to Fort Hale, then 300 feet wide to the bridges. The 1899 R&H Act also included anchorage areas of 20, 16 and 12 feet deep added in the upper harbor, and completed by 1904. The R&H Act of 1910 authorized widening the 20-foot deep channel in its upper 6,000 LF to the bridges, deepening the 12-foot deep anchorage to 15 feet, dredging a 12-foot deep channel in the Brewery Street Canal, and removing rocks from Morris Cove, all work completed in 1912. Further widening of the upper 20-foot deep channel reaches was authorized in 1913 and completed in 1915.

The National Industrial Recovery Act of 1933 and the R&H Act of 1935 authorized a 25-foot deep main channel 400 feet wide in the outer reaches, and 500 feet wide in the upper reaches to the bridges; work that was completed in 1935. The R&H Act of 1945 authorized a number of improvements, including a 30-foot deep main channel, none of which were ever constructed. The R&H Act of 1946 substituted a 35-foot deep main channel, 500 feet wide in the entrance seaward of the breakwater turn, 400 feet wide up to the New Haven Terminal, 800 feet wide above the terminal. The 35-foot deep channel was completed between 1947 and 1950. The 12-foot deep Brewery Street Channel was declared non-navigable by P.L. 81-234 in 1949. This feature and the 15-foot deep anchorage were also deauthorized by §1002 of the 1986 WRDA.

The first two harbor of refuge breakwaters; Southwest Ledge and Luddington's Rock, were authorized by the R&H Act of 1879. Only the Southwest Ledge breakwater was built at that time, completed between 1880 and 1890 to a length of 3,450 feet. The R&H Act of 1890 authorized three additional outer harbor breakwaters of 5,000 LF at Luddington's Rock, 4,200 LF on the west side of the harbor, and 1,200 LF as an East Shore Arm (which was never built). The Luddington's Rock and West breakwaters were completed in 1915. By direction of the Chief of Engineers, 21 April 1910, the unconstructed east shore arm breakwater was eliminated from the project.

The main channels portion of the project today consists of (1) a channel 500 feet wide by 35 feet deep running for about a mile from the Sound to the bend inside the breakwaters, then decreasing to a 400-foot width for approximately 3.75 miles to Sandy Point, increasing again to 500 feet wide from Sandy Point to Tomlinson's Bridge, and widened to 800 feet to create a maneuvering basin in the upper harbor, (2) a stone jetty at Fort Hale Park, (3) a stone T-dike at Sandy Point, 2,160 feet along the bar and 3,200 LF parallel to the bar channel, (4) a 16-foot deep anchorage, 300 feet wide by 1000 feet long, west of the main channel in the upper harbor. The three rubblestone harbor of refuge breakwaters across the outer harbor include the West, Middle (Luddington's Rock), and East Breakwaters at lengths described above.

The 1986 WRDA authorized deepening the main channel to 40 feet by 500 feet wide from the Sound to the bridges, widened to 780 feet in the outer bend at the Southwest Ledge, and with a 1200-foot wide octagonal turning basin in the upper harbor. This improvement was never constructed and was deauthorized April 16, 2002 under the sunset provisions of the 1986 WRDA. A restudy of this deepening project will be initiated in 2015.

2.9.2 West River FNP- New Haven Harbor, New Haven, CT

The West River section of the New Haven Harbor FNP was initially authorized by the River and Harbor Act of 1905 as a 9-foot deep by 100-foot wide channel from the west limit of the 16-foot anchorage in New Haven Harbor westward to Oyster Point, then along the Oyster Point wharves and upstream in the West River to Kimberly Avenue. This initial work was completed in 1906. The R&H Act of 1907 authorized widening the entrance channel; work that was completed later that year. The West River project was next modified by the R&H Act of 1912 which provided for a 12-foot channel with a widened bend at Oyster Point, widths of 125 to 150 feet up to Kimberly Avenue, and 75 feet above Kimberly Avenue to the Railroad Bridge. Also included in the 1912 authorization was a 6-foot deep by 1.3-acre anchorage basin along the south channel limit. This work was all completed in 1913. An act of August 9, 1955 declared non-navigable the channel above a point about 600 feet upstream of Kimberly Avenue. The West River FNP was last maintained in 1988-1989.

2.9.3 Mill River FNP- New Haven Harbor, New Haven, CT

The River and Harbor Act of 1902 authorized a channel, 12 feet deep by 200 feet wide up the Mill River to above East Chapel Street, then further upstream in two branches each at 75 feet wide to Grand Avenue. This work was completed in 1904. The Mill River Channel was modified by the R&H Act of 1912 to include widening the confluence of the two 12-foot branch channels and widening the East Branch channel to 100 feet and the West Branch channel to 125 feet up to 375 feet through its upstream end; work that was completed in 1913. The Mill River Channel was last maintained in 1982.

2.9.4 Quinnipiac River FNP- New Haven Harbor, New Haven, CT

The River and Harbor Act of 1902 authorized a 12-foot deep channel in the Quinnipiac River, 200 feet wide up to Grand Avenue. But the section above Ferry Street was only built to 8 feet deep by 50 feet wide. This initial work was completed in 1904. The R&H Act of 1912 set the dimensions of the channel above Ferry Street as 8 feet deep by 75 to 100 feet wide; work completed in 1913. The R&H Act of 1930 deepened the channel to 18 feet up to Ferry Street, beyond Ferry Street to Grand Avenue the channel was deepened to 16 feet and widened to 200 feet. That work was completed in 1931. The R&H Act of 1946 authorized deepening the Quinnipiac River Channel to 22 feet deep, 250 feet wide up to Ferry Street, and 250 to 400 feet wide to a point 1,000 feet above Ferry Street, with a turning basin at the confluence of the Mill and Quinnipiac Rivers. The 22-foot deep improvement was never constructed and was deauthorized by the 1986 WRDA. The Quinnipiac River Channel was last maintained in 1982.

2.10 Housatonic River – Milford Dredging Center

2.10.1 Milford Harbor FNP, Milford, CT

The FNP at Milford Harbor was first authorized by the River and Harbor Act of 1874. Authorization provided for a 4-foot deep by 100-foot wide channel across the bar, then at 60 feet wide above Merwin’s Wharf to the Town Dock, then at 40 feet wide to the Straw Works at the head of navigation; 20 stone groins on the East beach, 100 to 130 feet long from MHW to

MLLW; and two stone jetties: an East Jetty (Long Jetty) 510 feet long, and a West (Burns Point) Jetty 250 feet Long. The R&H Act of 1878 also authorized the 250-foot West Jetty, and the 1880 Act authorized extending the 4-foot deep channel upriver to the straw works. All of this work was completed by 1881. The R&H Act of 1882 authorized an entrance channel at 8 feet deep by 100 feet wide; work that was completed in 1889.

The R&H Act of 1902 authorized a 10-foot deep entrance and lower harbor channel 100 feet wide, a 10-foot east anchorage between the channel and east jetty, and a 6-foot deep by 90-foot wide channel up-harbor to the Straw Works. The Annual Report of 1906 states that the 10-foot deep east anchorage was only partly completed and a 10-foot deep by 1.6 acre anchorage dredged west of the channel to substitute for the uncompleted area of the east anchorage. This work was completed in 1905. The R&H Act of 1937 authorized deepening the upper channel to 8 feet deep at 100 feet wide and widened at its upper end above the town wharf, a 7.8 acre west anchorage 260 feet wide by 2000 feet long, split into 10-foot deep lower (1.9 acres) and 8-foot deep upper (5.9 acres) areas. That work was completed in 1939. A 6-foot deep upper west anchorage authorized by the Chief of Engineers under Section 107 authority was never constructed. The uncompleted portion of the east 10-foot deep anchorage of 1902 was deauthorized by the 1986 WRDA. The Annual Report for 1997 describes a realignment of channel and anchorage limits to resolve facility encroachment into the Federal Navigation Project, suing contributed funds from the City of Milford to cover the additional cost of realignment dredging. The realignment shifted the 8-foot deep inner channel about 40 feet west, except opposite the Town Landing where it was shifted east. The upper 8-foot deep anchorage was narrowed by up to 50 feet along the west and extended 970 feet north at a width of 75 feet to compensate for the lost area. That work was completed in 1988.

The project for Milford Harbor today consists of two stone jetties at the inlet, a 10-foot deep channel in the entrance and lower harbor, a small 10-foot east anchorage at the east jetty, an 8-foot deep upper channel to above the town landing, a 10-foot deep lower west anchorage and an 8-foot deep upper west anchorage. In addition to the FNP, NOAA fisheries maintains a laboratory with wharf, floats and small craft berth adjacent to the 10-foot deep west anchorage. That facility does not require maintenance dredging at this time.

2.10.2 Housatonic River FNP, Stratford to Ansonia, CT

The River and Harbor Act of 1871 provided authorization for a 7-foot deep by 150-foot wide channel across the bars and upriver to Derby, a stone breakwater 4,200 linear feet long from with a top elevation of +11 to +12 feet from Milford Beach easterly out to the -6-foot contour, and a stone dike at Sow and Pigs Reef to close the former east channel. Under this authorization the dike was constructed in 1871 and the channel was dredged between 1871 and 1881. The breakwater was not constructed at that time. The Annual Report of 1873 states that channel was approved to be deepened two years later to 8-feet MLLW for 2,000 linear feet across the bar at the River's mouth; work that was completed in 1886. The R&H Act of 1888 authorized a stone breakwater in two legs extending from the Milford shore 3,250 feet east at +3-foot top elevation, then 2,500 linear feet at +6 feet to the 12-foot contour, and a channel 7 feet deep by 200 feet wide across the bars at the mouth, and then upriver to Derby at 100 feet wide. Under the 1888 authorization the channel was dredged between 1889 and 1896, and the breakwater was built between 1889 and 1914. A 555-foot long stone training dike built from the Stratford shore under the R&H Act of 1894 and extended by the R&H Act of 1896 by 1,500 feet with a top elevation of +3 feet; work that was completed in 1916 but only to a total length of 1,225 feet. The R&H Act of 1896 also authorized deepening the channel across the bars to 9 feet deep by 200 feet wide, work that was completed later that year. In 1906 the breakwater was extended landward to prevent flanking. The R&H Act of 1930 authorized deepening the channel from Long Island Sound upriver to the lower end of Culvert's Bar to 18 feet by 200 feet wide throughout. This work was accomplished between 1944 and 1957. The uncompleted length of both the east breakwater and the Stratford Dike were deauthorized in 1979. The 18-foot deep lower channel was last maintained in 2013, and the 7-foot deep upper channel was last maintained in 1953.

2.11 Bridgeport Dredging Center

There are three FNPs in the Bridgeport Dredging Center; Bridgeport Harbor, Black Rock Harbor and Southport Harbor. There is also one Federal shore protection project at Jennings Beach in Fairfield which dredges the harbor at Ash Creek as its source of sand.

2.11.1 Bridgeport Harbor FNP, Bridgeport, CT

The FNP for Bridgeport Harbor consists of two rubblestone breakwaters dividing the inner and outer harbors, a main ship channel with associated deep-draft anchorage areas and turning/maneuvering basins, tributary channels in the Pequonnock River, Yellow Mill Channel and Johnsons Creek, and anchorages in upper Johnsons River. These four segments will be described separately. It should also be noted that Bridgeport Harbor is being studied under a separate project-specific DMMP that includes all segments of that project except Johnsons River, which is included in the LIS DMMP.

<u>Bridgeport Harbor – Main Channels and Breakwaters</u>: Bridgeport Harbor FNP was initially authorized in 1836 as an 8-foot deep channel, 200 feet wide through the outer bar and 100 feet wide through the inner bar. That work was completed in 1837. The Act of 30 August 1852 authorized dredging to 8 feet deep across both bars, which was partially done in 1854. The River and Harbor Act of 1871 authorized a 3,000-foot long breakwater extending southwesterly from the tip of Long Beach at a +11-foot top elevation, and an entrance channel 12 feet deep by 100 feet wide across the bars and up to Stratford Avenue. This channel was completed to a depth of 9 feet in 1875, and the breakwater to a length of 1,380 feet in 1873. The R&H Acts of 1872, 1873 and 1878 modified the 9-foot deep channel for widths of 300 feet in the outer harbor, 425 feet in the inner harbor and extended it 3,000 feet up the Pequonnock River to below the Horse Railroad Bridge. This work was completed in 1878. The R&H Act of 1882 called for a 12-foot deep by 600-foot wide channel into the harbor which was completed in 1887.

The R&H Act of 1890 authorized a 1,165-foot long West Breakwater extending ESE from Tongue Point with a top elevation of +3 feet MHW. That structure was completed in 1891. The R&H Act of 1892 authorized widening the 12-foot deep inner harbor basin, work completed in 1893, and the R&H Act of 1894 authorized deepening the channel across the bars to 15 feet by 100 feet wide, work completed in 1896. The R&H Act of 1896 authorized a 15-foot deep by 300-foot wide channel from the Sound into the inner harbor, then 200-feet wide up to the lower bridge at the mouth of the Pequonnock River; work that was completed in 1898. The R&H Act of 1899 authorized deepening the outer and inner channels to 18 feet, an 18-foot deep anchorage west of the channel above the beacon (500 by 2000 feet), a 12-foot deep anchorage west of the channel (500 by 1500 feet), and a second 12-foot deep anchorage east of the channel. This work was completed in 1907.

The R&H Act of 1907 authorized the deepening of the main channel to 22 feet in the entrance and lower harbor, a third 12-foot deep anchorage on the northeast side of the inner harbor, a 22-foot deep basin east of the head of the entrance channel, and shifting the lower reach of the Yellow Mill Channel to the west. Also authorized was extension of the east breakwater in an arc southwesterly towards the channel, and construction of a new outer west breakwater southeasterly from Seaside Park to the channel. The breakwaters and the 12-foot deep anchorage were completed in 1908, and the 22-foot depth improvements were completed in 1910. The R&H Act of 1919 called for widening the 18-foot deep inner harbor channel, widening the west 12-foot deep anchorage and declaring limits for the 18-foot deep anchorage, all work completed between 1920 and 1925. The R&H Act of 1930 called for deepening the main entrance channel and outer anchorage to 25 feet, widening the 18-foot deep upper channel to 300 feet.

The R&H Act of 1937 authorized deepening the main channel to 25 feet through the inner and up to Stratford Avenue and realigning the inner anchorages, work that was completed in 1939 The R&H Act of 1945 authorized deepening the main harbor channel to 30 feet (constructed in 1947 to 1948) and deauthorized the 12-foot deep anchorage. The R&H Act of 1946 added a 30-foot deep turning basin off the mouth of the Johnsons River (constructed in 1948). The R&H Act of 1958 authorized a 35-foot deep main channel, 400 feet wide from the Sound to Tongue Point, then 600 feet wide through the bend, narrowed to 300 feet in the upper 800 feet below the Pequonnock River, and a 35-foot deep east turning basin southwest of the mouth of the Johnsons River. The 35-foot depth improvements were constructed in 1963. In 1982 a fuel terminal proposed constructing an offloading berth at the site of the unconstructed west outer anchorage. In compensation the company deepened the Federal 25-foot east outer anchorage to 35 feet.

<u>Pequonnock River – Bridgeport Harbor</u>: A 9-foot deep channel in the lower Pequonnock River was first authorized by the River and Harbor Act of 1878 and completed in 1887. The 9-foot deep by 100-foot wide channel was extended upstream of the horse railroad bridge between 1889 and 1892 under provisions of the R&H Act of 1888. The R&H Act of 1899 called for a 12-foot deep by 100-foot wide channel in the Pequonnock River about one mile upstream to the upper bridges; work that was completed between 1901 and 1904. The R&H Act of 1910 called for extension of the 18-foot deep harbor channel up the Pequonnock River to a point 750 feet below the head of the 12-foot deep channel, with retention of maintenance of that remaining 12-foot deep reach. The R&H Act of 1930 called for deepening the remaining section of channel to 18 feet, which was accomplished in 1938, completing this project segment to its current dimensions.

<u>Yellow Mill Channel – Bridgeport Harbor</u>: The Yellow Mill Channel was initially authorized as part of the Bridgeport Harbor FNP by the River and Harbor Act of 1896 which allowed for a 12-foot deep by 200-foot wide channel from the main harbor channel up to the causeway in the

Yellow Mill River. That work was completed in 1898. The R&H Act of 1899 extended the 12-foot deep Yellow Mill Channel to the head of Yellow Mill Cove; work completed in 1907. The R&H Act of 1907 authorized deepening the Yellow Mill Channel to 18 feet, but that work was not constructed at that time. The R&H Act of 1919 shifted the lower channel reach to the west; work that was done in 1925. The R&H Act of 1930 repeated the 18-foot depth authorization for the Yellow Mill Channel, and that work was completed in 1932, except for removal of ledge to complete the upper end of the channel. That ledge was never removed and the uncompleted upper end of the channel was deauthorized in 1979, giving this project segment its current dimensions.

Johnsons River – Bridgeport Harbor: Johnsons River is the eastern tributary running into Bridgeport Harbor. The FNP at Johnsons River was created in 1899 when the River and Harbor Act authorized a channel, 9 feet deep by 100 feet wide for about 0.75 miles in the River above the main channel; work that was completed in 1907. The channel up to the first turn was realigned and deepened to 12 feet by 125 to 175 feet wide by the R&H Act of 1919, work that was completed in 1925. Work authorized by the R&H Act of 1930 to deepen the entire Johnsons River channel to 18 feet was never constructed and was deauthorized by the R&H Act of 1946. The 1946 Act also authorized a 15-foot deep channel 200 feet wide upriver to 1,700 feet below the dam, then at 9 feet deep by 100 feet wide to a point about 600 feet below the dam. The River and Harbor Act of 1958 added three anchorages to the Federal project in the Johnsons River: (1) 6 feet deep by 2 acres at the head of the 9-foot deep channel, (2) west of the 15-foot deep channel at 9 feet deep by 2.4-acres, and (3) 6 feet deep by 0.6-acres; all work that was completed in 1963. The 1996 WRDA deauthorized the upper end of the 9-foot deep channel and the upper 6-foot deep anchorage. The 2007 WRDA deauthorized the remaining two 9-foot and 6-foot anchorages west of the channel. The 15-foot deep channel and the remaining reaches of the 9-foot deep channel comprise the currently authorized FNP features in the Johnsons River.

2.11.2 Black Rock Harbor FNP, Bridgeport, CT

Black Rock Harbor began as a Federal project when a 1,790-foot long breakwater was built along the southern end of Fayerwether Point in 1836 to 1838. The River and Harbor Act of 1884 authorized the construction of a 2,600 foot long stone breakwater at +10 feet top elevation between Fayerweather Island and the mainland, and a 6-foot deep by 80-foot wide channel 3,300 feet long from the harbor into Cedar Creek to the Forge Company wharf. The breakwater and channel were constructed in 1885. The R&H Act of 1894 called for reconstruction of the breakwater, which was completed in 1895 with shoreward spurs added. The R&H Act of 1899 deepened the channel to a 9-foot depth and widened it to 100 feet from Black Rock Harbor upstream to the head of both branches of Cedar Creek and the head of Burr Creek; work that was completed in 1904. The R&H Act of 1910 authorized deepening the channel to 12 feet deep by 100 feet wide in the harbor and both branches of Cedar Creek, which was completed in 1911. All of the 12-foot deep channels were widened under the R&H Act of 1919, with a 7-foot deep channel in Burr Creek. This work was completed in 1925. The R&H Act of 1930 authorized deepening the 12-foot deep channels to 18 feet, which was accomplished in 1931 to 1932. The Burr Creek channels were reduced in scope by the 1937 R&H Act, and a portion of the west branch channel in Cedar Creek was deauthorized in 1955. A plan for two outer harbor breakwaters and large anchorage areas was authorized by the R&H

Act of 1958, but were never constructed and later deauthorized by the 1986 WRDA. The 1986 WRDA also deauthorized the remainder of the Burr Creek project features, most of which were filled as part of a dredged material beneficial use project in the late 1980s. Today the Black Rock Harbor FNP consists of the Fayerwether Island Breakwater and 18-foot deep channel from the outer harbor upstream to the head of both branches in Cedar Creek.

2.11.3 Southport Harbor FNP, Fairfield, CT

A stone breakwater, east of the channel and south about 1,420 linear feet from the Mean High Water line opposite Southport to the Mean Low Water line with a top elevation of +7 feet, top width of 8 feet, an earthen dike 1,350 feet long extending north from the sand spit along the marsh from the river mouth, and a 2-foot deep channel were authorized to be built at Southport by the Acts of 1829, 1832, and 1836. The channel was completed in 1833 and the dike and breakwater in 1837. The R&H Acts of 1875 and 1876 authorized the raising and extension of the breakwater, construction of a timber sand barrier landward of the breakwater, and a 4-foot deep by 60-foot wide channel to the upper wharves. The Breakwater and dike modifications were completed in 1878 and the channel in 1881. In 1883 the channel was extended upstream in two branches under authority in the R&H Act of 1882. The R&H Act of 1902 authorized deepening the main channel to 6 feet and widening it to 100 feet upstream to above White Rock and maintaining the upper branch channels; all work completed in 1908. The R&H Act of 1912 authorized removal of ledges to 7 feet, a 6-foot deep anchorage at the upper docks, and eliminated the west branch channel; work that was completed in 1914. The Emergency Relief Appropriations Act of 1935 and the R&H Act of 1935 both authorized a 9-foot deep channel 100 feet wide in the entrance, 100 to 400 feet wide in the river with a 6-foot deep anchorage 300 by 500 feet north of the Golf Club. This work was completed in 1936. The 1996 and 2007 WRDAs deauthorized the 6-foot deep anchorage and re-designated the upper portions of the 9-foot deep channel as anchorage. Today the FNP for Southport Harbor consists of the east breakwater and dike, and the 9-foot channel and anchorage. The project was last maintained in 2004-2005.

2.12 Norwalk Dredging Center

There are four FNPs in the Norwalk Dredging Center; Westport Harbor and Saugatuck River, Norwalk Harbor, Wilsons Point Harbor, and Fivemile River.

2.12.1 Westport Harbor & Saugatuck River FNP, Westport, CT

The FNP at Westport Harbor and Saugatuck River initially gained authorization by Acts in 1827 and 1830 which authorized removal of rocks from the channel and construction of a breakwater at Cedar Point. Another Act in 1836 authorized a 4-foot deep by 44-foot wide channel cut through Great Marsh with controlling jetties to provide an alternate entrance to the river, which were constructed between 1836 and 1839. Repairs to the Breakwater and restoration of the Canal were accomplished in 1870 under authority in the R&H Acts of 1867 and 1870. The Saugatuck River channel first gained approval in the R&H Act of 1892 which called for a 4-foot deep by 100-foot wide and about 4,300-foot long channel from deep water in the river up to Westport, then branching into two channels along the wharves at Westport. This work was constructed between 1893 and 1896. The R&H Act of 1896 authorized further repairs to the Cedar Point Breakwater and removal of boulders. The breakwater repairs were completed by 1908. The R&H Act of 1954 authorized a 9-foot deep channel across the bars and upriver to Saugatuck, with a 6-foot deep anchorage between the bridges. This improvement was never constructed and was deauthorized in 1979. Today the project for Westport Harbor and Saugatuck River consists of the Cedar Point Breakwater and a 4-foot deep channel in the upper river to Westport with two branch channels at its head. The project was last maintained in 1970 and preparations for maintenance dredging are currently in progress.

2.12.2 Norwalk Harbor FNP, Norwalk, CT

The River and Harbor Act of 1872 first authorized improvements to Norwalk Harbor consisting of an 8-foot deep channel 100 feet wide up to South Norwalk, thence 6 feet deep by 100 to 60 feet wide to the stone bridge at Norwalk. This project was constructed between 1872 and 1885. The R&H Act of 1878 authorized the removal of the Middle Ground at the head of the harbor to form a 6-foot deep basin; work that was completed in 1880. The lower portion of the 6-foot deep channel up to the Steamboat Wharf was deepened to 8 feet in 1887 under a provision of the R&H Act of 1880. The upper channel was widened in 1896-1897 under provisions in the R&H Act of 1894. The lower channel from the Sound to South Norwalk was widened under the R&H Acts of 1896 and 1897, with construction completed between 1896 and 1905.

The R&H Act of 1907 made significant changes to the harbor, approving the following modifications to the project: (1) a channel 10 feet deep by 150 feet wide (200 feet wide in the bends) from the Sound to South Norwalk, and a 10-foot deep by 100-foot wide by 1,600-foot long basin opposite South Norwalk, (2) an East Norwalk channel, 6 feet deep by 75 feet wide, widened in bends, and (3) a channel from South Norwalk upriver above the Railroad Bridge, 8 feet deep by 100 feet wide, with decreased width through the "gorge" and increased width above the Railroad Bridge and at Oyster Shell Point, with a turning basin at the head of the channel at Norwalk. These improvements were constructed between 1907 and 1909. The R&H Act of 1919 authorized further modifications, including deepening the main channel to 12 feet and widened it 200 feet from Sheffield Island Harbor to Dorlons Point, then 150 feet wide to the wharves at South Norwalk, then 250 feet wide along the wharves. The 1919 R&H Act also created a 10-foot deep by 17-acre anchorage about the confluence of the East Norwalk channel. These improvements were completed in 1929.

The R&H Act of 1945 authorized widening the East Norwalk Channel to 125 feet, 150 feet in the bend and upper reach, and added a 6-foot deep by 7-acre anchorage in the East Channel. The 1986 WRDA deauthorized and realigned areas of the East Channel and anchorage to resolve encroachments. The 2007 WRDA deauthorized and realigned small areas of the 10-foot deep west branch channel to resolve additional encroachments. Today the Norwalk Harbor FNP consists of a 12-foot deep main channel from the Sound to Washington Street at South Norwalk, a 10-foot deep West Branch channel up to Norwalk with a turning basin at its head, a 10-foot deep anchorage in the lower harbor, and a 6-foot deep East Branch channel and anchorage.

2.12.3 Wilsons Point Harbor FNP, Norwalk, CT

Wilsons Point Harbor was authorized by the River and Harbor Act of 1888. The project consists of a 15-foot deep channel, 700 to 900 feet wide up to the former railroad wharves at Wilsons Point, then 200 feet wide for a short distance above the wharf. The project was constructed between 1889 and 1892. The project has not been maintained, though today it is used as a combined channel and anchorage.

2.12.4 Fivemile River FNP, Darien & Norwalk, CT

The Fivemile River FNP was initially authorized by the River and Harbor Act of 1888, consisting of an 8-foot deep channel, 100 feet wide extending about 5,400 feet up to the head of the harbor. Construction was accomplished between 1889 and 1907, but for a distance of only 4,940 feet. The Federal project has remained unchanged since that time, and the uncompleted upper length was deauthorized in 1978. The project was last maintained in 1999.

2.13 Stamford Dredging Center

There are two FNPs in the Stamford Dredging Center; Westcott Cove and Stamford Harbor, both located in the City of Stamford.

2.13.1 Westcott Cove FNP, Stamford, CT

The FNP for Westcott Cove was authorized by the River and Harbor Act of 1948. The Federal project has remained unchanged since that time and still consists of an 8-foot deep by 100-foot wide channel from Long Island Sound into Westcott Cove to access the City's marina basin. The project was constructed n 1956-1957. The project was last maintained in 1978.

2.13.2 Stamford Harbor FNP, Stamford, CT

The Stamford Harbor FNP consists of three channels: the East Branch which goes through the hurricane barrier, the West Branch which goes to a turning basin at the mouth of the Rippowam River, and the main entrance channel. The River and Harbor Act of 1886 authorized a 5-foot deep channel from deep water in the harbor up to wharves below the bridges in the Mill River, and was completed in 1891. The R&H Act of 1892 called for deepening the West Branch channel to 7 feet by 150 feet wide with a turning basin at its head, and a 9-foot East Branch channel 100 feet wide 8,535 feet upstream to the steamboat wharf then 50 feet wide for another 1,200 feet; work that was completed in 1912. The R&H Act of 1919 called for a 12-foot deep entrance channel to the confluence of the two branch channels, a realigned 9-foot deep West Branch channel with a 200-foot wide basin at its upper end, and a 12-foot deep East Branch channel 85 to 125 feet wide. This work was completed between 1921 and 1927. The R&H Act of 1935 authorized deepening the entrance channel to 15 feet by 200 feet wide, and the West Branch channel to 15 feet deep by 125 feet wide with the turning basin at 15 feet also. These improvements were constructed between 1937 and 1940. The R&H Act of 1937 authorized a harbor of refuge in the outer harbor consisting of two stone breakwaters on either side of the entrance channel, and an 18-foot deep by 20-acre anchorage west of the channel, and deepening the channel to 18 feet up to the head of the anchorage; all work that was completed in 1944.

Eight-foot deep anchorages in the East Branch and outer harbor were never constructed and were deauthorized in 1990. The R&H Act of 1960 authorized construction of a hurricane barrier at Stamford which included a surge barrier dike across the East Branch with a 90-foot wide navigation sector gate.

Today the FNP for Stamford Harbor includes East (1,200 feet long) and West (2,900 feet long) Breakwater, both with a top elevation of +12 feet and top width of 6 feet; an entrance channel, 18 feet deep by 200 feet wide by approximately 0.75 miles long, then becoming 15 feet deep until it branches into the East and West Branch channels; an 18-foot deep by 20-acre, 600-foot wide anchorage to the west of the entrance channel; a West Branch channel running for about one mile upstream in the Rippowam River at 125 feet wide and 15 feet deep; a 15-foot deep by 380-foot wide turning basin at the head of the West Branch channel; an East Branch channel running for about 1.25 miles upriver at 100 to 150 feet wide by 12 feet deep. .

2.14 Greenwich Area Dredging Center

The Greenwich Area Dredging Center includes two FNPs; the Mianus River (Cos Cob Harbor), and Greenwich Harbor.

2.14.1 Mianus River FNP, Greenwich, CT

The River and Harbor Act of 1892 authorized a channel with a depth of 6 feet, 150 feet wide below the Railroad Bridge and 100 feet wide above the bridge to Mianus. The R&H Act of 1896 added a 7-foot deep anchorage area 300 feet wide to the lower harbor west of the channel between Goose Island and the Riverside Yacht Club wharf. The 1892 and 1896 project features were constructed between 1893 and 1899. The R&H Act of 1905 deauthorized and abandoned the prior projects. The R&H Act of 1945 reauthorized a 6-foot channel, 100 feet wide from lower Cos Cob Harbor up to the Route 1 Bridge at Mianus, with work completed in 1951. The 1986 and 1988 WRDAs deauthorized small portions of the 6-foot channel to resolve encroachments. The project was last maintained in 1985, and efforts are currently underway in preparation of maintenance dredging.

2.14.2 Greenwich Harbor FNP, Greenwich, CT

The River and Harbor Act of 1896 authorized a FNP for Greenwich Harbor consisting of a9-foot deep by 90-foot wide channel extending 3,500 feet from the Sound to the Steamboat Dock, then at 6 feet deep by 90 feet wide for 1,700 feet to a small turning basin at the head of the harbor. This project was constructed between 1897 and 1905. The R&H Act of 1919 provided for deepening the channel to 12 feet by 130 feet wide up to the town pier, then at 100 feet wide to below the 6-foot deep turning basin. These modifications were constructed between 1919 and 1924. The 1945 R&H Act authorized the addition of two anchorages west of the channel, one 8 feet deep by 17.5-acres east and south of Grass Island, the second at 6 feet deep by 5-acres north of Grass Island. Those anchorages were expanded in 1948, the one north of Grass Island was brought to 12.5-acres and the one east and south of Grass Island was increased to 21.5-acres.The two anchorages as expanded were completed in 1951. The upper 6-foot deep anchorage basin was declared non-navigable and abandoned in 1955. The 1990

WRDA deauthorized a small are of the 8-foot deep anchorage south of Grass Island to resolve an encroachment. The project was last maintained in 1968.

2.15 Port Chester – Rye Dredging Center

The Port Chester – Rye Dredging Center includes two FNPs: Port Chester Harbor and Byram River, and Milton Harbor.

2.15.1 Port Chester Harbor FNP, Rye, NY

The Port Chester Federal navigation project was authorized by the River and Harbor Act of 1872 and modified by the R&H Acts of 1910 and 1930. The authorized FNP consists of a 12-foot deep entrance channel, 150-foot wide leading from Long Island Sound to the tip of Fox Island; thence a 10-foot deep by 100-foot wide channel from Fox Island to the steamboat landing (900 feet below Mill Street Bridge); then a 3-foot deep channel 100 to 175 feet widre up to the Mill Street Bridge; a breakwater off the tip of Byram Point; a 12-foot deep anchorage to the east of the channel in the outer harbor; and a 10-foot deep turning basin at the steamboat landing. The total length of the channel is about 1.7 miles. The uncompleted portions of the project; widening of the turning basin and placement of fender dolphins at Fox island, as authorized in 1930, were deauthorized in 1975. The project was last maintained in 1990 and preparations are underway for its next maintenance operation.

2.15.2 Milton Harbor FNP, Rye, NY

The Federal navigation project at Milton Harbor was initially authorized April 23, 1965 by the Chief of Engineers under the continuing authority of Section 107 of the R&H Act of 1960. The project provides for a 6-foot deep entrance channel, extending 1.12 miles from the outer harbor; then at the same depth an inner channel 60 and 50 feet wide for another 0.15 miles; then at the same depth in branch channels 70 and 50 feet wide, 0.17 miles long. The project was completed in 1967, and was last maintained by the USACE in 1993.

2.16 Mamaroneck - New Rochelle Area Dredging Center

The Port Chester – Rye Dredging Center includes four FNPs: Mamaroneck Harbor, Larchmont Harbor, Echo Bay and New Rochelle Harbor. The project for Larchmont Harbor consists solely of a stone breakwater and so includes no dredged features.

2.16.1 Mamaroneck Harbor FNP, Mamaroneck, NY

The FNP for Mamaroneck Harbor was initially authorized by the River and Harbor Act of 1882, and was modified by the R&H Acts of 1922, 1935, and 1960. Mamaroneck Harbor has a 10-foot deep by 100-foot wide entrance channel that leads from Long Island Sound to Orienta Point, then 80 feet wide in the main channel to a point below Harbor Island Park where it splits into east and west branch channels. The East Branch channel is 10 feet deep by 80 feet wide to a point 150 feet below Boston Post Road, and leads from Otter Creek to two anchorage areas in the east basin, (1) 10 feet deep and about 4.5-acres in extent, (2) 6 feet deep, by approximately 14-acres in area which leads partially into Stony Creek. The West Branch is on the southern side of Harbor Island Park and is a 6-foot deep by 80-foot wide channel that ends in a 6-foot deep anchorage area in the west basin. The 10-foot deep channel and east basin anchorage were completed in 1933. The West Basin channel and anchorage were completed in 1939, and the 6-foot deep East Basin anchorage was completed in 1965. The project was last maintained in 1999.

2.16.2 Echo Bay, New Rochelle, NY

The Federal Navigation Project at Echo Bay Harbor was authorized by the River and Harbor 1875 and modified by the R&H Act of 1910. The FNP provides for a channel 10 feet deep, 100 feet wide, extending about 0.3 miles from deep water in Echo Bay to the inner harbor north of Beaufort Point, with a turning basin at the head of the channel. A 7-foot deep by 35-acre anchorage area authorized in 1973 was never constructed. The 10-foot project was completed in 1911 and was last maintained in 1949.

2.16.3 New Rochelle Harbor, New Rochelle, NY

The Federal Navigation Project at New Rochelle Harbor was authorized by the River and Harbor Act of 1881, and modified in 1922, and provides for two 8-foot deep channels, one south and west of Glen Island and 100 feet wide (completed in 1890), and the other, 120 feet wide extending about 3,400 feet from deep water in Long Island Sound between Glen Island and Davenport Neck to deep water in New Rochelle Harbor. The project was last maintained in 1971.

2.17 Eastchester Bay Area Dredging Center

There is only one FNP in the Eastchester Bay dredging center and that is the Eastchester Creek (Hutchinson River) FNP. Throgs Neck is at the far western end of this dredging center, making the western-most center along the north shore of the Sound in the study area.

2.17.1 Eastchester Creek FNP, Bronx, NY

The project for Eastchester Creek, the only FNP is the Eastchester Bay Dredging Center, was initially authorized by the River and Harbor Act of 1873. The project as modified through the 1930 consists of an 8-foot deep channel 100 feet wide from deep water in Long Island Sound through the bay to a point 700 feet below the Boston Post Road, then 70 feet wide to a point about 300 feet past the Fulton Avenue Bridge. The total length of the channel is about 5 miles long. The project includes a passing basin south of the Boston Post Road Bridge. The project as modified through 1930 was completed in 1936. Modifications for a 10-foot deep project were authorized by the R&H Act of 1950, but were never constructed and later deauthorized. The project was last (partially) maintained in 2010.

2.18 Manhasset and Little Neck Bays Dredging Center

This is the western-most dredging center in the study area on the north shore of Long Island, with the Throgs Neck Bridge on its western boundary. The Manhasset and Little Neck Bays Dredging Center includes one FNP: Little Neck Bay. A project authorized in 1930 for

Manhasset Bay on the east side of Great Neck was never constructed and was deauthorized in 1990. The U.S. Maritime Administration operates the U.S. Merchant Marine Academy at Kings Point, NY. That facility performs periodic maintenance dredging.

2.18.1 Little Neck Bay FNP, Bayside & Douglaston, NY

The Federal navigation project at Little Neck Bay was initially authorized by the River and Harbor Act of 1962. The project consists of a very short, 200-foot wide by 7-foot deep, entrance channel that leads from Little Neck Bay directly into a large (350-acre) anchorage area, 7 feet deep, situated between Douglaston and Bayside. The project was completed in 1968 after three seasons of construction, has not been maintained since its construction, and is significantly shoaled.

2.19 Hempstead Harbor Area Dredging Center

The Hempstead Harbor Area Dredging Center includes three FNPs: Hempstead Harbor, Glen Cove Harbor, and Glen Cove Creek. The project for Glen Cove Harbor consists solely of a stone breakwater and has no dredged features.

2.19.1 Hempstead Harbor FNP, Roslyn, NY

The River and Harbor Act of 1910 authorized a FNP for Hempstead Harbor consisting of a 6-foot deep by 100-foot wide channel from the entrance outside bar point about 5,600 feet up to Ward's Wharf, then 80 feet wide for 3,200 feet to the Roslyn town wharf, then 50 to 70 feet wide for 1,700 feet to the head of navigation. This work was completed in 1912. A project for a 13-foot deep channel and turning basin was authorized by the R&H Act of 1968, but was never constructed and was subsequently deauthorized in 1990. The 6-foot deep project was last maintained in 1950.

2.19.2 Glen Cove Creek FNP, Glen Cove, NY

The Federal project at Glen Cove Creek, authorized by the River and Harbor Act of 1925, consists of an 8-foot deep by 100 to 50-foot wide channel extending about 1 mile easterly from Hempstead Harbor through Mosquito Cove upstream in Glen Cove Creek. The project was completed in 1935 except for widening the upper channel reach to 100 feet. The project was last maintained in 2007.

2.20 Oyster Bay – Cold Spring Harbor Dredging Center

There are no Federal Navigation Projects in the Oyster Bay – Cold Spring Harbor dredging center.

2.21 Huntington and Northport Bays Area Dredging Center

There are two FNPs in the Huntington and Northport Bays Area Dredging Center: Huntington Harbor and Northport Harbor. Additionally the U.S. Coast Guard occasionally performs maintenance dredging at is Eaton's Neck Station.

2.21.1 Huntington Harbor FNP, Huntington, NY

The River and Harbor Act of 1871 authorized a FNP for Huntington Harbor consisting of a 8-foot by 140-foot wide channel extending about one-half mile along the east side of the harbor to the old town dock; work that was completed in 1873. The R&H Act of 1890 authorized the restoration of the 8-foot deep channel within the harbor for 2,400 feet along the waterfront, which was completed in 1904 to a width of 200 feet. The R&H Act of 1938 modified the project to extend the head of the channel 880 feet to the southeast at a depth of 6 feet, with a 6-foot deep by 14-acre anchorage to the west, and an 8-foot deep cross channel to the western wharves extending to within 150 feet of the causeway. The 6-foot deep channel extension and anchorage were completed in 1941. The cross channel was never constructed and was deauthorized in 1975. The project was last dredged during the 1941 improvement.

2.21.2 Northport Harbor FNP, Huntington, NY

The FNP at Northport Harbor was authorized by the River and Harbor Act of 1945 and provides for an 8-foot deep by 100-foot wide by 0.4 mile long channel along the east side of Northport Harbor, with an anchorage area, 6 feet deep and 15-acres in extent located along the western side of the channel. The project was last dredged during its 1956 improvement.

2.22 Smithtown Bay and Stony Brook Harbor Dredging Center

There are no Federal Navigation Projects in the Smithtown Bay and Stony Brook Harbor dredging center.

2.23 Port Jefferson – Mount Sinai Dredging Center

2.23.1 Port Jefferson Harbor, Brookhaven, NY

Port Jefferson Harbor's Federal navigation project was initially authorized by the River and Harbor Act of 1871, consisting of two stone jetties at the inlet and an 8-foot deep by 100-foot wide channel through the inlet; work that was completed in 1883. The design was modified during construction in 1875 and 1877. As built, the east jetty was 1,390 feet long northerly from the tip of Misery Point into LIS (top elevation +5 feet MHW, slopes of 1:1), and the west jetty 940 feet long (top elevation +4 feet MHW inner, +2 feet MLW outer, slopes 1:1). The R&H of 1890 authorized deepening the inlet channel to 10 feet by 200 feet wide. The R&H Act of 1894 increased the authorized inlet channel depth to 12 feet by 200 feet wide and 2,600 feet long, and extension of the east jetty to the 21-foot contour. The east jetty was extended to give a total length of 1,550 feet and both jetties were repaired and enlarged in section. The 12-foot deep channel was completed in 1903 and last maintained in 1906. All work on the jetties was completed in 1908.

The R&H Act of 1930 authorized the deepening of the channel to -16 feet by 300 feet wide and extension of the east jetty by 450 feet. This work was never accomplished by the Federal government as local interests dredged the channel to 16 feet deep in 1931, and to 26 feet deep in 1957. The R&H Act of 1968 authorized deepening the channel to 40 feet by 350 feet wide from LIS about 2.3 miles to the wharves at the head of Port Jefferson Harbor, with a turning basin near the head of the channel 30 feet deep, 700 feet wide and 1,400 feet long. These improvements also were never accomplished by the Federal government, as local interests dredged the channel to 40 feet deep in the late 1960s, and have maintained the channel and basin since that time. The last Federal dredging at Port Jefferson was maintenance of the 12-foot deep channel in 1906.

2.24 Suffolk County Northeast Shore Area Dredging Center

2.24.1 Mattituck Harbor FNP, Southold, NY

The FNP for Mattituck Harbor was initially adopted by the River and Harbor Act of 1896. The present FNP as modified in 1935 (extension of the West jetty) and 1964 provides for a 7-foot deep by 100-foot entrance channel, thence 80 feet wide, extending from Long Island Sound for about two miles into the wharves at Mattituck. An anchorage, 7 feet deep, 460 by 570 feet wide is located at the head of the channel and was authorized in 1964 and completed in 1965. There are also two riprap jetties (East and West) that extend into the Long Island Sound on either side of the channel. The project was last maintained in 2014, when the entrance was maintained and significantly over-dredged to acquire sand for a Section 111 shore damage mitigation project for beaches adjacent to the inlet.

2.25 Great and Little Peconic Bays Dredging Center

2.25.1 Peconic River FNP, Riverhead and Southampton, NY

The Peconic River FNP was initially authorized by the River and Harbor Act of 1871, which provided for a channel, 6 feet deep by 100 feet wide, extending from deep water in the Great Peconic Bay westerly for a distance of 1,100 feet, thence the same depth with a reduced width of 75 feet to about 1,100 feet below Peconic Avenue. The total length of the channel is about 4.6 miles. Between 1871 and 1873 a channel 6 feet deep by 55 feet wide was dredged up to Mud Creek, and 4 feet deep by 25 feet wide above that point to Riverhead. Suffolk County performed additional dredging of the channel in 1873, 1888, 1913 and 1936. In 1936 maintenance funds were used by the USACE to dredge a channel to a depth of -6 feet MLW by 60 feet wide from the bay to Riverhead. The R&H Act of 1945 authorized a channel 6 feet deep by 100 feet wide from Great Peconic Bay upriver to Riverhead. The project was last dredged by the USACE in 1948 in completing the improvement and minor maintenance. Suffolk County performed maintenance dredging in 1960 and 1970.

2.26 Shelter Island – Gardiners Bay Dredging Center

2.26.1 Greenport Harbor FNP, Greenport, NY

The Greenport Harbor FNP consists of a breakwater, a channel into Stirling Basin, and two anchorage areas, one outside the basin and the other inside the basin. The River and Harbor Act of 1881 authorized construction of a stone breakwater extending southeasterly 1,570 feet from Young’s (Joshua’s) Point, with a top elevation of +5 feet MHW and 5-foot top width. Work on the breakwater began in 1883 and was completed in September 1893. A 9-foot deep 5-acre anchorage area was dredged in the lee of the breakwater and a channel 8 feet deep by 60 feet wide was dredged from the harbor into the entrance to Stirling Basin, all under authority of the R&H Act of 1890. The R&H Act of 1937 authorized improvements to Stirling Basin consisting of an 8-foot deep by 100-foot wide channel connecting the harbor with the basin, and an 8-foot deep anchorage in the basin, 360 by 1000 feet. The basin improvements were constructed in 1939. The breakwater was last maintained n 1940-1941. The project features were last dredged by the USACE for the Improvement in 1939.

2.26.2 Sag Harbor FNP, East Hampton & Southampton, NY

The Sag Harbor FNP was initially authorized by the River and Harbor Act of 1902. The FNP provides for a breakwater, extending from Conklin Point in a northwest direction for a total length of 3,180 feet, built to a height of 8 feet above mean low water, with a top width of 5 feet and side slopes of 1 to 1. The project was modified by the R&H Act of 1935 to add an entrance channel (10 feet deep, 100 feet wide by 3,200 feet long) from Shelter Island Sound to the Standard Oil Co, a turning basin (10 feet deep), and two anchorage areas (one large, 8 feet deep between the channel and the breakwater; the second smaller, 6 feet deep between the Village Wharf and the Sag Harbor Yacht Club Pier). The project was last dredged by the USACE for the Improvement in 1937. The dredged navigation features of this FNP were deauthorized by the WRDA of 1992, leaving the breakwater as the only Federally-maintained portion of this FNP.

2.27 Montauk Dredging Center

2.27.1 Lake Montauk Harbor FNP, Montauk, NY

Prior to its improvement by the Federal government this was a privately owned and developed harbor. Lake Montauk Harbor’s FNP was authorized by the River and Harbor Act of 1945 and consists of a channel, 12 feet deep by 150 feet wide, extending from the 12-foot contour line in Block Island Sound to the same depth in the yacht basin inside the harbor off Star Island; a boat basin (10 feet deep, 400 feet wide and 900 feet long) located northwest of Star Island; repair and extension shoreward of the East and West jetties; and addition of sport fishing facilities on top of both jetties. Dredging of the channel and construction of the shoreward extension of the Wes Jetty were completed in 1942 using Department of the Navy funds. The channel was last maintained by the USACE in 2014.

3 EXISTING CONDITIONS

3.1 Long Island Sound Study Area

The study area for this DMMP and the accompanying PEIS is the Long Island Sound Estuary and surrounding watersheds (see Figure 1-2). Long Island Sound is a 110-mile long, semi-enclosed estuary located between the coastline of Connecticut and the northern coastline of Long Island, New York. The Connecticut-New York state line runs east-west through the middle of Long Island Sound. Unlike most estuaries, Long Island Sound is connected to the ocean at both ends. The eastern end (“The Race”) of LIS presents an open passage to the North Atlantic Ocean, while the ocean passage at the western end is more restricted, traveling through the Narrows, along the East River, and around the western tip of Long Island.

Long Island Sound is one of the most significant coastal areas in the nation. Its watershed, which includes an area of more than 16,000 square miles (mi^2), traverses all of Connecticut and parts of New York, Massachusetts, New Hampshire, Rhode Island, and Vermont (EPA, 1994). Four major rivers (the Connecticut, Housatonic, Quinnipiac, and Thames) deliver fresh water to the Sound, which is bounded by Connecticut and New York’s Westchester County to the north, by New York City to the west, and by Long Island to the south. LIS intersects Washington County, Rhode Island at the easternmost boundaries of Connecticut and New York.

For discussion purposes, LIS can be divided into three major regions defined by submarine features: the Western, Central, and Eastern Basins. As shown in Figure 1-2, the Western Basin is the area from the Narrows (between Throgs Neck and Willets Point, New York) to the Stratford Shoal (between Stratford Point, Connecticut [near Bridgeport, Connecticut], and Port Jefferson, New York). The Central Basin stretches from the Stratford Shoal to the Mattituck Sill (between Mulberry Point, Connecticut [near Guilford, Connecticut], and Mattituck Point, New York). The Eastern Basin extends from the Mattituck Sill to the Race at the eastern end of LIS and includes Peconic Bay, Gardiners Bay, and Fishers Sound. The terrestrial portion of the study area includes Washington County in Rhode Island (including Block Island), the entire State of Connecticut, and Westchester, Bronx, Queens, Suffolk, and Nassau counties of New York, as well as the Boroughs of Brooklyn (Kings County) and Manhattan (New York County), New York.

Data used to describe the existing conditions in LIS for the DMMP and PEIS were derived from existing literature. Technical Supporting Document 1 - Literature Review Update, and Technical Supporting Document #10 - Environmental Update (see the compact disk included with this report), describe the design and results of an annotated database which contains environmental data sources available for the LIS region. The most prevalent topics covered were water quality, ecology/habitat/species, sediment, shellfisheries, and fisheries. The majority of the data sources were developed by state and federal agencies including U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Agency and National Marine Fisheries Service, U.S. Geological Service, U.S. Army Corps of Engineers New York District and New England District, U.S. Navy, U.S. Coast Guard, Connecticut Department of Environmental Protection, New York State Department of Environmental Conservation, New York Department of State, Rhode Island Coastal Resources Management Council, University of Connecticut, University of Rhode Island, State University of New York, and the Woods Hole Oceanographic Institution.

3.2 Geological Setting and Landscape

The geological setting of the Long Island Sound study area is a primary driver of dredged material management alternatives. LIS lies at the junction of the glacially modified bedrock landscape of New England and the sediment-dominated Atlantic Coastal Plain (Lewis, 2014). LIS has an east-west axis roughly parallel to the coast of southern New England. The orientation of the basin is controlled by the elongated moraine complex that borders the southern New England coastline. This unique combination results in a striking contrast between the northern shore and southern shore of LIS. The northern shore is bedrock-controlled with dominant north-south drainage, headlands, and pocket beaches and marshes. The southern shore is sediment-dominated with large amounts of unconsolidated materials, limited drainage, and a long, straight coastline.

The location of harbors, sources and types of sediments, and opportunities for beneficial placement are strongly affected by the geological history of southern New England, as compared to that of Long Island, NY. Section 4.2 of the PEIS discusses the geologic setting of the LIS region in detail.

3.3 Meteorology, Climate Change and Sea Level Change

The meteorological conditions in the Long Island Sound region are typical of the northeastern United States, with hot summers and cold, stormy winters. Large ranges of air temperature are observed both daily and annually. The average precipitation is about 40 inches per year, distributed evenly across the seasons. Section 4.3 of the PEIS discusses the meteorological setting of the LIS region in detail.

Climate change in the Long Island Sound region will affect the meteorology and circulation of Long Island Sound as well as nearshore sediment transport and ecological conditions. Results of climate change include sea level change (SLC), changes to wind stress fields, longer periods of water column stratification, an increase in the frequency and intensity of coastal storms (wave climate, tidal surge, flooding), temperature increases leading to alterations in food webs, shifts in living resources, and acidification from increased levels of carbon dioxide. The alterations in physical processes in turn affect the biology and chemistry of the Sound (such as dissolved oxygen levels and salinity).

Climate change will likely affect the volume and timing of delivery of freshwater to the Sound through changes in precipitation and evaporation. The Long Island Sound region has become warmer and wetter than in the past, and peak riverine flows have been shifting to earlier in the year. Similar to wind impacts, the earlier spring snowmelt flows and warming increase the duration of water column stratification in the Sound. Less mixing results in reduced replenishment of dissolved oxygen (DO) in bottom waters and an increased periods of hypoxia in the western Sound.

Globally, sea level is rising due to the thermal expansion of seawater and the melting of glaciers and ice sheets. NOAA tide gauges around Long Island Sound indicate that from 1986 to 2010 relative sea level has risen by about 4.5 inches. The rate of rise, about 0.2 inch per year, is projected to increase in the future. Sea level rise combined with storm surge and wave action pose risks of flooding, shoreline erosion, saltwater intrusion into groundwater, and wetland deterioration and loss.

Climate change and SLC will impact dredged material management decisions. Changes in sea elevations must be considered in placement facility design (CDF dike elevations, beach and marsh fill elevations, beach berm widths, CDF and CAD cell cap thickness, etc.). SLC and increased storm frequency/intensity will also present opportunities for beneficial use of dredged material in coastal and ecological resiliency applications in response to increasing sea levels and other aspects of climate change. For example, increased sea levels will more frequently inundate salt marshes and may even begin to encroach into more brackish and fresh water wetlands. This will increase the need for beneficially using dredged material to mitigate and offset those losses in function through methods such as marsh creation or increasing marsh elevation (thin layer placement).

In general, future navigation improvement projects in the LIS region will also need to examine sea level change and climate change impacts when formulating plans and evaluating feasibility of proposed projects. Issues such as elevation of port facilities (wharves, terminal lay-down areas, fuel storage containment dikes, crane pads, etc.), air draft on bridges, and increased tidal range relative to channel and berth design depths, will all be among the considerations examined.

For this programmatic DMMP, no specific projects are investigated or evaluated in detail. That work will occur in the future as individual projects are funded for study or design and specific dredged material placement alternatives are examined. For illustrative purposes, a typical SLC analysis for a location central to the study area, and developed for the ongoing USACE study of Bridgeport Harbor, CT, with additional technical explanation from the USACE Asharoken, NY study, is summarized below.

SLC Guidance: Sea Level Change is the combined effect of the eustatic (i.e. global average) sea level increase due to global warming trends and the land movement in the region. The future SLC for the project area is estimated based on the National Research Council (NRC) and Intergovernmental Panel for Climate Change (IPCC) estimates of eustatic SLC and corrected to include the local land subsidence. Both the historic SLC trend and the future accelerated rate are identified and used for planning, design, sensitivity and risk & uncertainty analysis if required.

The most recent USACE published guidance to incorporate sea-level change for project planning and design is found in ER 1100-2-8162 (February 2014) and ETL 1100-2-1 (December 2014). ER 1100-2-8162 and its predecessor were developed with the assistance of coastal scientists from the NOAA National Ocean Service and the US Geological Survey. The most recent guidance recommends both the National Research Council report (NRC, 1987) and the Intergovernmental Panel for Climate Change report (IPCC, 2007) findings for prediction of future sea level change. The recommendations are summarized as follows:

1) An extrapolation of the historic rate of local mean-sea-level change shall be used as the low rate of sea level change for analysis, design, and evaluation;

2) Estimate the intermediate rate of local mean sea-level change using the modified NRC Curve I and NRC equations 2 and 3, and add those to the local rate of vertical land movement.

$$E(t) = 0.0017t + bt2 \text{ (NRC Equation 2)}$$
$$E(t2) – E(t1) = 0.0017(t2 – t1) + b(t22 – t12) \text{ (NRC Equation 3)}$$

3) An upper (high) rate of local sea level change shall be estimated by considering the modified NRC Curve III value, and combining these numbers with the local rate of vertical land movement. This scenario of high rate of local mean sea level rise exceeds the upper bounds of the IPCC estimates from both the 2001 and 2007 and also includes additional sea-level rise to accommodate the potential for rapid loss of ice from Antarctica and Greenland;

Sea Level Change Calculator: The local SLC chart and curve are calculated based on the online calculator provided by USACE. Both the USACE and NOAA curves and charts are calculated and presented in this report. The link to the online calculator is shown below:

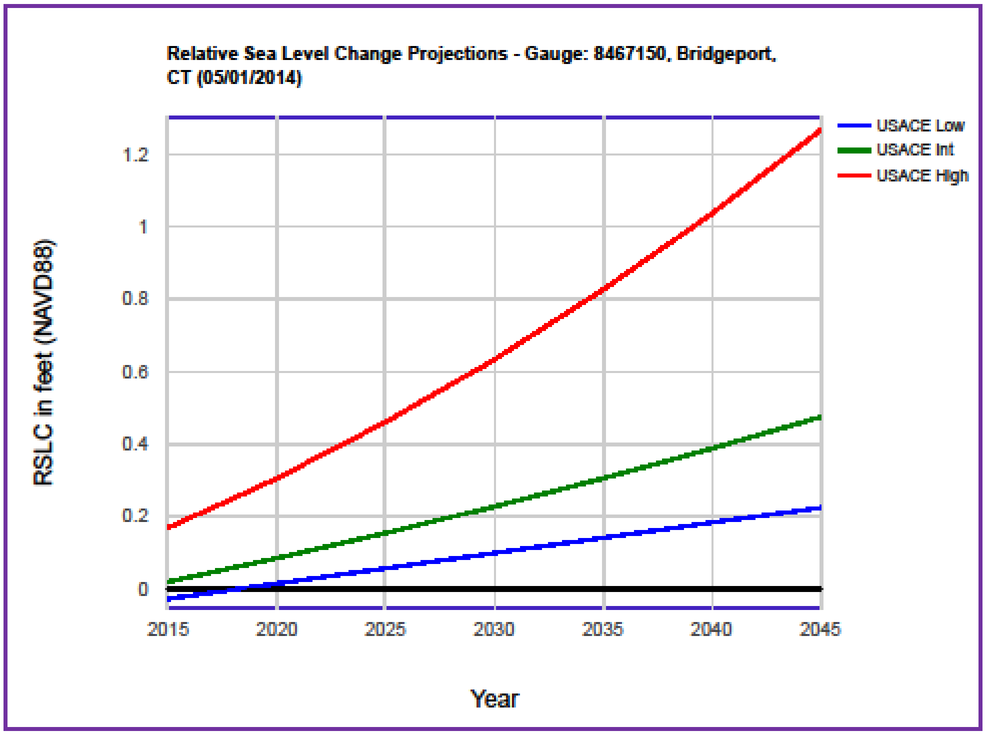
http://www.corpsclimate.us/ccaceslcurves.cfm

The historic rate of SLC was based on the nearest tide gage to Bridgeport Harbor, which is located at that port. The rate for the "USACE Intermediate Curve" is computed from the modified NRC Curve I considering both the most recent IPCC projections and modified NRC projections with the local rate of vertical land movement added. The rate for the "USACE High Curve" is computed from the modified NRC Curve III considering both the most recent IPCC projections and modified NRC projections with the local rate of vertical land movement added. The three local relative sea level change scenarios updated from ER 1100-2-8162, Equation 2) for both USACE and NOAA rates for years 2016 to 2116 in 5-year interval are estimated based on the on-line calculator, are depicted in Table 3-1 and Figure 3-1 below.

Table 3-1
Tide Gage Data - #8467150, Bridgeport, CT
NOAA's Published Rate: 0.00840 feet/year
All values are expressed in feet relative to NAVD88

Year	USACE Low	USACE Intermediate	USACE High
2015	-0.03	0.02	0.17
2020	0.02	0.09	0.31
2025	0.06	0.15	0.46
2030	0.1	0.23	0.63
2035	0.14	0.31	0.83
2040	0.18	0.39	1.04
2045	0.23	0.48	1.27

Figure 3-1 - Relative Sea Level Change Projections – Bridgeport Harbor, CT



3.4 Physical Oceanography

The transport, dispersion, and eventual fate of sediment in the marine environment depend upon the physical characteristics of the sediment and the structure (density, temperature, and salinity gradients both vertical and horizontal) and dynamics of the water column. The physical parameters that are important in the transport and dispersion of sediment include currents, waves, and the density structure of the water column. Currents directly affect the transport and dispersion of sediment by imparting shear stress to the surface sediments and transporting suspended sediments. In shallow water, waves can re-suspend sediments previously deposited on the seafloor. These re-suspended sediments may then be transported by local currents. The density structure of the water, relative to the density of the sediment, influences how long the sediment remains in the water column. Section 4.4 of the PEIS describes the physical oceanography (currents, waves, and density structure) of the LIS region.

Long Island Sound has outlets at both ends: at The Race in the east and through the East River at the west. The mean range of the tide in the study increases from east to west, from 1.9 feet at Lake Montauk Harbor on the eastern tip of Long Island, to 7.4 feet at Greenwich Harbor and the New York Harbors in western LIS. Spring tides are generally a few tenths to half of a foot higher and lower than the mean. Extreme tides can be up to 2 feet lower, or 7 feet higher than the mean. In terms of the DMMP, tides can affect the design elevations for beach fill and marsh creation projects, confined disposal facility design where port development or habitat are the intended end uses, or design for coastal flood damage reduction purposes.

3.5 Sediment/Soil Quality, Contaminants, Toxicity, Bioaccumulation

Within Long Island Sound, sandy silt/clay dominates the areas of the Western and Central Basins of LIS and in harbors on the north shore. Coarser silty sand and sand dominate the shoal complexes that separate the depositional basins and the Eastern Basin. Total organic carbon (TOC) and sediment grain size parameters are typically correlated with one another, and in LIS, the amount of sedimentary TOC decreases with increasing grain size, with an average of more than 1.9% dry weight (dw) in sandy clay/silt and less than 0.4% in sand (Hunt, 1979; Poppe et al., 2000). In general, TOC content increases toward the west and from the shallow margins to the deeper parts of the LIS basin (Hunt, 1979; Poppe et al., 2000).

Contamination of sediments with toxic substances, particularly metals and organic pollutants, is common in many coastal ecosystems (Mitch and Anisfeld, 2010). LIS is one of the largest and most urbanized estuaries in the USA (Robertson et al, 1991) with a long history of metal, chemical, and weapons manufacturing in its watersheds. Despite the fact that these industries have declined in the region in recent decades, the legacy of these sources is still evident in portions of the sediments in LIS. Section 4.5 of the PEIS discusses the distribution of contaminants throughout LIS as well as the accumulation of contaminants in marine and estuarine organisms that live in the region.

3.5.1 Sediment Sampling and Testing and Suitability

Prior to the passage of the CWA and MPRSA, the aquatic disposal of dredged material, as well as mixed debris and even hazardous waste, with little or no restriction clearly had the potential for measureable and long-term impacts in Long Island Sound. This was the case in the coastal waters of much of the United States. The sediment testing requirements and restrictions implemented by the CWA and MPRSA were intended to minimize the potential for impact.

One of the first steps in the permit application review process for both CWA and MPRSA projects is for the USACE, working with the state and Federal resource agencies and the applicant, to develop sampling and testing plans to determine the suitability of the material for various placement options. The USACE solicits comments from the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), EPA, the CTDEEP Office of Long Island Sound Programs, the state of New York, and the RI CRMC as described in the State of Rhode Island Coastal Resources Management Program, as appropriate, in preparing the sampling and testing plans that initiate the permit process.

Any proposal for the placement of dredged material from a particular project must begin with an examination of the nature of the material. Federal and non-Federal projects evaluated under MPRSA or CWA are subjected to the same quantitative analysis. Applicants perform sampling and analysis based on these plans, and the USACE and Federal agencies review the results according to several testing protocols designed for regional and national use. In this way, they determine the suitability of the material for placement at a given site.

National guidance for determining whether dredged material is acceptable for open-water placement is provided in the 1991 EPA/USACE Ocean Testing Manual (also known as the Green Book). The 1998 EPA/USACE Inland Testing Manual provides guidance for CWA Section 404 projects. A Regional Implementation Manual (RIM), consistent with the Green

Book and the Inland Testing Manual (EPA/USACE 2004), provides specific testing and evaluation methods for dredged material projects at specific sites or groups of sites. The testing guidance manuals use a tiered approach that was developed with reference to the requirements of CWA, MPRSA and the Ocean Dumping regulations, and the 2004 EPA/USACE RIM for dredged material testing and evaluation in the Long Island Study Area. The guidance specifies metals and organic compounds (including pesticides, PCBs and PHAs), to be tested with the list based on toxicity, persistence in the environment, ability to bioaccumulate, and any widespread or consistent occurrence in New England sediments and organisms.

Guidance for testing materials proposed for dredging and placement at an island, nearshore, or upland CDF can be found in USACE (2003). The guidance provides methods for the assessment, where appropriate, of potential effects of the proposed placement of dredged material in upland, nearshore, and island CDFs. It uses physical, chemical, and biological analyses as necessary to provide effects-based conclusions within a tiered framework regarding potential contaminant-related impacts outside the CDF associated with the five potential pathways: effluent, precipitation runoff, leachate and seepage, volatilization, and direct uptake by wetland and terrestrial plants and animals (USACE and EPA, 1992).

Whether or not any particular material from a dredging project is suitable for open-water placement, beneficial use (such as beach nourishment, marsh creation, or other aquatic habitat development), use as structural fill, or any other commercial application first depends on an evaluation of its physical properties. Through physical testing, material found to consist of clean sand, gravel, rock, or geological parent material (such as glacial tills and marine clays) may in certain circumstances be excluded from further testing (See 40 CFR § 227.13). This material is often made available for consideration in beneficial uses as described in further detail in subsequent chapters.

Material that includes silts, material with high organic content, and other shoal material from harbors and areas with a history of contamination and industrial use are subjected to additional chemical testing to determine the relative likelihood of suitability. For materials exhibiting higher concentrations of contaminants in comparison to reference site values, project proponents may elect not to incur the cost of further testing and may investigate non-open-water options such as containment and/or treatment. For materials with chemical test results that do not exhibit high concentrations of contaminants, or where the project proponents wish to maintain the option of open-water placement and other uses, the sediment is subjected to further tests aimed at predicting the biological response to exposure to the material during different phases of the placement process. These tests are generally described as bioassay (toxicity) tests, and bioaccumulation (tissue uptake of contaminants) tests.

Toxicity tests consist of exposing test organisms to the proposed dredged material and comparing survivability rates to selected organisms exposed to both reference and control materials. A reference material is whole sediment collected from a site that is near, but not under the influence of, a placement site. A control material is a whole sediment that is essentially free of contaminants and is used routinely to assess the acceptability of a toxicity test.

Where the dredged material exhibits greater toxicity to test species than the reference sediments (using statistical tests and nationally developed interpretation guidance), project proponents again may elect to forgo any further cost of testing for suitability for open-water placement and seek alternative placement methods. Material that exhibits toxicity results comparable to the reference sediments may also be required to undergo bioaccumulation testing before any determination on suitability for open-water placement can be made. In general terms, bioaccumulation involves a long exposure of test organisms to representative sediment proposed for dredging, followed by analysis of their tissues to determine the potential for uptake of contaminants from the proposed dredged material. The test results are evaluated to determine the risk of exposure to ecological and human health. Dredged material that is determined, through these testing protocols, to pose no unacceptable risk to the human or ecological health is deemed suitable for ocean placement. These findings may be accompanied by placement management requirements.

The unique nature of the regulatory requirements in Long Island Sound, specifically the dual application of MPRSA and CWA, results in differing regulatory approaches for dredged materials, depending on the proponent and the size of the proposed dredging project (see the discussion in the PEIS Section 2.1.2 on the Ambro Amendment). Non-Federal projects seeking to place 25,000 CY of dredged material or less are not subject to the requirements of MPRSA. Materials from these smaller dredging projects that exhibit potential for adverse impacts may sometimes still be placed in open water under CWA with proper placement management.

3.5.2 Nitrogen Loading in Long Island Sound

A number of commenters on the draft DMMP/PEIS stressed the issue of nitrogen loading on LIS from sources within the watershed and the contribution of dredged material placed in the Sound to the total nitrogen load. Nitrogen loading is a concern due to its impact on excessive algae levels, which among other concerns is one potential driver of hypoxia in the waters of the Sound.

Organic matter entering Long Island Sound waters from both natural and anthropogenic sources often ends up incorporated into the surficial sediment layer. Once part of the sediment, the decay of this organic matter releases nitrogen and other nutrients to the overlying waters. Estimates for the various sources of nitrogen loading to the Sound are summarized from Latimer (et al. *from Scott Libby)* in Table 3-2. Jones and Lee (1981) present an average sediment total nitrogen concentration of 1.55 g nitrogen per kg of sediment for a series of coastal water sites that included several Long Island Sound harbors. Using this average concentration, the amount of nitrogen potentially released during placement of dredged material at open water sites in Long Island Sound was estimated at less than one tenth of one percent of the overall annual nitrogen loading to the Sound. This estimate is considered conservative (over predicting the amount of nitrogen released) based on the following:

- The release rate used in the calculation (1%) was developed for hydraulic dredging and is considered an over prediction for scow disposal of mechanically dredged sediment (from Jones and Lee 1981).
- The total amount of annual dredging estimate includes some component of over dredging or improvement dredging. This would remove native glacial outwash and till deposits that typically lie beneath the surficial sediment and that have much lower nitrogen (and other nutrient) concentrations than surficial sediment.

Further, the dredging process scrapes a relatively thin layer of surficial sediment from a wide area, and aquatic placement consolidates that volume of sediment into a much smaller footprint. Hence, much of the nitrogen that was available for potential future release from surficial sediment (due to biological reworking or physical disturbance in the shallower environment) is sequestered out of contact with the water column in deposits that have been shown to be stable features on the seafloor.

Table 3-2 Calculation of Potential Contribution of Aquatic Placement of Dredged Material to Long Island Sound Nitrogen Loading			
Background on Nitrogen Loadings to Island Sound (From Latimer et al)			
Loading Type	Year		Amount - kgN/year
Waste Water Treatment Plant (WWTP) Loadings	2011		22,338,000
	TMDL Goal		14,563,500
Wet Atmospheric to Watershed	2009		15,000,000
Direct Atmospheric to LIS	2009		2,500,000
Ground Water Nitrogen Load to LIS	LI, NY Only		750,000
Ground Water Nitrogen Load to LIS CT Rivers (Includes Portion of 11.3 M from CT WTTP)	CT		No Data
	2008		17,000,000
Total with 2011 Loading			57,588,000
Total with TMDL Goal			49,813,500
Estimated Nitrogen Release from Dredged Material Placement			
Average Total Nitrogen (N) in Dredged Material (From Jones and Lee 1981)			
Average Total Nitrogen (N) in Dredged Material (From Jones and Lee 1981)	0.00155	kgN/kg	Dry Weight of Sediment
Average Annual Dredging of Silty Materials in LIS (From NAE 30-Year Projections)	871,690	m3/year	Wet Volume
	557,881,344	kg/year	Dry Weight
Estimated Total Annual Nitrogen (N) in Dredged Material	864,716		
Estimate of Nitrogen Lost to the Water Column During Placement	8,647	kg	(Conservatively at 1% from Jones & Lee 1981)
Calculation of Nitrogen Loading Increase Due to Release from Dredged Material Placement			
As a % of 2011 Conditions	0.015%		
As a % Assuming TMDL Conditions	0.017%		

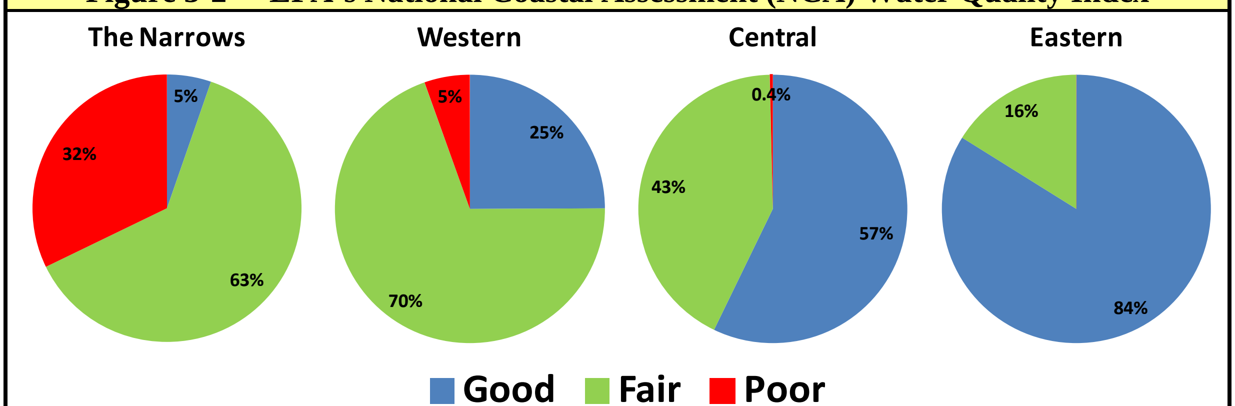
3.6 Water Quality

Water quality, which encompasses temperature, turbidity, nutrients, biomass/chlorophyll, dissolved oxygen (DO), pH, pathogens, and toxic contaminants of a particular water body, is a measure of the condition of water relative to one or more biotic species needs. Section 4.6 of the PEIS addresses each of the water quality factors in detail.

EPA's National Coastal Assessment (NCA) developed a water quality index that is used to qualitatively compare conditions in coastal waters across the United States (EPA, 2012). The water quality index is based upon five parameters: dissolved inorganic nitrogen and dissolved phosphorus in surface waters, chlorophyll in surface waters, DO in bottom waters, and water clarity as measured using a Secchi disk. Good water quality is defined as water containing low concentrations of dissolved inorganic nitrogen (DIN), dissolved inorganic phosphorus (DIP), and chlorophyll *a*, high concentrations of DO, and high water clarity. Fair water quality conditions are defined based on a range of threshold values: DIN $\geq$0.1 to 0.5 mg/L; DIP $\geq$0.01 to 0.05 mg/L; chlorophyll *a* $\geq$5 to 20 µg/L; DO $\leq$5 to 2 mg/L; and Secchi depth $\leq$1.1 to 0.7 m. Nutrient and chlorophyll values higher than the maximum thresholds and DO and Secchi depths lower than the minimum thresholds are indicative of poor water quality for the NCA index.

As with many conditions in the Sound, water quality improves from west to east. The average water quality in the Narrows over the 20-year period of 1991-2010 is best described as fair (86%) with a relatively high percentage of readings (32%) that fell in the poor category (Figure 3-2). The percentage of good readings increases from a minimum of 5% in the Narrows to about 25% in the Western Basin and 84% in the Eastern Basin. Similar trends of improving water quality from the Narrows in the west to the Eastern Basin are discussed in Section 4.6 of the PEIS.

Figure 3-2 - EPA's National Coastal Assessment (NCA) Water Quality Index



Source: EPA, 2014

3.7 Plankton

Plankton form the base of the marine ecosystem's food chain. They are small, free-floating or weakly swimming organisms that drift through the water column. They play a crucial role in transferring carbon and nutrients up to higher trophic levels.

Phytoplankton are single-celled plants that produce organic carbon via photosynthesis. The level of primary production (as this process is called) varies based on the availability of light and nutrients. In the temperate waters of Long Island Sound, there is a clear seasonal signal (light- and temperature-related) to phytoplankton primary production, and the rates of production are enhanced due to the high rate of nutrient loading to the system (see Section 4.6 of the PEIS). Parts of LIS, but especially western LIS, are eutrophic, with very high nutrient loading to the system that leads to elevated rates of production. Ultimately, increased transfer of organic material to the sediments occurs, where decay occurs and often leads to hypoxic conditions in this system.

Zooplankton range in size from small (less than 50 micrometers [μm]), single-celled, microzooplankton to larger, multicellular, macrozooplankton. The zooplankton serve as the first trophic transfer – often referred to as secondary production - from phytoplankton to larger pelagic or benthic organisms. The mechanisms followed for this transfer are important to the development and understanding of how an ecosystem's fisheries and other larger organisms function. Changes to zooplankton community structure and abundance are likely to have ramifications higher up the trophic ladder.

In general, the plankton community in the study area appears to be consistent with that expected for the mid- to north Atlantic (Capriulo and Carpenter, 1983; Peterson, 1983; Anderson and Taylor, 2001; Capriulo et al., 2002). One of the primary environmental factors affecting the nature of the phytoplankton and zooplankton communities in LIS is the seasonal stratification of the water column. The water column is well-mixed from fall through early spring, but increased freshwater runoff and increasing water temperatures cause buoyant, warmer water to become layered over denser, colder water during late spring, summer, and early fall. This stratification results in seasonal changes in the distribution and abundance of the plankton community. Phytoplankton and zooplankton communities in the LIS region are discussed in more detail in Section 4.7 of the PEIS.

3.8 Benthic Resources

The interface between the water column and sediment supports an extensive community that is often used as an indicator of ecosystem stress or recovery status. Known as the benthic infauna community, it consists of invertebrate organisms that live on or within the sediment, typically inhabiting the upper 4 inches. Benthic infauna are an important component of the food web, providing a food source for megafauna such as lobster and other motile species such as fish and crabs. Benthic infauna also play an important role in geochemical and physical processes such as sediment reworking, chemical flux, and sediment resuspension. Benthic invertebrate community structure is used to provide a measure of ecological condition; it is particularly useful for evaluating impacts from anthropogenic activities that result in disturbance to the seafloor.

The structure of benthic communities is influenced by water depth, sediment grain size and organic content, dissolved oxygen, sediment transport regimes, and hydrodynamics. The general condition of the benthic community in LIS has been described in several key studies conducted in the 1950s, 1970s, and 1980s. In addition, in recent years, a significant number of studies have been conducted relative to the impacts of dredging and dredged material placement at designated sites within the Sound. These data provide a generalized picture of the benthic condition in the Sound and provide a baseline from which to assess future conditions. Taken together, they illustrate some recurring dominant patterns. These data are discussed in detail in Section 4.8 of the PEIS.

3.9 Shellfish Resources

Several commercially harvestable shellfish species occur throughout the study area, including American lobster, eastern oyster, bay scallop, blue crab, northern quahog/hard clam, softshell clam, surfclam, blue mussel, horseshoe crab, channeled whelk, and knobbed whelk. State and local authorities regulate harvesting of these marine shellfish based on stock assessments, management goals, and health regulations using lease agreements, harvesting seasons, and licenses. Section 4.9 of the PEIS includes a summary of the status of the principal commercial and recreational shellfish resources within the LIS region as well as general information on the life stages and distribution of the species present, the habitat where the species are generally found, and the preferred food sources.

3.10 Fish

The Long Island Sound region is occupied by more than 83 species of fish; however only a few species are considered year-round residents (Gottschall et al, 2000). Most fish species migrate through the area in response to seasonal variations in water temperature and access to spawning and nursery grounds in the shallow estuaries and rivers that lead into LIS. Section 4.10 of the PEIS presents data (e.g., preferred habitat, distribution in the region, etc.) for fish species which have Essential Fish Habitat (EFH) designations or are commercially or recreationally important throughout the LIS region.

3.11 Submerged Aquatic Vegetation and Sensitive Upland Vegetation

The waters of Long Island Sound include habitat areas for submerged aquatic vegetation (SAV), while upland portions of the study area include a number of rare and sensitive plants. These plant species have specific habitat requirements and are protected by various state and Federal regulations.

SAV in Long Island Sound includes eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*). Eelgrass, the primary seagrass in the study area, historically had a wide distribution in the shallow coastal waters of the Sound, while widgeon grass distribution is typically limited to the more estuarine and freshwater environs (Latimer et al., 2014). Seagrass beds are extremely productive ecosystems; they provide critical habitat for marine fishes, and invertebrates, including many commercially important species such as the bay scallop

(*Argopecten irradians*), hard clams (*Mercenaria mercenaria*), and American lobsters (*Homarus americanus*) (NYNHP, 2013). Section 4.11 of the PEIS documents the distribution of SAV throughout the LIS region.

The study area also includes several listed threatened or endangered upland plants. Section 4.11 of the PEIS documents the distribution of these protected species throughout the LIS region.

3.12 Marine Protected Areas

Marine protected areas (MPAs) are regions in which restrictions have been placed on human activity to protect the natural environment, its surrounding waters and the occupant ecosystems, and any cultural or historical resources that may require preservation or management. Typical restrictions in MPAs include fishing, oil and gas mining, and tourism. Other limits may include restrictions on sonar use, development, and construction. Some fishing restrictions include "no-take" zones, which means that no fishing is allowed. In other instances, activities are restricted seasonally or temporarily to let the area recover.

MPAs can include shoreline habitat, Federally-designated sites such as national wildlife refuges, and state-identified sites such as parks. There are seven Federally-designated national refuges in the study area. The largest is Silvio O. Conte National Fish and Wildlife Refuge (which encompasses the large areas of the Connecticut River watershed). The most dispersed is the Stewart B. McKinney National Wildlife Refuge, which consists of several units along the coast of Connecticut and the islands of LIS. Four others are part of the Long Island National Wildlife Refuge Complex in New York: Oyster Bay, Target Rock, Elizabeth A. Morton, and Conscience Point. Lastly, the Rhode Island portion of the study area includes the Block Island National Wildlife Refuge. Additional information on each national refuge and MPA is provided in Section 4.12 of the PEIS.

3.13 Birds

The coast of the Northwest Atlantic Ocean supports a large number of resident and migratory marine and coastal birds. The Long Island Sound region is important for three main groups of birds: those found primarily in open water, those found on or near coastal beaches and mudflats, and those found in tidal marshes. Regular census activities, such as winter waterfowl surveys, breeding bird surveys, and Christmas bird counts, confirm that dozens of marine and coastal bird species migrate annually through the LIS region. Section 4.13 of the PEIS details avian resources found in the LIS region.

3.14 Marine Mammals and Marine Reptiles

Long Island Sound provides habitat for several marine mammals (e.g., whales, dolphins, and seals) and marine reptiles (e.g., sea turtles). Section 4.14 of the PEIS discusses the marine mammals and marine reptiles that may potentially be found in the open water, nearshore, and beach areas present within the study area.

3.15 Wetlands

Inland and coastal wetlands are present in the areas of Connecticut and New York contiguous to Long Island Sound and portions of Rhode Island's Washington County contiguous with Block Island Sound and its southern coast. Coastal estuarine wetlands are located along the shorelines, coastal embayments, and mouths of coastal rivers that are influenced by the tides (tidal wetlands). Coastal wetlands include tidal and brackish salt marshes (in Connecticut and New York), coastal shoals, bars and intertidal mudflats (in New York), and shoreline features including beaches (in Rhode Island). Inland palustrine wetlands within the study area include forested swamp, scrub-shrub swamp, marsh, and wet meadow. Riverine wetlands are located within inland areas. Section 4.15 of the PEIS details the location of wetlands in the study area and provides discussion on the ecological value of wetland resources.

3.16 Terrestrial Wildlife and Threatened and Endangered Species

Threatened and endangered species are protected under the Federal Endangered Species Act, 16 U.S.C. §§ 1531 et seq. and under state law, while species listed as "special concern" or "concern" are protected only by state law. An endangered species is one whose overall survival in a particular region or locality is in jeopardy as a result of loss or change in habitat, overall exploitation by man, predation, adverse interspecies competition, or disease. Unless an endangered species receives protective assistance, extinction may occur. Threatened or rare species are those with populations that have notably decreased due to any number of limiting factors that lead to deterioration of the population. A species may also be considered as a species of "special concern." These may be any native species for which a welfare concern or risk of endangerment has been documented within a particular state (USFWS, 2014). In addition, certain states also identify "historical species" which are native species that have been previously documented for the state, but which are currently unknown to occur.

Due to the mobility and migratory patterns of terrestrial wildlife, information on the use of specific sites by terrestrial mammals, reptiles, amphibians, and invertebrates is not well studied or available for the proposed alternatives. This evaluation focuses on identifying species relevant to the general LIS Study Area and determining the likelihood of their occurrence. Project specific evaluations will need to be further analyzed to evaluate the impact at individual sites. For more detailed information see accompanying PEIS, Section 4.16.

3.17 Air Quality

Air quality is defined as the concentration of specific pollutants of concern in ambient air. The levels of concern are set with respect to the health and welfare of the general public. Air quality within the three states in the project area, including the open water areas, may be sensitive to potential air quality effects as a result of implementing the proposed action. Both state and federal air quality regulations apply to the study area. Coastal waters within three (3) nautical miles (nm) of the coast are under the same air quality jurisdiction as the land areas. Hence, most open water, nearshore, and upland areas within the Study Area are under these jurisdictions.

Air quality can be affected by air pollutants produced by mobile sources, such as vehicular traffic, trucks, or non-road equipment such as those used for dredging activities; and by fixed or non-mobile facilities, referred to as "stationary sources". Stationary sources include combustion and industrial source stacks and exhaust vents from power generating and other industrial facilities, such as a material transfer station, a landfill site, etc.

Criteria Pollutants and National Ambient Air Quality Standards: The U.S. EPA, under the requirements of the 1970 Clean Air Act (CAA), as amended in 1977 and 1990 (Clean Air Act Amendments), has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 Code of Federal Regulations [CFR] 50): Carbon monoxide, Nitrogen dioxide, Ozone (with nitrogen oxides and volatile organic compounds [VOCs] as precursors), Particulate matter (PM) (PM10 [less than 10 microns in particle diameter]; PM2.5 [less than 2.5 microns in particle diameter]), Lead, and Sulfur dioxide.

The NAAQS include primary and secondary standards. The primary standards were established to protect human health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Typical sensitive land uses protected by the primary standards are publicly accessible areas used by these populations, such as residences, hospitals, libraries, churches, parks, playgrounds, schools, etc. Secondary standards set limits to protect the environment, including plants and animals, from adverse effects associated with pollutants in the ambient air.

Areas that meet the NAAQS standard for a criteria pollutant are designated as being "in attainment." Areas where a criteria pollutant level exceeds the NAAQS are designated as being "in nonattainment." When a nonattainment area is re-designated as an attainment area, the CAA requires that a maintenance plan be put in place to ensure continued compliance with the corresponding NAAQS. Therefore, a former nonattainment area is also defined as a maintenance area. Where insufficient data exist to determine an area's attainment status, an area is designated unclassifiable (or in attainment). For more detailed information see accompanying PEIS, Section 4.17.

3.18 Noise

Environmental noise is defined as the sound in a community emanating from man-made sources such as automobiles, trucks, buses, aircraft, and fixed industrial, commercial, transportation, and manufacturing facilities, or from natural sources such as animals, insects, and wind (EPA, 1974). Since environmental noise is composed of sounds from moving as well as stationary sources, it varies geographically and temporally.

Noise in terms of air pressure is the force experienced by an object immersed in air divided by the area on which the force acts also referred to as intensity. The typical unit of measurement used to evaluate air pressure is pounds per square inch. However, when dealing with sound pressure levels, an international unit, the Pascal (Pa) is commonly used. One pound per square inch is equal to 6,890 Pa. The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be detected. Because of this vast range, using a linear scale to represent the intensity of sound becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level. The dB unit expresses the ratio of sound pressure to a reference standard. Specifically, the sound pressure level in dB is defined as 20 times the common logarithm of the ratio of sound pressure in Pa to the reference pressure (0.00002 Pa or 20μPa for airborne sound).

Historically, the health effects (e.g., hearing damage) and the welfare effects (e.g., task interference and sleep disruption) of noise were studied and documented in terms of the Equivalent Sound Level, L_{eq}, and the Day-Night Sound Level, L_{dn} (EPA, 1974). These two metrics have been widely used in evaluating noise conditions. For more detailed information see accompanying PEIS, Section 4.18.

3.19 Cultural Resources

A Cultural Resources Inventory (USACE and PAL, 2010; also noted as Technical Supporting Document 11) was developed in support of the Long Island Sound DMMP by the Public Archaeology Laboratory (PAL). The inventory identifies historic properties, including the archaeological sites and sensitivity, of 57 coastal communities located along the shores and tributaries of LIS, in Fairfield, New Haven, Middlesex, and New London Counties, Connecticut; Washington County, Rhode Island; and Westchester, Bronx, Queens, Nassau and Suffolk Counties, New York,.

Overall, the LIS region is archeologically sensitive, with more historical resources currently identified at its western and eastern ends than in its wide center. The terrestrial portion of the study area (inland at a distance of no greater than 10 miles) contains 3,146 recorded archaeological sites, of which 195 are identified as National and State Register (NR/SR) listed or eligible sites (USACE and PAL, 2010). There are also 2,032 aboveground historic resources, including buildings, sites, structures, objects, and districts that are listed, determined eligible, or potentially eligible for the NR/SR within the respective states in which they are located. No traditional cultural properties were identified in the state inventories; however, it is expected that such resources are present in some areas and would need to be identified through discussions with Native American tribes and other ethnic groups or communities. Overall, the LIS DMMP study area along the coast of LIS is a highly sensitive region for terrestrial archaeological resources that date from all temporal/cultural periods of documented human occupation, approximately 12,000 years ago to present.

In the underwater portions of the study area, 847 shipwrecks and obstructions are reported. Areas of low, moderate, and high sensitivity for underwater archaeological resources is highest at the study area's western end closest to the port of New York City and at its eastern end in association with the Groton-New London port area. Detailed results of the cultural resource inventory are presented in USACE and PAL (2010). For more detailed information see accompanying PEIS, Section 4.19.

3.20 Socioeconomic Environment

The socioeconomic environment includes commercial and recreational fisheries, shipping and navigation, recreational activities and beaches, parks and natural areas, and other human uses of the Long Island Sound Study Area. This section summarizes information presented in Technical Supporting Document #3, the 2010 Economic Impact Assessment Update.

The coastline throughout the study area is densely populated with urban cities and communities especially those surrounding LIS. The boroughs of Queens, Manhattan, Brooklyn, and the Bronx within New York City house 7.7 million persons, slightly over half of the total population within the study area. The remaining population is distributed over 200 other communities within the study area (U.S. Census Bureau, 2010).

Historically significant in its contribution to the overall development of the region, LIS provides open-water access to commercial navigation, commercial and recreational fishing, strategic military operations, and shore-side tourism (Latimer et al., 2014). USACE (2010; also noted as Technical Supporting Document 3) estimated the regional economic significance of LIS activities that are dependent upon the commercial opportunities afforded by the water body. This analysis estimated the economic importance of navigation-dependent activities in LIS using input-output modeling that estimated annual direct, indirect, and induced effects of spending. The navigation-dependent economic activities evaluated were marine transportation (including commercial shipping, scenic water transportation, and ship-building activities), commercial fishing, recreational boating, ferry-dependent tourism, and activities associated with the U.S. Navy Submarine Base in New London, Connecticut.

The contribution of navigation-dependent activity to economic output in the study area is approximately $9.4 billion per year. Navigation-dependent activity is estimated to contribute $5.5 billion per year to the region's GSP, providing 55,720 jobs. In addition, navigation-dependent activity accounts for an estimated $1.6 billion per year in Federal and state tax revenues. The contribution of navigation-dependent activity to the Gross State Product (GSP) within the LIS region represents approximately 0.93% of the study area's overall contribution to GSP, or 0.38% of total 2007 GSP for Connecticut, New York, and Rhode Island (USACE, 2010). For more detailed information see accompanying PEIS, Section 4.20.

3.20.1 Transportation

There are numerous methods of transportation for people, goods and services within the Long Island Sound Study Area. There are nearly 400 identified ports within the study area. Hundreds of commercial and recreational boats and ships use these ports daily as well as ferries. Ferries offer cross-Sound transportation to commuters, tourists, commercial vehicles and automobiles, and provide access to destinations in and around LIS.

The study area is highly developed with a complex roadway system of 3,300 miles of Interstate, U.S., and State Highways. Transportation of goods to and from the coast via tractor trailers and trucks is a popular method of transport. Thousands of trucks travel the highways within the study area every day.

From the start of railroading in America, through the first half of the twentieth century, New York City and Long Island were major areas for rail freight transportation, but their location, across the Hudson River from northeastern New Jersey, and from most of the United States, presented a formidable barrier to rail transportation. For more detailed information see accompanying PEIS, Section 4.20.1.

3.20.2 Recreation

Parks: The EPA (2004a) identified areas of special concern in the LIS region, including national wildlife refuges, state parks, county and city lands, and habitat management and conservation areas. State parks in Connecticut are located throughout the study area and can be found in Westport and Milford. Connecticut is also home to the U.S. Department of Fish and Wildlife's Stewart B. McKinney National Wildlife Refuge, which includes holdings along the coast of southern Connecticut from Norwalk to New London. Other parks in Connecticut include Cummings Park and Cove Island Park in Stamford, and Lighthouse Point Park in New Haven. Wildlife management areas can be found in Stratford, Milford, New Haven, and Guilford. In New York, state parks are located near Wildwood, Smithtown, Kings Park, and Huntington. Target Rock National Wildlife Refuge is located in Huntington (EPA, 2004a). For more detailed information see accompanying PEIS, Section 4.20.1.

Sport Fishing: The top seven important recreational species of finfish are bluefish, scup, striped bass, summer flounder, tautog, weakfish, and winter flounder. Crabs (horseshoe, lady, rock, and spider), long-finned squid, and American lobster are important recreational invertebrates (CTDEEP, 2013). Recreational shellfishing focuses on quahogs, soft-shell clams, and oysters. Popular locations for recreational shellfishing can be found in the salt ponds of Washington County, Rhode Island (EPA, 2004b).

In the LIS region, a large portion of the recreational fishing activity occurs between the spring and fall months when weather and water temperatures are most favorable. During these months, offshore angling is concentrated around ledges, shoals, banks, and other places where habitat and depth changes induce fish to congregate. Historic recreational fishing areas occur off Lloyd's Neck, Huntington Bay, and Eaton's Neck, in New York and off Long Neck Point, Sheffield Island (Norwalk), and three nautical miles east of the WLDS Alternative in Connecticut (EPA, 2004a).

Recreational fishing activity takes places both from shore and from boats off the coast. Shore-based fishing, generally defined as surf casting, takes places at beaches along the coast. Jetties, piers, shoals, and banks are all angling sites for shore-based recreational fishermen (EPA 2004b). For more detailed information see accompanying PEIS, Section 4.20.1.

Boating: Private, charter, and party boats are used for recreational fishing offshore. Charter vessels often carry up to six passengers to a recreational fishing location in the area. Party boats carry more passengers than charter vessels and are normally offshore for shorter periods of time. Party boats can be found in the active recreational ports of Montauk, New York; Point Judith, Rhode Island; and New London, Connecticut, with the majority taking place out of Montauk (EPA 2004b). For more detailed information see accompanying PEIS, Section 4.20.1.

3.20.3 Tourism and Recreational Activities

Tourism has a variety of economic impacts. Tourists contribute to sales, profits, jobs, tax revenues, and income in an area. The most direct effects occur within the primary tourism sectors — lodging, restaurants, transportation, amusements, and retail trade. Through secondary effects, tourism affects most sectors of the economy (Stynes, 1997).

Tourism supported an estimated 43,000 businesses and 17 million workers with an annual payroll of $15.5 billion within the study area in 2011 (U.S Census Bureau, 2011b). For more detailed information see accompanying PEIS, Section 4.20.1.

3.20.4 Military Installations

Military activities in the western and central portions of the Long Island Sound region include a decommissioned U.S. Army engine production plant (Stratford, Connecticut) and U.S. Air Force 103rd Air Control Squadron at Orange Air Guard Station (New Haven, Connecticut) (EPA, 2004a). Army National Guard installations are located in Connecticut at Camp Rell in Niantic, and at Stone Ranch Military Reservation at East Lyme (UConn, 2014).

Portions of three U.S. Coast Guard Sectors, all within the First Coast Guard District, are located within the DMMP study area. These are Sectors New York, Long Island Sound and Southeastern New England. The U.S. Coast Guard Academy on the lower Thames River at New London requires periodic maintenance for its vessel access. Within the DMMP study area Sector Southeastern New England has a station at Point Judith and a seasonal facility at Great Salt Pond on Block Island. Sector Long Island Sound has stations at New London, New Haven and Montauk, and seasonal stations at Eatons Neck and Fishers Island, NY. Sector New York has a station at Kings Point, which is co-located with the Merchant Marine Academy at Kings Point, NY (USCG Sector NY letter of September 29, 2015). Most of these facilities will require periodic maintenance dredging during the 30-year planning horizon.

The U.S. Naval Submarine Base New London, located in Groton, Connecticut, is a significant contributor to employment in the LIS region. This facility is the Navy's first submarine base and is considered the home of the submarine force. The base performs periodic maintenance and improvement dredging to ensure warship access to its facilities. In his letter of October 9, 2015 the base Commander stated that submarine operations at the base are critical to the national defense and depend on dredging to maintain required depths. The base commander noted that the Navy is planning to conduct additional improvement dredging of about 60,000 CY to support basing of the newest Virginia class submarines. The Navy confirmed the DMMP's other projections of the Navy's maintenance dredging needs. For more detailed information see accompanying PEIS, Section 4.20.1.

3.21 Existing Dredged Material Management in Long Island Sound

Management of dredged material placement in Long Island Sound is carried out by the USACE and US EPA under their CWA and MPRSA authorities, and by the states under their delegated CWA and CZMA authorities. Federal management and monitoring of the active open water placement sites occurs in conformance with those authorities and as guided by the Site Management and Monitoring Plans (SMMPs) for each site produced by the two agencies. The principal mechanisms for monitoring and management are EPAs periodic field surveys of the sites, and activities carried out under the USACE NAE's Disposal Area Monitoring System (DAMOS) program.

3.21.1 The DAMOS Program

DAMOS is a program carried out by the New England District of the U.S. Army Corps of Engineers to monitor and manage aquatic dredged material placement sites from Long Island Sound to Maine. Sites that are monitored include exposed, open-water placement sites; near-shore placement sites; and confined aquatic disposal or CAD cell sites. DAMOS is a comprehensive monitoring program designed to address the common questions and concerns that regulators and the public have regarding in-water placement of dredged material:

- Can the dredged material be accurately placed at a given site?
- Will there be an unacceptable release of material to the water column as it is released from a barge and falls through the water column?
- Will the placed material cause an unacceptable impact to the benthic community?
- Does the placed material remain in place or will it be disturbed by currents and storms?
- Are there site-specific concerns such as proximity to a fisheries resource?

Although DAMOS is a Corps of Engineers program, the overall direction and specific site survey objectives are determined in close cooperation with the USEPA as well as with regulatory agencies in the New England states.

History of the DAMOS Program: With the growing awareness of environmental impacts in the 1960s and the passage of the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act in the 1970s, a series of scientific investigations were carried out in New England waters to determine the effects of open-water placement of dredged material. The Corps participated in these studies along with newly formed environmental agencies and academic institutions, and DAMOS was formally initiated in 1977 as a dedicated New England District program. For nearly four decades, DAMOS has performed annual site surveys throughout New England waters at both active and historic dredged material placement sites.

Tools Used to Investigate Dredged Material Placement Sites: The DAMOS Program utilizes state-of-the-art instrumentation to monitor the water column and the seafloor, and DAMOS investigators have been involved in the development of some of that instrumentation. At present, the primary survey tools include multi-beam bathymetry and side-scan sonar (to map the depth, features, and characteristics of the seafloor); sediment profile and plan view imaging (to assess physical, chemical, and biological conditions at the sediment water interface); sediment collection using grabs and coring devices (to allow for laboratory physical, chemical, and biological analyses); acoustic Doppler current profiler (to measure currents and suspended matter within the water column); water quality instrumentation (to measure parameters such as dissolved oxygen, pH, and turbidity); highly accurate GPS instrumentation (to track the barge placement of dredged material and monitor the sites).

Types of Studies Carried-Out by the DAMOS Program: The DAMOS Program includes both confirmatory and focused investigations. Confirmatory surveys are performed periodically at sites with recent disposal activity, with a tiered monitoring approach designed to allow for efficient assessment of potential impacts and overall compliance. Primary goals include documentation of the physical location of dredged material placement at a specific disposal site and evaluation of the environmental status of the disposal site relative to placement at a specific disposal site and evaluation of the environmental status of the disposal site relative to nearby reference areas. Focused investigations are undertaken to evaluate inactive/historic disposal sites or to further knowledge on specific disposal and monitoring techniques. A hallmark of the DAMOS Program has been the development of clear monitoring objectives that drive the collection of meaningful data and allow for translation of those data that can support management actions.

Public Availability of DAMOS Information: All of the information gathered through the DAMOS Program is publically available. Following a survey at a given site, the collected data are analyzed, and a summary report is typically prepared, and reports can be downloaded from: http://www.nae.usace.army.mil/Missions/DisposalAreaMonitoringSystem(DAMOS).aspx

Program results are also presented periodically in scientific journals and at conferences and symposia. The DAMOS Program Manager serves as a co-chair with the USEPA for the New England Regional Dredging Team (NERDT) made up of federal and state agencies involved in the permitting and regulation of dredging and dredged material placement. The NERDT meets quarterly and communicates frequently by email, allowing for close coordination among the New England states on dredging and placement approaches (including beneficial use of dredged material). Information on the NERDT can be found at:
http://nerdt.org/

What has been Learned from DAMOS Program Investigations: To date, the DAMOS Program has generated over 200 detailed reports addressing all of the major questions and concerns related to placement of dredged material in an aquatic environment. In summary:

- Dredged material can be placed in the aquatic environment with very high accuracy. For nearshore placement or for placement within a CAD cell, material can be placed within 10’s of feet of a target location. Even in deeper, open-water locations, material can be placed within 100-200 feet of a target location.
- Multiple field investigations have clearly demonstrated that only a very limited amount of material is released to the water column during placement. This is supported by computer simulation and academic studies of the hydrodynamics of materials falling through a water column.
- Sequential surveys of biological conditions at sites following the placement of dredged material consistently show a rapid recovery of the benthic community to that of the surrounding habitat outside of the disposal site.
- With the nearly 40 year record of surveys, there have been multiple opportunities to evaluate the passage of large storms (both hurricanes and nor’easters) on the dredged material deposits on the seafloor. These investigations have demonstrated long-term stability of the deposits even at the most exposed energy sites.

- The placement sites and surrounding areas are actively fished throughout New England waters, with no discernable impacts.

3.21.2 Site Management and Monitoring Plans for Long Island Sound

Management plans for ocean dredged material disposal sites are required pursuant to §102(c) of the MPRSA. Site Management and Monitoring Plans (SMMPs) for the CLDS and WLDS were developed in conjunction with EPA's final site designation EIS and final rule in 2005. In accordance with those SMMPs, and similar management of the two more easterly placement sites in LIS, the DAMOS program continues to perform monitoring surveys periodically in order to expand the knowledge base that is the foundation of the SMMPs. SMMPs serve as frameworks to guide the development of future project-specific sampling and survey plans created under the monitoring program. Data gathered from monitoring is evaluated by EPA New England Region, the USACE-NAE, and other agencies to determine whether modifications in site usage, management, testing protocols, or additional monitoring are warranted. While the SMMP documents are updated about once every ten years, the management of the sites is ongoing and adaptive as each study or survey makes additional information available.

As discussed in the guidance for development of site management plans issued by EPA and the USACE ("Guidance Document for Development of Site Management Plans for Ocean Dredged Material Disposal Sites"; EPA/USACE, 1996), management of the site involves: regulating the times, quantity, and physical/chemical characteristics of dredged material that is placed at the site; establishing placement controls, conditions, and requirements; and monitoring the site environment to verify that potential unacceptable conditions which may result in significant adverse impacts are not occurring from past or continued use of the placement site and that permit terms are met.

In addition, an SMMP also incorporates the six requirements for ocean placement site management plans discussed in MPRSA § 102(c)(3), as amended. These are:

1. Consideration of the quantity of the material to be placed of at the site, and the presence, nature and bioavailability of the contaminants in the material [§102(c)(3) Section II C];
2. A baseline assessment of conditions at the site [§102(c)(3) Section III];
3. A program for monitoring the site [§102(c)(3) Section IV];
4. Special management conditions or practices to be implemented at each site that are necessary for protection of the environment [§102(c)(3) Section V.A);
5. Consideration of the anticipated use of the site over the long term, including the anticipated closure date for the site, if applicable, and any need for management of the site after closure [§102(c)(3) Section VI);
6. A schedule for review and revision of the plan (which shall not be reviewed and revised less frequently than 10 years after adoption of the plan, and every 10 years thereafter) [§102(c)(3) Section VII).

The SMMPs for the CLDS and WLDS are currently being updated and will be published after EPA's modification of the final rule on designation of the two sites.

4. FORMULATION OF ALTERNATIVES

4.1 Statement of the Problem

The U.S. Army Corps of Engineers is responsible for maintaining the nation's system of authorized Federal navigation projects, to provide safe and efficient waterborne transportation systems (river channels, harbors, and other waterways) for movement of commerce, national security needs and recreation. The Corps New England and New York Districts (NAE and NAN) share responsibility for maintaining safe navigation in those harbors of the Long Island Sound (LIS) region which have FNPs, nearly all of which include dredged general navigation features. Periodic maintenance dredging is required to maintain authorized project dimensions, and occasional improvement dredging is necessary to meet the changing needs of waterborne commerce.

The demand for appropriate cost-effective and environmentally acceptable management of dredged material with the LIS region is great. A total of nearly 240 harbors, coves, bays and rivers supporting various levels of navigational access, including 55 Federal navigation projects described earlier, and dozens of non-Federal projects are located within the LIS region. Other Federal agencies, including the U.S. Navy, U.S. Coast Guard, Maritime Administration, and the NOAA Fisheries operate facilities around LIS requiring navigational access. There are limited economically feasible options for the future placement of sediments anticipated to be dredged in LIS. Available options have become increasingly controversial and contested by regional stakeholders for a variety of reasons.

Historically, the majority of dredged material in the region was placed in open water sites in LIS. Even today most dredged material is found suitable for open water placement in the Sound following extensive physical, chemical, and biological testing. Over the past 30 years, however, local groups and regulatory agencies have increased their efforts to encourage minimizing open water placement of dredged material in LIS, particularly in New York waters, and to encourage maximizing the amount of dredged material that is handled by upland placement or management methods.

By 1980 the number of active open water dredged material placement sites had been reduced to four. Amendments to MPRSA in 1980 and 1990 required the Federal government to evaluate dredged material placement under the requirements of that law, as well as the CWA. In 2004 the USEPA published its final EIS designating the Central and Western LIS disposal areas, with limitations placed on the continued use of the two sites. EPA is currently preparing a second EIS examining whether or not to designate sites in eastern LIS. However, limitations in the current designations, and uncertainty with future designations, call into question the long-term availability of open water as an alternative for dredged material placement for the harbors of the LIS region.

The Governors of the States of Connecticut and New York, by letter dated February 8, 2005, requested that the Corps prepare a regional DMMP for Long Island Sound. The USACE Director of Civil Works, in his response of May 17, 2005 confirmed Corps support for this effort. Additionally, in 2005 when the USEPA formally designated the Central and Western LIS disposal sites, they required in the Final Rule that that a DMMP be prepared from a regional perspective. Relevant sections of the USEPA Final Rule are quoted below:

> *"... each proposed dredging project will be evaluated to determine whether there are practicable, environmentally preferable alternatives to open-water disposal. … Alternatives to open-water disposal that will be considered include upland disposal and beneficial uses such as beach nourishment. If environmentally preferable, practicable disposal alternatives exist, open-water disposal will not be allowed."*

> *"[These restrictions] are designed to support the common goal of New York and Connecticut to reduce or eliminate the disposal of dredged material in Long Island Sound. To support this goal, the Restrictions contemplate that there will be a regional dredged material management plan (DMMP) for Long Island Sound that will guide the use of dredged material for projects which occur after the DMMP is completed. DMMPs are comprehensive studies carried out by the USACE, in consultation with the EPA and the affected states, to help manage dredged material in a cost-effective and environmentally acceptable manner."*

The limited number of practicable placement options for dredged material inhibits dredging operations required for maintaining safe navigation. This constrains Federal agency activities, port operations, and commercial and public accessibility, which in turn adversely affects commerce and economic development in the region. The DMMP has been developed to provide a 30 year management strategy to add certainty to dredging and placement activities from navigation channels and Port facilities within the Region in an environmentally acceptable and economically practicable manner.

4.2 Federal Objective

The USACE planning process is grounded in the Economic and Environmental Principles and Guidelines (P&G), which were promulgated in 1983 via the Water Resources Council. Within this framework, the USACE seeks to balance economic development and environmental needs as it addresses water resource problems. The P&G states: "The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

> (a) Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective.

> (b) Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed."

The P&G are comprised of two parts: The Economic and Environmental Principles for Water and Related Land Resources Implementation Studies, and Environmental Guidelines for Water and Related Land Resources Implementation Studies. Together, both provide the framework for USACE water resource planning studies. The P&G require that plans be formulated considering of four criteria: completeness, effectiveness, efficiency, and acceptability. These terms are defined as follows:

- Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.
- Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives.
- Efficiency is the extent to which an alternative plan is the most cost effective means of achieving the objectives. Efficiency will be measured through a comparison of benefit-to-cost ratios (BCRs) and reduced damages.
- Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. The alternatives were formulated to be in accord with applicable laws and regulations. Public acceptance of the plan is one criterion to consider

4.3 DMMP Planning Objectives

The primary planning objective for this DMMP is to develop plans to aid in the removal of sediments from the navigation channels and port facilities in the Region in an environmentally acceptable and economically practicable manner for the next 30 years. Typically DMMPs use a 20 year planning horizon. However, given the regional nature of this DMMP, the large number of FNPs and non-Federal harbors and projects involved, and the longer maintenance frequencies of FNPs in New England compared to other regions of the country, a longer, 30-year planning horizon was determined appropriate. That 30-year period runs from 2015, the anticipated publication date for this DMMP, to 2045. Specific planning objectives include the following:

- Identify the Federal Base Plans for all FNPs and for other Federal agency facility needs in the LIS region, for the 30-year study period, where possible, for dredged material placement and beneficial use.

- Where practicable, identify non open water alternatives to the Federal Base Plans for the 30-year study period, and identify what opportunities for non-Federal partnerships may be employed to implement such alternatives.

- Develop procedures and processes to implement dredged material management plans for the 30-year study period, including consideration of alternatives to open water placement.

- Develop a 30-year regional dredged material management plan that is consistent with the Federal Standard, and which also, to the maximum extent practicable, addresses the goals of the states and other regional stakeholders.

4.4 Planning Opportunities & Constraints

Planning opportunities are framed in terms of the Federal objective and the specific planning objectives. Furthermore, planning opportunities should be defined in a manner that does not preclude the consideration of all potential practicable alternatives to solve a problem. For the DMMP analysis Planning Opportunities include the following:

- Opportunity to provide for the long-term cost-effective and environmentally acceptable dredged material placement options for the needs of navigation in the LIS region.
- Opportunity to engage states and other non-Federal interests in partnerships to develop practicable alternatives to open water placement of dredged material which will have other national and regional benefits, such as environmental enhancement and restoration, coastal resiliency, and economic development.
- Opportunity to constructively engage other Federal agencies (e.g., U.S. Environmental Protection Agency, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Navy and U.S. Coast Guard), the States of NY, CT, and RI, Indian nations/tribes, county and municipal governments, port authorities, universities and NGO's, in the development, implementation, management and monitoring of practicable dredged material placement options in the LIS region.

Planning constraints are restrictions that limit the planning process. Alternative plans are formulated to achieve the planning objectives and avoid the planning constraints. Although specific to each study, typical planning constraints include engineering, economical, financial, environmental, public views and policies. These constraints can be grouped into two categories: resource constraints and legal and policy constraints. Resource constraints include those associated with limits on knowledge, expertise, experience, ability, data, information, money and time. Legal and policy constraints refer to those defined by law, and by USACE policies and guidance documents. Specific study constraints for the DMMP include the following:

- Near shore property suitable for dewatering or storing dredge materials within the Study Area is very costly, and undeveloped land is scarce. This limits availability of practicable on shore alternatives for the processing and transfer of dredged materials.
- The PDT was provided with a limited data set from the New York District which has impacted the development of volume estimates and sediment quality data for the FNPs within New York District's area of responsibility. As a result there is a higher level of speculation involved in determining dredging frequency, volumes, timing and placement needs from those harbors.
- The States have very different policies and opinions on environmental impacts of placement and how to best manage future dredged material. While Connecticut is more willing to consider, approve and participate in open water placement alternatives, New York is generally opposed to further use of LIS for that purpose.
- The two states have adopted, with NOAA's approval, overlapping state Coastal Zone Management (CZM) jurisdictions within the waters of LIS. Each state exercises CZM oversight beyond its boundary as far as the 20-foot contour off each other's shores.

- The broad range of sediment classifications present in the LIS region constrains the development of economically practicable alternatives to open-water placement. The harbors of the LIS region generate a full range of marine and estuarine sediment types, from gravel to clay physically, and from clean material suitable for human contact to unsuitable materials requiring containment and isolation from the environment.

- Planning for large port expansion projects creates uncertainty in determining need for and size of future placement areas or beneficial use of dredged material. Congressional resolutions are extant calling for the study of major improvements to New Haven Harbor and Mystic Harbor in CT, and to Little Narragansett Bay on the CT/RI border. The New Haven Harbor port deepening study has been funded as a new start in Federal fiscal year 2015. New Haven in particular, with a potential to generate more than 5 million CY of material, could drive implementation of potential placement solutions in that area of LIS for other harbors as well.

4.5 Evaluation Criteria

Corps policy in the Planning Guidance Notebook states that each alternative plan shall be formulated in consideration of four evaluation criteria, as outlined in the P&G. They are: completeness, efficiency, effectiveness, and acceptability. Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other federal and non-federal entities. Effectiveness is the extent to which the alternative plans contribute to achieving the planning objectives. Efficiency is the extent to which the alternative plan is the most cost effective means of achieving the objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. Lastly, appropriate mitigation of significant adverse effects is an integral component of each alternative plan.

It should be noted that the DMMP is different from a typical USACE Feasibility Study, which normally involves the selection of one preferred alternative out of several feasible alternatives to solve a single defined objective. Rather, this DMMP is developed to formulate a strategy for the management of dredged material for the entire LIS region. Since each dredging project is unique and has its own set of objectives that need to be met, the best alternative for each of the 52 FNPs that require dredging can be very different, and so each must be examined separately, before considering whether common solutions exist to address the needs of groups of projects geographically or those generating similar types of materials.

4.5.1 Completeness, Effectiveness, and Efficiency

The recommended alternatives presented should be complete and sound, and provide sufficient detail so that environmental and economic investigation on a feasibility level can be completed. Additionally, the recommended alternatives should be technically feasible and implementable.

A DMMP must identify the least cost, environmentally acceptable alternative for dredged material placement as the Federal Base Plan. That Base Plan is used to determine the extent of

Federal financial involvement in alternative placement solutions. Alternatives other than the Base Plan which are proposed by other parties may be pursued provided that any incremental cost beyond the Base Plan is either funded in full by a non-Federal interest, or that alternative is determined through study to qualify for implementation under another Corps authority (such as the Section 204 or 103 continuing authorities) with Federal/non-Federal cost-sharing and partnership. Any alternative beyond the Base Plan that requires Federal cost-sharing for implementation becomes a separate project that must be found in the federal interest, including displaying feasibility by satisfying the benefit-cost (B/C) criteria. Generally, this ratio must be at least greater than one to allow federal participation for continued study and implementation of any project proposal.

The extent to which a dredging project's material placement at a particular alternative site is evaluated for completeness, effectiveness and efficiency would need to be determined by project-specific investigations. Completeness requires that a paring of a specific dredging project with a placement alternative include all the elements needed to bring that project to completion, including the generation of any beneficial use benefits, and achievement of the supporting navigation benefits. Dredging must provide navigation access for the design fleet, and placement must minimize impacts and/or achieve the intended benefits, and the project as a whole must represent an efficient use of fiscal resources as measured through cost. All of plans for dredging and dredged material placement outlined in this DMMP were developed a complete plans, incorporating all actions (and estimates) for their implementation insofar as this level of analysis allowed.

Effectiveness was evaluated based on all FNPs and other Federal agency actions being included in the 30-year LIS DMMP planning horizon, with maintenance cycles sufficient to permit safe and efficient navigation over that period. Utilizing beneficial use opportunities where identified is also a measure of efficiency in the context of the LIS watershed as a whole. Specific project proposals would need to further examine issues of effectiveness in determining any recommendation for placement and beneficial use. For this DMMP where a beneficial use could be employed it has been included, and where its costs were in a range of less than to only slightly more than another placement alternative it has been identified as a likely base plan.

Efficiency at this programmatic level of analysis was evaluated based on project cost. For beneficial uses costing more than the Base Plan, efficiency is measured in terms of increment cost compared to incremental benefit. In other words the additional benefits would serve to offset the incremental cost of the alternative placement. Where future project-specific analyses show that beneficial uses are incrementally justified (economically and/or environmentally), there may be a Federal interest in participating in the cost-shared implementation of those beneficial use plans. Project specific studies would be needed to demonstrate whether these criteria would be met for any project proposal. For this DMMP the total cost of dredging and disposal was used to identify the likely base plans and evaluate alternatives.

4.5.2 Acceptability

Applicable environmental requirements must be met in determining the Federal Base Plan for a DMMP. Environmental acceptability must be ascertained; and short-term and or long-term significant adverse impacts should be avoided if possible, or minimized, if avoidance is not possible. The alternative options and plans should be acceptable to interested Federal and state agencies, non-Federal sponsors, local agencies and organizations, and the public. In the LIS region it must be recognized that significant differences exist between the states, and between the marine trades interests, fishing interests, and among the general public concerning acceptability of various alternatives, particularly open water placement. While all parties profess sincere concern for both environmental protection, and the needs of commerce for economy, different weights are given to these concerns by the various entities. The USACE must weigh the concerns of these various interests and other agencies, together with the results of its own investigations, in making its determination of impacts and environmental acceptability relative to the Federal Standard. For the projects and harbors of LIS the history of sediment sampling and testing was used to determine acceptability of the many projects and materials for various placement alternatives generally. The site identification and initial evaluation/screening process as detailed in several of the Technical Supporting Documents is outlined in Section 4.9. The availability of specific alternative sites for placement of dredged materials was made through the site evaluation and screening process as described in Appendix G and the accompanying PEIS. Use of these criteria was considered appropriate for this programmatic level evaluation of potential alternatives and likely Federal Base Plans. Future USACE and other Federal agency projects will need to consider the views of other Federal, state and local agencies and the public when determining the acceptability of proposed projects, including dredged material placement recommendations.

4.6 Plan Formulation Methodology

Plan formulation for the LIS DMMP involved a series of steps to define the specific problems, needs and opportunities for solutions. This included an examination at the individual Federal Navigation Project level, the sub-regional dredging center level, and the larger LIS regional level. Sequentially the steps included the following:

- Identify and quantify the dredging needs for each FNP and each non-Corps Federal facility at the project level, and for all non-Federal permit activities collectively at the dredging center level, over the 30-year DMMP planning horizon.
- Define the characteristics of the material to be dredged for each FNP and each non-Corps Federal facility at the project level, and for all non-Federal permit activities collectively at the dredging center level.
- Identify potential dredged material placement options available for the anticipated dredged material types by Federal project, harbor, dredging center, and regionally. Identify other processes and methods needed to use such sites, including dewatering and re-handling areas, transportation methods, material treatment technologies, and beneficial use opportunities.
- Screen the potentially available placement options by the type of material accepted placement capacity, anticipated environmental and social impacts, and match the most likely solutions to the dredging needs.
- Estimate the unit costs for dredging, transport and placement for each of the screened and ranked alternative placement options.
- Identify the Federal Base Plans and associated best management practices for dredged material use or placement for each FNP and other Federal agency facility where possible.

- Identify practicable alternatives to the Federal Base Plan for each FNP and Federal facility. Estimate the incremental cost of implementing these alternatives over the Base Plan cost. Identify potential Federal authorities and processes for Federal participation in the incremental costs of such alternatives. Outline the non-Federal requirements for participation.
- Develop and recommend processes (the “standards and procedures” as stated in the 2007 PMP and EPA’s 2005 rule) for future Federal and non-Federal dredged material placement alternatives evaluation to be followed in the NEPA analysis for projects (Section 7).
- Develop recommendations for further interstate and interagency cooperation in investigating and implementing alternatives to open-water placement (Section 7).

4.7 Dredging Needs Analysis

The first step in developing a DMMP for the LIS region was to identify the dredging needs in the region. There are 55 FNPs in the LIS study area; 36 in NAE and 19 in NAN. Larger rivers and harbors in the NAE inventory, such as Pawcatuck River, New London Harbor, Connecticut River, New Haven Harbor and Bridgeport Harbor each have a number of projects or sub-projects for geographically separate rivers and small harbors that were authorized and are budgeted separately, or in some cases under the larger harbor name. If counted solely by budget authority the NAE project total would be 29. Three of the projects in NAN have no dredged project features, either because they consist solely of breakwaters (Larchmont Harbor and Glen Cove Harbor), or because their dredged features were later deauthorized (Sag Harbor). EPA’s 2004 FEIS on the CLDS and WLDS site designations included a larger number of NAN FNPs because it was assumed that the dredged material draw area extended west of the Throgs Neck Bridge to include rivers and harbors tributary to the East River, such as Westchester Creek, the Bronx River and Flushing Bay.

For purposes of the earlier EPA site designation EIS and this DMMP the LIS region was divided into geographic Dredging Centers: two in western Rhode Island, eleven in Connecticut and fourteen in New York. Each was centered on a large port or group of adjacent smaller harbors. FNPs and non-Corps Federal facilities needs are each examined individually. Non-Federal dredging actions under permit were examined collectively by dredging center. The use of dredging centers also allowed for development and consideration of regional and sub-regional placement and processing solutions to serve a single dredging center or group of adjacent centers. These dredging centers are shown in Figure 4-1.

The EPA 2004 FEIS included a dredging needs analysis that described the then-projected dredging needs for Federal and non-Federal projects in the region over a 20-year timeline. In 2008-2009 the DMMP study updated that analysis using a 30-year timeline. The 2010 report on this effort is included as Appendix C to this DMMP. The 2008-2009 update included a more intensive effort to survey and identify the non-Federal dredging needs of the region, an issue raised by regional marine trades interests with the original analysis. A total of 731 facilities were surveyed, of which 451 responded, a return rate of about 62 percent. Figure 4-2 provides a map of the LIS region showing the locations of the facilities surveyed.

During preparation of the draft DMMP in 2014-2015 it was recognized that (1) a significant volume of dredging work had occurred in the LIS region since 2009 including the work done in the wake of Hurricane Sandy, (2) that the 2010 report had not differentiated the types of dredged material in developing its dredging needs timeline, (3) that a number of FNPs, including many from NAN, and up-river/up-harbor segments of larger projects, did not have specific data on historical or projected dredging, and (4) that some FNPs with maintenance frequencies of less than 30 years did not have future projections that included recurring dredging actions. For these reasons the information gathered from the analysis of FNPs and the non-Corps facility survey was updated. Information for the FNPs was revised to reflect recent activities and currently proposed efforts. This mainly involved eliminating dredging completed from the projections, adding newly projected work to later years of the extended DMMP timeframe, and adjusting volume estimates as described below. For the non-Corps dredging work, large projects completed since 2009 were removed from the projections, and dredging center wide projections of demand were shifted over the revised 30-year period, as was recurring maintenance at those facilities reporting such needs in 2009.

Each FNP's history of improvement and maintenance was developed by examining various records including Congressional and Corps planning documents, archived dredging plans and specifications for contracts, annual reports of the Chief of Engineers and Assistant Secretary of the Army, and Corps NEPA documents. Where possible (because of detailed data) or necessary (because of different sediment types) FNPs were broken down into their individual waterway segments for analysis. Annual shoaling rates were developed based on the maintenance history of each project and segment. Recent project condition and after-dredge surveys, and the shoal volume estimates developed from them, were also examined. This information was used to adjust the annual shoaling rates developed from the historical record. Using this information dredging frequency estimates were made for each FNP. Overall, the 2105 update of dredging projections yielded a 30-year total dredging volume greater than the projections in either the 2009 dredging needs update study or the 2006 Preliminary Assessment, due principally to the increase in the number of projects for which data was available or developed, and a more thorough examination of projects with recurring maintenance needs.

Due to uncertainty with future budget priorities the 30-year DMMP planning horizon was divided into five-year increments beginning in 2015 and extending out to 2045. Anticipated dredging events and their volumes of dredged material were entered in this timeline. Where a FNP's anticipated maintenance frequency requirements resulted in multiple dredging events over the 30-year period those events were also added to the timeline. These were further divided by material type as described below. The summary of dredging needs over the timeline is shown in Table 4-1. The resulting 52.9 million CY over the 30-year period is significantly higher than the projections included in the Preliminary Assessment and the 2009 Dredging Needs Update, due to the addition of projects left out of the prior projections and the re-evaluated dredging frequencies. The detailed histories and projections for each FNP are described in subsequent formulation sections that present the analysis for each dredging center and project.

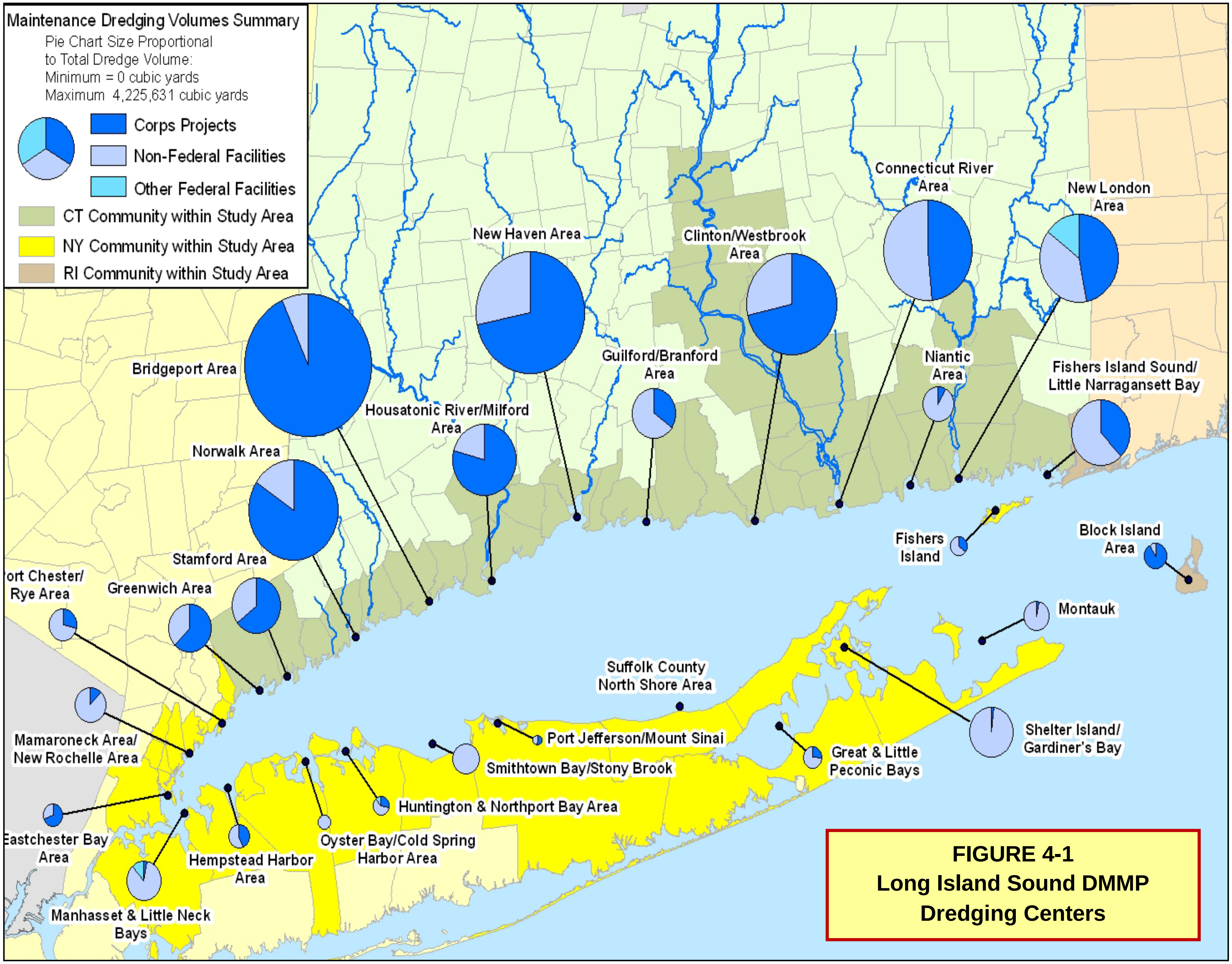


FIGURE 4-1
Long Island Sound DMMP
Dredging Centers

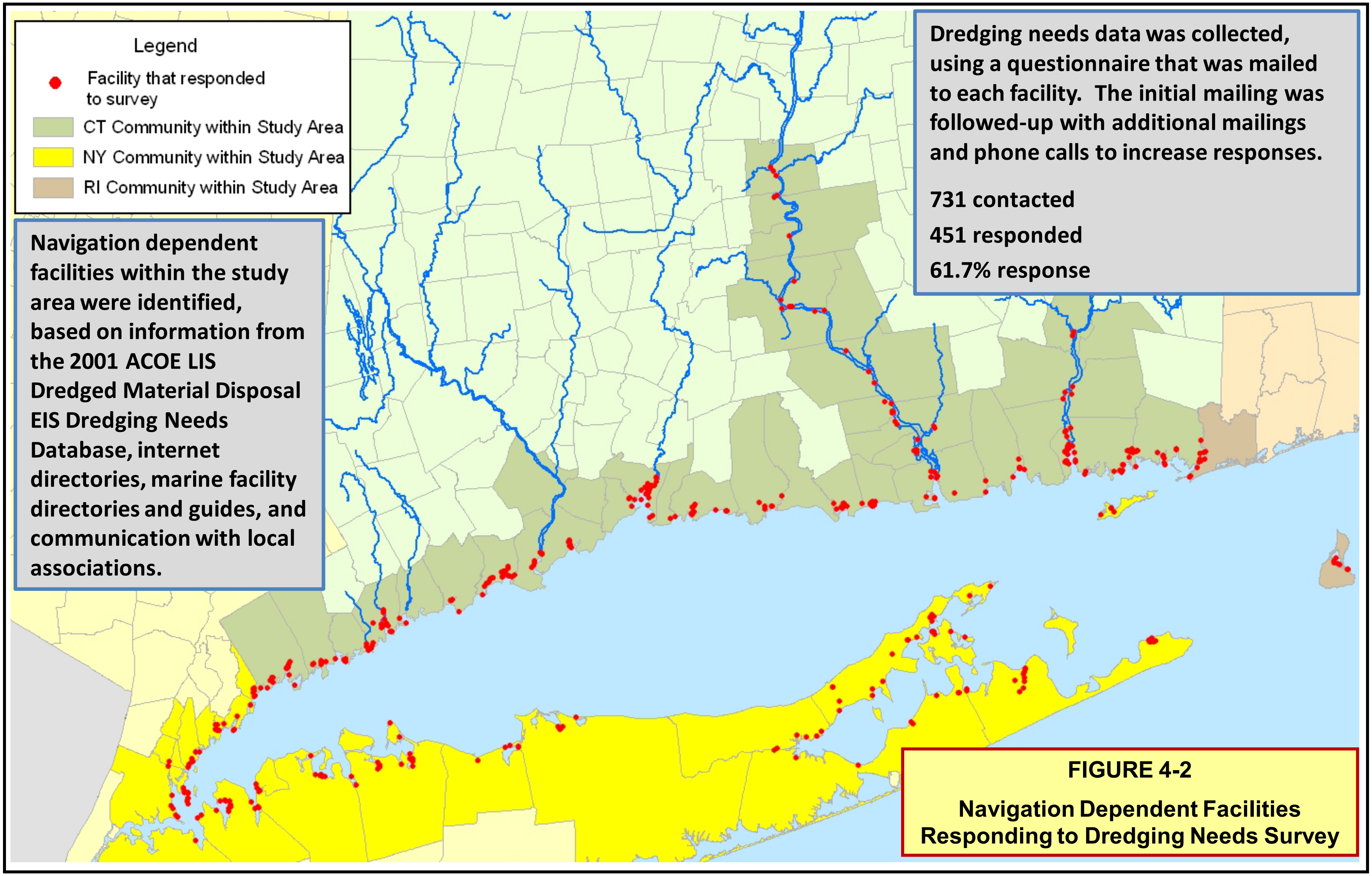


FIGURE 4-2

Navigation Dependent Facilities Responding to Dredging Needs Survey

Table 4-1 - Summary of All Potential Future Dredging Center Activity in the Long Island Sound Region

Dredging Center	Material Type	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045	Total CY
Block Island RI Dredging Center	Suitable Sand	100,000	82,000	43,000	58,000	58,000	43,000	384,000
	Suitable Fine	2,200	0	0	0	0	0	2,200
Fisher's Island NY Dredging Cent.	Suitable Fine	28,300	8,300	16,200	4,100	4,200	4,100	65,200
Fisher's Island Sound and Little Narragansett Bay Dredging Center	Suitable Sand	0	37,500	0	19,900	0	19,900	77,300
	Suitable Fine	148,800	712,400	36,400	36,400	35,500	584,000	1,553,500
New London CT Dredging Center	Suitable Fine	567,900	390,100	1,716,900	95,500	90,300	2,992,800	5,853,500
	Unsuitable	50,000	0	30,900	0	0	0	80,900
Niantic CT Dredging Center	Suitable Sand	83,000	15,000	2,600	12,100	5,000	5,000	122,700
	Suitable Fine	88,200	265,000	2,900	11,600	5,000	5,000	377,700
Connecticut River CT Dredging Center	Suitable Sand	169,800	1,235,500	96,200	1,577,700	76,100	129,300	3,284,600
	Suitable Fine	1,081,000	227,400	365,600	96,200	65,600	699,300	2,535,100
Clinton-Westbrook CT Dredging Center	Suitable Sand	39,300	14,300	35,700	35,700	1,983,700	35,700	2,144,400
	Suitable Fine	190,200	112,400	189,200	215,900	81,700	108,400	897,800
Guilford-Branford CT Dredging Center	Suitable Sand	0	0	6,800	0	6,800	0	13,600
	Suitable Fine	395,300	195,500	112,600	0	251,000	71,500	1,025,900
New Haven CT Dredging Center	Unsuitable	0	0	0	0	418,600	0	418,600
	Suitable Fine	577,600	7,181,800	481,300	993,200	187,300	1,016,200	10,437,400
Housatonic-Milford CT Area Dredging Center	Suitable Sand	833,400	35,700	201,800	15,300	201,800	117,300	1,405,300
	Suitable Fine	80,500	114,900	27,700	58,400	20,700	153,300	455,500
Bridgeport CT Area Dredging Center	Suitable Sand	0	18,400	0	0	0	16,700	35,100
	Suitable Fine	2,658,100	780,100	27,500	27,500	37,500	58,200	3,588,900
	Unsuitable	1,379,800	88,000	0	0	0	0	1,467,800
Norwalk CT Area Dredging Center	Suitable Fine	121,600	443,300	653,400	222,300	37,500	232,800	1,710,900
	Unsuitable	0	20,000	0	20,000	0	20,000	60,000

Dredging Center	Material Type	2015-2020	2021-2025	2026-30	2031-35	2036-40	2040-45	Total CY
Stamford CT Area Dredging Center	Suitable Sand	0	34,300	0	0	0	0	34,300
	Suitable Fine	174,600	84,400	20,000	506,000	30,000	30,000	845,000
	Unsuitable	0	0	0	144,600	0	0	144,600
Greenwich CT Area Dredging Center	Suitable Fine	190,900	47,800	19,500	19,400	83,800	5,100	366,500
	Unsuitable	296,400	22,800	7,500	7,400	86,700	5,100	425,900
Port Chester-Rye NY Area Dredging Center	Suitable Fine	147,900	23,000	12,000	13,000	12,000	80,500	288,400
	Unsuitable	199,600	0	0	0	0	166,400	366,000
Mamaroneck-New Rochelle NY	Suitable Fine	141,000	191,900	33,000	98,400	53,000	118,400	635,700
Eastchester Bay NY Area Dredging Center	Suitable Fine	13,800	1,800	7,100	7,200	112,400	900	143,200
	Unsuitable	0	286,300	0	0	0	0	286,300
Little Neck & Manhasset Bays DC	Suitable Fine	128,700	884,600	50,200	50,200	83,100	347,200	1,544,000
Hempstead Harbor NY Area Dredging Center	Suitable Sand	19,600	7,100	4,600	4,600	4,600	4,600	45,300
	Suitable Fine	19,700	7,200	191,600	4,700	4,700	4,600	232,300
	Unsuitable	14,300	0	0	19,600	0	19,600	53,500
Oyster Bay - Cold Springs Harbor	Suitable Sand	4,600	10,400	1,600	1,600	4,000	4,000	26,000
	Suitable Fine	6,800	15,500	2,300	2,300	5,900	6,000	39,000
Huntington and Northport Bays NY Dredging Center	Suitable Sand	3,040,200	64,200	51,500	37,600	36,600	76,000	3,306,100
	Suitable Fine	32,800	46,600	36,300	22,400	18,600	57,900	214,600
Smithtown Bay – Stony Brook Harbor NY	Suitable Sand	393,800	121,800	116,600	116,600	119,600	116,800	985,200
	Suitable Fine	70,300	2,300	1,000	1,000	1,800	1,000	77,400
Port Jefferson - Mount Sinai NY	Suitable Sand	41,600	31,800	31,800	31,800	31,700	31,900	200,600
Suffolk County Northeast Shore	Suitable Sand	10,100	10,300	69,100	10,200	10,200	64,700	174,600
Great and Little Peconic Bays NY Dredging Center	Suitable Sand	212,800	211,900	210,600	210,700	213,700	213,600	1,273,200
	Suitable Fine	141,800	141,300	140,400	140,400	155,700	142,400	862,100
Shelter Island - Gardiners Bay NY Dredging Center	Suitable Sand	334,000	295,400	229,100	219,100	147,000	150,200	1,374,900
	Suitable Fine	81,000	73,900	54,800	54,800	36,700	36,800	337,900
Montauk NY Dredging Center	Suitable Sand	164,000	89,200	89,100	89,200	89,100	89,200	609,800
TOTAL ALL DREDGING	All Materials	14,475,300	14,683,400	5,426,400	5,312,600	4,907,200	8,085,400	52,890,300
TOTAL SUITABLE SAND		5,446,200	2,314,800	1,190,100	2,440,100	2,987,900	1,117,900	15,497,000
TOTAL SUITABLE FINE		7,089,000	11,951,500	4,197,900	2,680,900	1,414,000	6,756,400	34,089,700
TOTAL UNSUITABLE		1,940,100	417,100	38,400	191,600	505,300	211,100	3,303,600

4.8 Harbor Sediment Characterization

In order to determine which placement alternatives may be practicable for any project dredging action the character of the dredged material must be defined. On a project basis this is done though a three-tiered evaluation. The historical and current commercial and non-commercial uses of the harbor, shoreline, adjacent upland and watershed are considered, along with any prior sediment testing history and record of chemical spills, in order to develop a plan for sediment sampling and testing. Sampling and testing of the sediment for physical and chemical parameters is undertaken to determine whether and to what extent contaminants are present and whether and in what proportions the material is gravel, sand, silt, or clay. Should contaminants of concern be identified, and depending on the disposal options under consideration, the material may also go through biological testing, including bioassays (toxicity testing) to determine the survivability of different types of test organisms exposed to the sediment relative to control and reference sediments, and bioaccumulation testing to determine whether there is uptake of contaminants from the sediments into the tissues of different types of test organisms exposed to the sediment relative to control and reference sediments. Based on all of the results assessments would be made of the potential impacts to the environment and human health from the placement of these sediments. Further if concerns do exist the material may be barred from certain disposal options or uses, or the agencies may require that certain management measures be followed during construction to isolate the material from the marine environment (containment, treatment, sequential dredging, or capping).

For purposes of the DMMP, dredged material in LIS was characterized in one of three types as shown in Table 4-2: (1) clean sand, (2) fine grained material suitable for unconfined open-water placement, and (3) material unsuitable for unconfined open-water placement. The classifications, as displayed below, were used to help match dredged material from specific projects and dredging centers to practicable placement options.

Testing of dredged sediments in New England harbors by the Corps began in the late 1960s. The earliest testing in LIS was at New Haven Harbor in 1970. Since that time nearly all FNPs in the LIS region have been tested at least once and many of the larger ports have been sampled a number of times. For FNPs the sampling and testing history was examined to make assumptions on the future dredged material quality from each harbor.

In Connecticut only one FNP has no testing history (Duck Island Harbor of Refuge). In New York only two FNPs have no testing history available (Northport Harbor and Echo Bay). For those harbors, testing data from non-Federal permit projects and more subjective characterizations from pre-testing era work (report descriptions such as “mud” or “sand”) were relied on. The history and determinations are described in detail in each of the separate FNP and dredging center formulation sections that follow. Section 3.5.1 describes in detail the procedures and methods for dredged material sampling and testing under USACE/EPA regulatory implementation guidelines.

Table 4-2 – Dredged Material Types	
Sand	Clean Sand: Coarse material with 65 to 85 percent coarser than #200 standard sieve depending on the use (placement) proposed. Up to 15-20 percent fines on the beach. Up to 35 percent fines in nearshore bars/berm. All sand materials in the LIS region have historically been determined suitable for open water placement
Suitable Fine	Material with a significant portion (>35 percent) finer than #200 standard Sieve. Silty sands, Silt and Clay.
Unsuitable	Fine-grained material determined by chemical and biological testing to be unsuitable for unconfined open-water placement.
Mixed	Material of mixed classes not differentiated by testing or not separable during dredging. In terms of matching placement suitability mixed materials are treated as suitable fine-grained materials.
Typical disposal/placement options for these types of materials will be described in detail later. Material types in subsequent tables are color-coded as indicated.	

4.9 Alternatives Considered

The purpose of this section of the report is to review all relevant and feasible management alternatives for meeting the Federal and Planning Objectives while taking into consideration the Planning Opportunities and Constraints discussed above. The preliminary alternatives considered include no action, source control, various placement and beneficial uses of suitable materials, and treatment of unsuitable materials. Combinations of these alternatives may also be feasible for meeting the Federal and Planning Objectives. For example, combining contaminant source control with the development of a regional beneficial use plan may provide a more cost effective alternative by making more material available for coastal resiliency uses.

As part of this DMMP effort a wide range of alternatives were studied over the past eight years. Reports detailing these efforts, the processes used, and the resulting inventories of placement and beneficial use alternatives, are contained in the several Technical Supporting Documents (TSDs) included on the compact disk accompanying this report. The TSDs describe in detail the results of alternative placement site inventories and evaluations that were conducted over the years following the public scoping effort and before preparation of the draft DMMP/PEIS. Each of these studies, which were scoped with the assistance of the Federal and State Project Development Team, involved outreach to state and local officials to help identify potential placement and processing sites and methods, contacting owners or managers of those lands and facilities to determine the interest in receiving dredged materials, and site conditions/uses that may limit or preclude placement or use, and other factors affecting potential use. The TSDs covering alternatives identification and analysis are as follows:

TSD #5 – Upland Beneficial Use, and Sediment De-watering Site Inventory Phase 1
TSD #6 – Follow-on Characterization of Small Site Management Alternatives for Potential Non-Federal Project Consideration
TSD #7 – Upland Beneficial Use, and Sediment De-watering Site Inventory Phase 2

TSD #8 – Investigation of Potential Nearshore Berm Sites for Placement of Dredged Materials
TSD #9 – Investigation of Potential Containment Sites for Placement of Dredged Materials

The intent of conducting these investigations, also discussed in Appendix G, was to prepare as comprehensive a list as possible of potential dredged material placement and processing alternatives for evaluation on a programmatic level (not project specific), with the understanding that future dredging projects would need to conduct their own site specific investigations when they were funded for pre-construction studies or implementation. It must be noted that responses varied between the states, with state and local agencies and officials in Connecticut more willing to participate in the identification and investigation of potential sites.

4.9.1 No Action Alternative

The No Action Alternative permits the existing conditions of the problems associated with the management of dredged material presented under the Statement of the Problem to persist without implementing a long-term management strategy (i.e., the LIS DMMP). Inclusion of the No Action alternative is required under the National Environmental Policy Act (NEPA), and is used as a baseline alternative for the evaluation and comparison of all alternatives developed.

In this case, the No Action Alternative is defined as the failure to implement a plan for dredged material management in Long Island Sound (i.e., the DMMP recommendations would not be implemented). Without implementation of the DMMP recommendations for long-term management, the current process of dredging and dredged material placement would continue to take place on a project-by-project basis without agreement by Federal and State partners to pursue practicable alternatives that would reduce future reliance on open water placement. Furthermore, the conditions under which the long-term use of the CLDS and WLDS were designated (40 C.F. R. 228.15(b)(4)(vi)(D)) would not be met, and use of the sites would expire for MPRSA-regulated projects as currently scheduled on April 30, 2016. Expiration of the WLDS and CLDS placement sites would mean that open-water placement in LIS of MPRSA-regulated projects could occur only at the two USACE-selected sites (CSDS and NLDS) until they expire on December 23, 2016 (as per §116 of the Consolidated Appropriations Act. For FY2012 (2012 CAA), P.L. 112-74.

It is impossible to know with certainty how the dredging needs of LIS harbors and waterways would be met if there were no designated open-water placement sites for MPRSA-regulated projects within LIS. However, several scenarios might reasonably be considered. First, placement site authorization for private projects involving less than 25,000 CY of material would simply continue to be evaluated on a project-specific basis under CWA Section 404. Second, for projects subject to MPRSA §106(f) (i.e., either Federal projects of any size or private projects involving greater than 25,000 CY of material), project proponents would need to pursue one or more of the following courses of action:

(1) Use an alternative open water site, either inside or outside of Long Island Sound, that has been "selected" by the USACE under MPRSA §103. Such a site would need to be one that has not been in use since the 1992 amendments to MPRSA, or has not had its second five-year period of use expire. EPA would need to concur with the Selection.

(2) Use an existing EPA-designated (MPRSA §102) open water site outside of the Long Island Sound study area (e.g., RISDS, HARS). EPA would need to concur with any placement at such sites.
(3) Delay dredging until an EPA designation (MPRSA §102) of a different open water placement site within Long Island Sound.
(4) Cancel the proposed dredging projects.
(5) Study, design, authorize, construct, and use practicable and cost-effective land-based, in-harbor, nearshore, beneficial use, or CDF placement/use alternatives. The type of alternative would vary depending on the size of the project, nature of the material to be dredged, any additional non-navigation benefits of the alternative, non-Federal sponsorship and funding, and the level of Federal participation warranted.

To understand the impacts of the No Action alternative it is important to appreciate the relationship between the sediment types found in the region and unavailability of the open water placement option over the next 30 years. Over the next 30 years it is estimated that regional stakeholders will need to manage 52.9 million cubic yards (MCY) of dredged material. That volume of material is composed of three classification types as shown in Tables 4-3 and 4-4 below: fine sediments (34.1 MCY or 64.5%); sand (15.5 MCY or 29.3%); and unsuitable material (3.3 MCY or 6.2%). Suitability (or unsuitability) is determined by the dredged material sampling and testing procedures specified by the Corps and the USEPA under the requirements of both the CWA and the MPRSA. MPRSA, as described earlier, applies to ocean waters seaward of the territorial sea baseline, and to the waters of LIS for Federal actions, and for non-Federal dredging projects in excess of 25,000 CY. Under MPRSA, and its implementing regulations, and USEPA policies, only materials deemed suitable may be placed unconfined in open water. Materials deemed unsuitable may not be placed in MPRSA regulated waters whether confined or otherwise managed or not.

Table 4-3 - Distribution of Regional 30-Year Volume by Material Type

Material Type	30-Year Volume (CY)	% of Total Demand
Sand	15,497,000	29.3%
Suitable Fine-Grained and Mixed Materials	34,089,700	64.6%
Unsuitable Material	3,303,600	6.3%
Total 30-Year Volume Demand	52,890,300	100%
Distribution of Regional 30-Year Volume by Source		
USACE FNPs	33,241,600	63.1%
Other Federal Agency Projects	751,400	1.4%
Non-Federal Activities	18,727,300	35.5%

Table 4-4 – Distribution of Dredged Material by Type and State				
Material Type	Volumes in CY	Rhode Island	Connecticut	New York
Total Demand	52,890,300	386,200	39,362,800	13,141,300
Sand	15,497,000	99.4%	18.1%	60.5%
Suitable Fines (including mixed) Materials	34,089,700	0.6%	75.3%	33.8%
Unsuitable	3,303,600	0.0%	6.6%	5.4%

Further complicating the matter, many harbors, and particularly the larger ports, generate more than one classification of dredged material. In these cases reducing reliance on open water placement requires segmenting the project where possible to best target placement by material type. These analyses are project specific and are presented in Chapter 5 where each individual harbor and project is examined and the present and potential alternatives are presented.

It is assumed that the No Action alternative will not impact the management of unsuitable material, as that classification currently precludes the open water placement option. These materials require containment in Confined Disposal Facilities (CDFs), Confined Aquatic Disposal (CAD) cells, upland landfills, or treatment and processing to remove contaminants before final placement or use.

It is also assumed that management of sand, which is desirable from a beneficial use perspective (e.g. beachfill,), will not be significantly impacted by closure of the four open water placement areas. While it may still be possible for a Federal Base Plan for sandy material to specify open water placement, the actual placement of sand in open water is considered unlikely, since recent experience throughout New England and elsewhere is that state and local governments are almost always willing to pay the additional cost of hauling sand to more distant placement sites for beach nourishment purposes.

Long term management options for fine-grained material that would otherwise be suitable for unconfined open water placement in LIS poses the biggest challenge to the region. Fine-grained material testing as suitable for open water placement composes 65% of the total projected volume, and open water placement has long been the most economically practicable option for this class of material. Other placement methods are seen as more costly than open water placement, as they require land for placement and processing, the double or triple handling of the dredged material, fees for upland placement, or site preparation and construction for containment facilities or habitat creation sites. Without available designated open-water placement sites for MPRSA-regulated projects in Long Island Sound, or practicable cost-effective alternative placement sites and methods, maintenance and periodic improvement of the region's waterways requiring the dredging of suitable fine-grained materials would become more costly and uncertain. Increased costs in times of limited or fixed budgets will reduce the amount of maintenance dredging that can be accomplished from year to year, and could make both public and private improvement projects less likely to be implemented. Less frequent maintenance dredging will led to more significant shoaling between maintenance events, which will result in shallower controlling depth in channels. Navigation will become constrained, difficult, and risky for all classes of vessels. The No Action alternative will result in economic hardship for the maritime interests in the LIS region at all levels. Each of the five possible future scenarios, some of which would require Federal actions independent of a DMMP, are discussed briefly below, and are presented in detail in the PEIS (Section 5.2).

USACE Selection of Alternative Open Water Sites Within or Outside of Long Island Sound: A site Selection would be an “action” undertaken by the USACE with the concurrence of EPA. USACE-selected sites are limited to no more than two five-year periods. Over the long term, this approach would require the USACE to select a series of multiple sites as needed around Long Island Sound, or elsewhere, thus spreading any environmental effects throughout and possibly outside Long Island Sound. This would be contrary to the MPRSA principle that favors the continued use of otherwise acceptable historically used sites so as to geographically limit impacts. Under this approach, after 2016 none of the four currently active sites could be selected for future use as their designations (CLDS and WLDS) or their five-year extended period (2012 CAA) would have expired. USACE would then be required to Select historic sites that had not been used for two five-year periods after the 1992 amendments, or select sites that had not previously been used for dredged material placement. To serve the dredging needs of a 30-year planning horizon multiple sites would need to be selected for different areas of LIS to replace the current placement capacity. To the extent that the use of any of the currently active sites would be environmentally preferable to the use of other sites, this No Action scenario would preclude that outcome. To the extent that any newly selected sites were more distant from the current sites, transport costs and project durations would increase. Any significant increase in costs could render some projects infeasible. Although of less significance, it is also worth noting that increased haul distances could also increase any risk of mishap in transit, increase project air emissions, and require greater fuel consumption. Finally, over the long term, this approach would pose the additional administrative difficulty of requiring multiple site selection studies.

Use an Existing EPA-Designated Open Water Site Outside of Long Island Sound: Currently existing EPA-designated placement sites located outside of the Long Island Sound study area are all too far away from most of the dredging projects located within Long Island Sound to constitute reasonable alternatives. Reliance on such sites would greatly increase the cost, duration, and transportation safety risk of dredged material placement projects from Long Island Sound. This would likely render the vast majority of dredging projects prohibitively expensive to conduct. As a result, needed dredging would not be able to take place, with significant impact on waterway use, transportation methods and cost, and the regional economy.

Delay Dredging until EPA Designation of a Different Open Water Placement Site Within Long Island Sound: This No Action scenario presents uncertainty. Further a site designation would be an “action” undertaken by EPA. An ongoing effort by EPA and the state of Connecticut is examining possible designation (MPRSA §102) of a placement site in eastern Long Island Sound. The current CSDS and NLDS are among those being considered for designation. Use of sites in eastern LIS involves a significant increase in transport distance, project duration, and cost for many projects in central and western LIS. Many projects would likely become prohibitively expensive and infeasible. It is not yet known when EPA’s site designation process will be completed, or what the results may be. No other site designation evaluation process is currently under consideration for Long Island Sound.

Cancel Proposed Dredging Projects: Simply cancelling dredging projects that would otherwise take place would have adverse effects on navigational safety and marine-dependent commerce. It could also have adverse environmental ramifications if shoaling in the navigation channels resulted in more marine accidents and spills and forced the use of other transportation methods (such as truck and rail) to move products, which could result in greater air emissions, traffic congestion, and other impacts from increased truck traffic on the region's highways and roads. In the case of small harbor maintenance and improvement projects that are still within the size range regulated under MPRSA §106(f) such projects would be either scaled-back, deferred or cancelled. Over time, as maintaining and improving waterfront access became more costly, land use patterns can shift toward less water-dependent uses, reducing public access to the waterfront.

Implement Practicable Cost-Effective Alternatives to Open Water Placement in LIS: These potential No Action scenarios have short- and long-term limitations. These could include such placement options as upland (landfill or brownfield placement), in-harbor placement such as CAD cells (in the case of unsuitable materials) or port fill, CDF construction, or beneficial uses such as beach or nearshore bar nourishment (in the case of sandy materials), or habitat enhancement/creation such as marsh fill. Both New York and Connecticut have some limited land-based, in-harbor, nearshore, beneficial use, or CDF placement/use alternatives sites which could provide some capacity for dredged material placement, but these sites would not be reasonable, long-term alternatives to open-water placement for all but a minor portion of LIS's projected dredging needs. Although both state and Federal agencies are pursuing alternatives to open-water placement, the potential areas identified either do not have sufficient long-term dredged material placement capacity or are not cost-effective or practicable alternatives to open-water placement. The only potential exception could be a large scale regional CDF, which would require a significant public investment to implement. While most of these types of alternatives would accommodate only a fraction of the placement need, they could in sum if implemented contribute towards reducing the need for open water placement in LIS.

For example, the estimated capacity of beneficial use and other land-based alternatives evaluated in this PEIS that could potentially accept suitable material that could otherwise go offshore is about 25 million CY; the currently available capacity at the four active open water placement sites in Long Island Sound is 248 million CY. For comparison, the total dredging needs of USACE and other Federal navigation projects within the Long Island Sound study area is projected to be more than 34 million CY, and total Federal and non-Federal needs are 52.7 million CY. Even if all potential non open water alternatives were fully implemented, regardless of cost or practicability, their capacity is less than half the projected capacity needed. Complete reliance on land-based or beneficial use placement is not possible.

Summary: The existing conditions and potential at the any proposed alternative sites would first need to be assessed. Implementation of non-open water alternatives would likely raise the cost and increase the duration of dredging projects, possibly rendering some infeasible. Though, some beneficial uses may be otherwise justifiable based on non-navigation benefits. For all types of impacts associated with the selection or designation of new open water sites within Long Island Sound the level of impact would vary depending on the number of sites selected and the volume of dredged material placed. Impacts associated with the various types of land-based and beneficial use placement alternatives are described in detail in the PEIS (Section 5.2).

4.9.2 Source Control and Reduction

Sediments deposited in regional estuaries, harbors, navigational channels and coastal waters are composed of materials of both upland and littoral origins. Sediment movement and deposition as a result of littoral processes from wave and current action along the coast contributes to the accretion of sediment in harbor channels on the open coast. Sediment deposited in inner harbor areas and at the mouths of regional rivers and streams, such as the Connecticut, Thames, and Housatonic, is a result primarily from watershed runoff during storms. Since an appreciable fraction of the sediment discharged from upland areas has the potential to be contaminated, reduction and containment of sediment and contaminant sources within the watersheds are, therefore, a potentially effective option for the management of sediment within the Study Area for this project.

Pursuant to 40 CFR §228.15(b)(4)(vi)(C), the LIS DMMP is intended to help achieve the "goal of reducing or eliminating the disposal of dredged material in Long Island Sound." It is often less expensive to prevent sediment from entering waterways than it is to remove or treat the sediment once it is in the waterway. The following section summarizes a report from US EPA Region 1, prepared in cooperation with the states of Connecticut and New York (Appendix E), outlining programs that may reduce the volume of sediment carried by storm water and runoff from the states within the watershed (New York, Connecticut, Massachusetts, New Hampshire and Vermont) into LIS. In addition, because other pollutants are often attached to the sediments that are carried into LIS harbors and navigation channels, these programs may also result in a reduction of contaminants entering the LIS watershed.

MS4 Program: Pursuant to 40 CFR 122.26(b)(8), a municipal separate storm sewer system (MS4) is described as:

> *"a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): (i) owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act (CWA) that discharges to waters of the United States; (ii) designed or used for collecting or conveying storm water; (iii) which is not a combined sewer; and (iv) which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."*

To prevent harmful pollutants, including sediment, from being washed or dumped into an MS4, operators must obtain a National Pollutant Discharge Elimination System (NPDES) permit and develop a storm water management program. Each operator of a regulated MS4 is required to develop and implement a storm water management program to reduce the contamination of storm water runoff and prohibit illicit discharges.

Compliance with MS4 permits can help reduce the frequency of dredging and reduce contaminant levels in harbor sediments. The more municipalities can comply with the stormwater regulations required by the Clean Water Act, the less sediment will run off into local rivers and streams, and eventually, harbors and navigation channels, which reduces the need for, or at least the frequency of dredging. Reducing stormwater discharges also reduces contaminant loads, since rainwater picks up oil, fertilizer, and other pollutants as it runs off into waterways, so it reduces the likelihood that the sediments that need to be dredged will need treatment before disposal. But reducing sediment loads in stormwater doesn't eliminate the natural erosion and sedimentation that occurs in riverine systems, so there will always be a need for dredging even if stormwater is controlled to the maximum extent.

Storm Water General Permits and Additional State Regulation: Storm water runoff is generated when precipitation from rain and snowmelt flows over land or impervious surfaces (paved streets, parking lots, and building rooftops) and does not percolate into the ground. As the runoff flows over the land or impervious surfaces, it accumulates debris, chemicals, sediment, or other pollutants that could adversely affect water quality if the runoff is discharged untreated.

Nonpoint Source Pollution: Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, or discrete storm water conveyances, comes from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground waters.

Impaired Waters and Total Maximum Daily Loads (TMDL): Under section 303(d) of the CWA, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters. A Total Maximum Daily Load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards.

Literature Related to Best Management Practices (BMPs): BMP is a term used to describe a type of water pollution control. Storm water BMPs are techniques, measures or structural controls used to manage the quantity and improve the quality of storm water runoff. The goal is to reduce or eliminate the contaminants collected by storm water as it moves into streams and rivers in order to maintain the water quality, which protects both the environment and the public.

Once pollutants are present in a water body, altering its physical makeup and habitat, it is much more difficult and expensive to restore the water body. Therefore, the use of BMPs that seek to prevent or reduce contaminant input to the waterway can mitigate the necessity for restoration. Storm water pollution has two main components: the increased volume and rate of runoff from water resistant surfaces, such as roads and parking lots, and the amount of pollutants in the runoff. Both components are directly related to urban development.

Watershed Management Program: Many watershed organizations, local governments, tribes, state and Federal agencies are now working together to manage water quality at the watershed level using a step-by-step watershed management process developed by the EPA. The process uses a series of cooperative actions to characterize existing conditions, identify and prioritize problems, define management objectives, develop protection or remediation strategies, and implement and adapt selected actions as necessary.

A watershed plan documents the expected outcomes of this process and serves as the action agenda for managing water quality at the watershed level. Developing a watershed plan helps better manage water resources. A watershed plan is a document that describes the water resource assessments, management strategies, and restoration and protective actions – and expected outcomes of those actions – for a particular drainage basin or watershed. A plan will guide the efforts to protect and restore water quality.

Harbor Management Plans: The Coastal Zone Management Act (CZMA) encourages states/tribes to preserve, protect, develop, and where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. A unique feature of this law is that participation by states/tribes is voluntary. To encourage states/tribes to participate, the act makes federal financial assistance available to any coastal state, tribe, or territory, including those on the Great Lakes, that is willing to develop and implement a comprehensive coastal management program.

In its reauthorization of the CZMA in 1990, Congress identified nonpoint source pollution as a major factor in the continuing degradation of coastal waters. Congress also recognized that effective solutions to nonpoint source pollution could be implemented at the state/tribe and local levels. Therefore, in the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), Congress added Section 6217, which calls upon states/tribes with federally approved coastal zone management programs to develop and implement coastal nonpoint pollution control programs. The Section 6217 program is administered at the federal level jointly by EPA and NOAA.

Low Impact Development (LID) Examples: LID is an approach to land development (or re-development) that works with nature to manage storm water as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat storm water as a resource rather than a waste product. There are many practices that adhere to these principles such as bio-retention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions. New York and Connecticut have each provided one recent example of LID in their respective states.

Beneficial Use of Dredged Material: Much of the sediment dredged from ports, harbors and waterways is placed of in open water, confined disposal facilities, upland facilities, used as beach nourishment or nearshore placement. Other beneficial uses for dredged material include habitat restoration and creation, additional beach nourishment, and applied uses resulting from biotechnology. These uses require amendment of the dredged material but include the following applications: aquaculture, agriculture, mine reclamation, and industrial and commercial development. There are several hurdles to planning and using dredged material beneficially. The primary issue in the LIS region is that the material that shoals in the harbors consist of predominantly silt and clay material that is too fine to be used as beach nourishment.

Source Reduction in Dredging Permits: Some states require review of dredging applications to include examining opportunities for sediment source reduction. In addition, increased storm events due to climate change may increase shoaling and movement of sediment resulting in possible safety issues and the need for dredging.

Road Sand: Salts, gravel, sand, and other materials are applied to highways and roads to reduce the amount of ice during winter storm events, or for driver safety in slippery road conditions. Salts lower the melting point of ice, allowing roadways to stay free of ice buildup during cold periods. Sand and gravel increase traction on the road, making it safer to travel. Both salt and sand/gravel have the potential to enter the watershed through runoff from the roadway and improper storage of the materials at private, municipal, or state facilities. Some states have enacted policies to prevent road sand/gravel from entering the watershed and becoming a potential source of sediment.

4.9.3 Open Water Placement Alternatives in Long Island Sound

Open-water placement is the placement of dredged material in rivers, lakes, estuaries, or oceans via pipeline or released from hopper dredges or barges. Open water sites are generally large (one or more square nautical miles) sites in deep water of sufficient capacity to accommodate placement for many decades. Sites are generally either in deep-water with hydrologic conditions that support containment of placed materials, or are higher energy sites chosen to disperse materials. Such placement may also involve appropriate management actions or controls such as capping at sites where containment is desired. The potential for environmental impacts is affected by the physical behavior of the open-water discharge. Physical behavior is dependent on the type of dredging and disposal operation used, the nature of the material (physical characteristics), and the hydrodynamics of the disposal site. Dredged material can be placed in open-water sites using direct pipeline discharge, direct mechanical placement, or release from hopper dredges or scows. In LIS placement at open water sites is accomplished by either bottom release scow or by hopper dredge.

Open water placement of dredged material occurs either in waters subject to regulation under the CWA or in waters regulated under MPRSA. As described earlier, the CWA applies to territorial sea waters out to the three mile limit, while MPRSA applies to waters seaward of the baseline of the territorial sea. Where these areas overlap between the baseline and the three mile limit, the Federal government applies MPRSA requirements. The waters of LIS, though inside the baseline, are also subject to MPRSA requirements as a result of the Ambro amendments to MPRSA. Open water placement sites for dredged material in MPRSA regulated waters are either 'designated' by EPA for long-term use, or are 'selected' by the USACE (with EPA's concurrence) for temporary use (up to two five-year periods). Open water placement sites in CWA regulated waters are 'specified' by the USACE subject to EPA concurrence. All of the open water placements sites in LIS are subject to the MPRSA requirements for designation or selection.

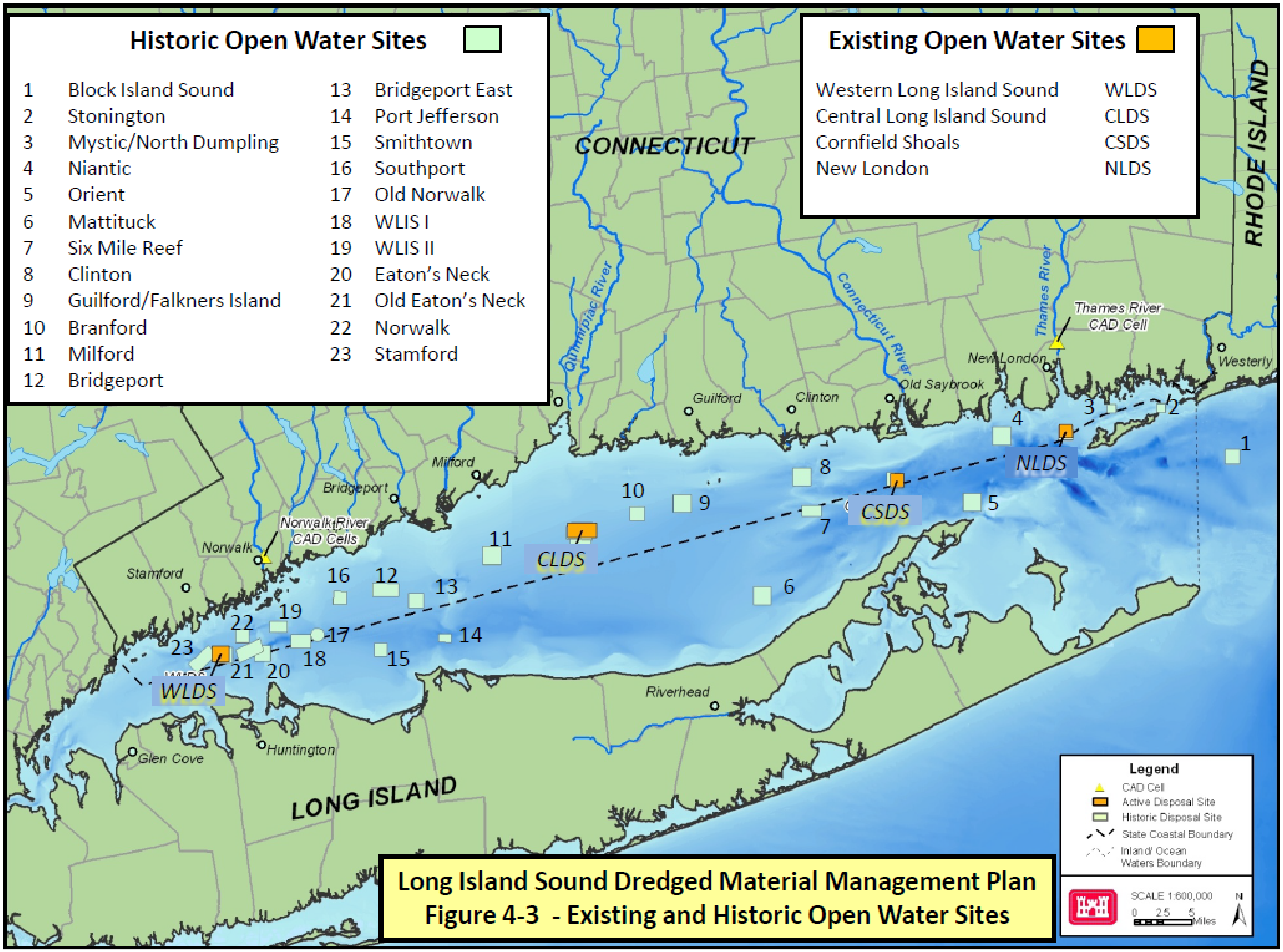
As LIS is regulated under MPRSA for all Federal projects and non-Federal projects of more than 25,000 CY, EPA does not permit capping of unsuitable materials in open water. However Connecticut often requires sequential dredging and placement from different harbor segments and projects, or a group of projects from multiple harbors as a means to accomplish capping of less suitable material with more suitable material. Location of dredged material mounds at open water placement sites has also be ongoing for many years, particularly at CLDS where mounds have been sited to form a large ring berm around a central bowl as a form of lateral containment for future placement activities.

The one dispersive open water placement site (CSDS) receives materials from the Connecticut River area which are typically sandy or more suitable silty materials for which dispersion off site in not a concern. At the NLDS mound placement is targeted to avoid the area of the site crossed by the main shipping approach lane into New London Harbor. Site capacities at all sites in LIS use a final mound top elevation of 18 meters below MLLW to avoid any conflicts with shipping.

Current Open Water Placement Sites: There are four currently active open water placement sites in Long Island Sound. These are the Western Long Island Sound Disposal Site (WLDS), the Central Long Island Sound Disposal Site (CLDS), the Cornfield Shoals Disposal Site (CSDS), and the New London Disposal Site (NLDS). The interstate and Federal-state agreements that led to this DMMP specified a goal to reduce or eliminate open water disposal in LIS. However, as several decades of research and monitoring through the DAMOS program have shown no significant impact from the unconfined open water placement of dredged material meeting the requirements and criteria of established sampling and testing protocols, these sites must be considered as alternatives for dredged material placement. The location of these sites is shown in Figure 4-3.

Western Long Island Sound Disposal Site (WLDS): The Western Long Island Sound Disposal Site (WLDS, historically referred to as WLIS) is one of four regional dredged material placement sites located in the waters of Long Island Sound. WLDS is situated approximately 3.1 miles (2.8 nautical miles, or 5.1 km) south of Long Neck Point, Noroton, Connecticut and two nautical miles north of Lloyd Point, New York, in water depths of 79 to 118 feet (24 to 36 meters). The site is entirely within Connecticut state waters, approximately 200 yards north of the New York state border. The WLDS was officially opened in 1982 as the single active dredged material placement site in the Western Long Island Sound region, and was designated by US EPA in its 2005 rulemaking. The WLDS is a 1.2 by 1.3 nautical mile rectangular area, about 1.56 nmi^2 in size (5.29 km^2). The site is centered at 40° 59.406' N, 73° 28.624' W (North American Datum 1983 - NAD 83). There have been three slightly different configurations of this site at this location under the names WLIS, WLIS-III and WLDS.

WLDS collectively received over 1.9 million cubic yards of material from 1982 to 2014 with an average annual placed volume of 85,000 cubic yards. The site is positioned over an east-to-west depression on the seafloor with a relatively flat bottom. The sediments at the site are heterogeneous, with clay-silt in the northeast corner and a mixture of sand-silt-clay in the center and southeast corner. Long term use of the site is subject to the completion and findings of this DMMP and subsequent modification of the rule. Long term use of the site requires EPA to remove the sunset restrictions included in the current rule. The site has a remaining long-term capacity of at least 20 million CY.



Long Island Sound Dredged Material Management Plan
Figure 4-3 - Existing and Historic Open Water Sites

<u>Central Long Island Sound Disposal Site (CLDS)</u>: The Central Long Island Sound Disposal Site (CLDS, historically referred to as CLIS) is located approximately 6.5 miles (10.4 km) south of South End Point, East Haven, Connecticut. This general location has been utilized for the placement of sediments dredged from surrounding harbors for at least 60 years, with well-documented placement locations since 1973 (ENSR 1998). The current boundary of CLDS is a rectangle measuring 2.2 by 1.1 nautical miles (4.1 by 2.0 km) with a total area of 2.39 square nautical miles (8.2 km^2); the center of the rectangle has coordinates 41° 08.95' N and 72° 52.95' W (NAD 83). This site has had at least six different configurations at this location and was formerly known as the New Haven Disposal Site.

The CLDS site occupies a wide, flat area of the seafloor in a depositional area with a gradually sloping bottom. The sediments at the site are predominately uniform clayey silt with an area of mixed sand and silt. These sediments are typical of those found in fine-grained depositional environments of the central basin of LIS. The CLDS has been one of the most active dredged material placement sites in New England. Overall, CLDS has received close to 14 million cubic yards since 1941. CLDS receives the largest volumes from FNPs in New Haven and Bridgeport harbors, with numerous smaller harbors in Connecticut and New York contributing to the total placement volume.

The CLDS was designated under MPRSA by EPA in its 2005 rulemaking. Long term use of the site is subject to the completion and findings of this DMMP and subsequent modification of the rule. Long term use of the site requires EPA to remove the sunset restrictions included in the current rule. The site has a remaining long-term capacity of at least 20 million CY.

<u>Cornfield Shoals Disposal Site (CSDS)</u>: The Cornfield Shoals Disposal Site (CSDS) is situated in eastern LIS, approximately 3.7 miles (6 km) southeast of Cornfield Point in Old Saybrook, Connecticut and centered at 41° 12.686' N, 72° 21.491' W (NAD 83). CSDS occupies 1.32 square miles (3.43 km^2) and is defined as a 1.15 mile square (1 nautical mile square or 1.85 x 1.85 km) area on the seafloor. CSDS is one of two open water dredged material placement sites managed by USACE NAE as a non-depositional site (CSDS is managed as a dispersive placement site and Buzzards Bay Disposal Site in Massachusetts is managed as a semi-dispersive site); all other DAMOS placement sites are containment sites where it is expected that the dredged material remains on site as a stable deposit. There have been at least three slightly different configurations of this site at this general location, each one nautical mile square (1.32 square statute miles in size).

The site is located at a sandy shoal seaward of the mouth of the Connecticut River where strong bottom currents tend to disperse material deposited there. The predominant topographic features are a smooth, sandy bottom and bed forms oriented in an east-west direction. This site would not be appropriate for use for depositing dredged materials that require long-term containment as part of their management. In the recent past, only clean sandy material and some clean silty material for which containment in mounds was determined unnecessary have been approved for disposal at CSDS. Since 1982, 1.3 million cubic yards of dredged material (mostly sand) have been disposed at this site.

The CSDS was constructively selected under MPRSA Section 103(b) authority by the USACE from its continued use by Ambro-triggering projects (all Federal projects and non-Federal projects greater than 25,000 CY) after the 1992 Water Resources Development Act (PL 102-

580, 106 Stat. 4797, 31 October 1992) amendments to MPRSA, which limited the continued use of selected sites to two non-consecutive five-year periods. A site selection document was prepared 2 March 2003 for the maintenance dredging of the North Cove FNP, but due to funding, actual work did not begin until 8 November 2008. Section 116 of the Consolidated Appropriations Act for Fiscal Year 2012 (PL 112-74, 125 Stat. 786) provided that the site would remain open for five years after enactment (23 December 2011) in order to provide time for completing this DMMP and for USEPA to complete their investigation to determine if a ocean placement site should be designated in eastern LIS.

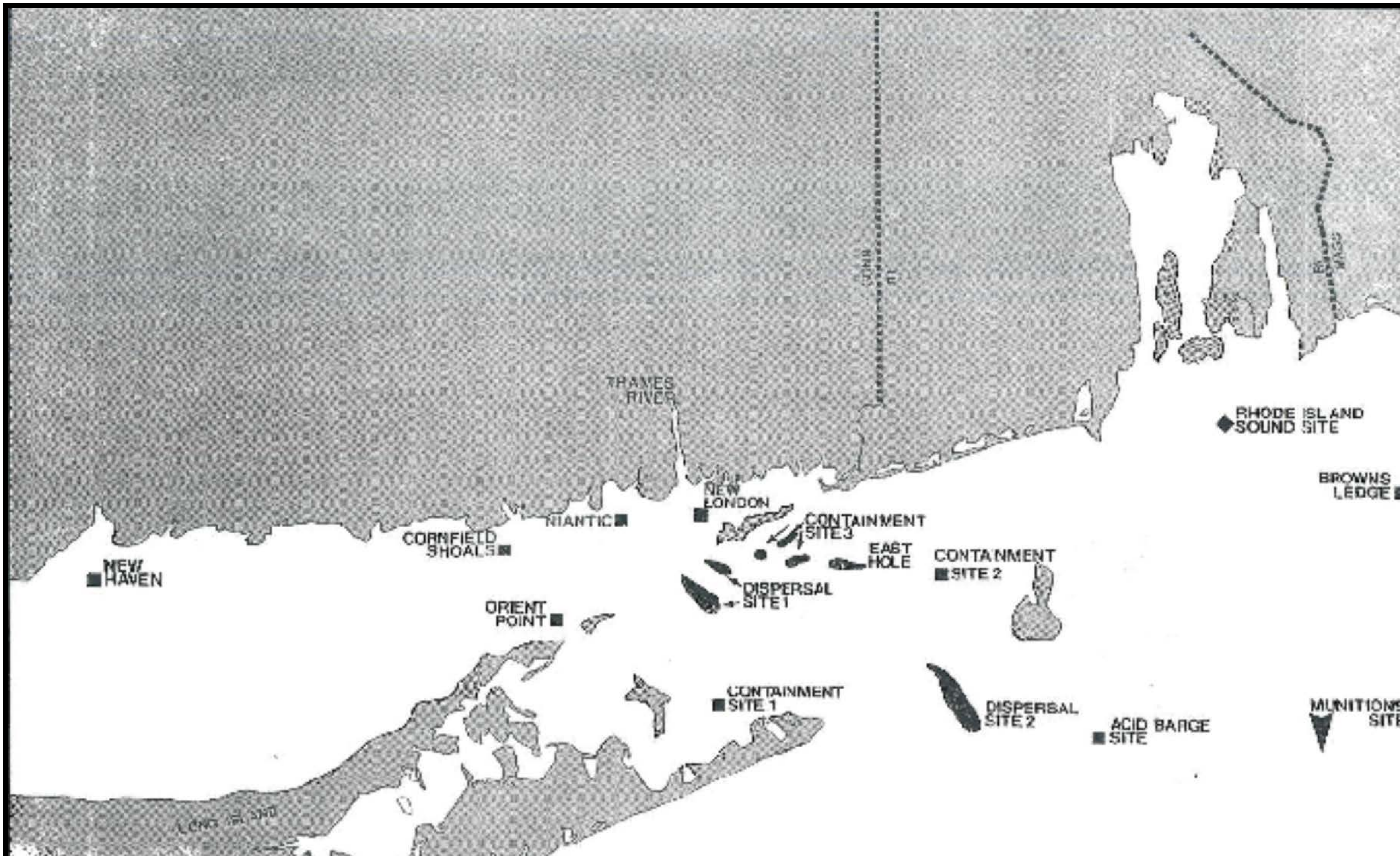
<u>New London Disposal Site (NLDS)</u>: The New London Disposal Site (NLDS) is an active open-water dredged material disposal site located 3.3 miles (5.4 km or 3.1 nautical miles) south of Eastern Point, Groton, Connecticut. NLDS is centered at 41º 16.306´ N, 72º 04.571´ W (NAD 83) and covers a 1.32 square mile (3.42 km^2) area of seafloor. Water depths range from 44 to 80 feet (13.4 m to 24.3 m) at its deepest point. The 1 square nautical mile site has received approximately 2.8 million cubic yards of dredged material since 1981. Currently, the NLDS is used for the unconfined placement of sediments determined suitable for open water placement. For projects not subject to MRPSA requirements (non-Federal projects of no more than 25,000 CY), subaqueous capping of sediments deemed unsuitable for unconfined open water disposal may also occur. There are currently 12 dredged material mounds located within the boundaries of NLDS that have been created and investigated since the late 1970s. However, this site was in used for dredged material placement for several decades before any studies began. In recent years, dredged material has been placed in depressions between the historic mounds to minimize lateral spread. Two important management boundaries bisect the NLDS: a 300 meter submarine transit corridor and the New York-Connecticut state boundary. The site has a remaining capacity of approximately 7.8 million CY.

The NLDS was constructively selected under MPRSA Section 103(b) authority by the USACE from its continued use by Ambro-triggering projects after the 1992 Water Resources Development Act (PL 102-580, 106 Stat. 4797, 31 October 1992) amendments to MPRSA which limited the continued use of selected sites to two non-consecutive five-year periods. Section 116 of the Consolidated Appropriations Act for Fiscal Year 2012 (P.L. 112-74, 125 Stat. 786) provided that the NLDS would remain open for five years after enactment (23 December 2011) to provide time for completion of this DMMP and for USEPA to complete their investigation to determine if an ocean placement site should be designated in eastern LIS.

<u>Historic Open Water Placement Sites</u>: Prior to the 1970s there were significantly more open water placement sites in use in LIS. Some of these were specific to a single harbor. Others were used by several harbors, and still others were more regional in nature. As the impacts of open water placement were called into question and studied through the 1970s and 1980s, a number of sites were proposed as alternatives to those in use. Some of these were briefly used (WLIS-I), others never used (Six Mile Reef), and still others replaced some of those previously used sites (WLDS). Other sites were shifted in location (CSDS) or had their boundaries modified as studies were completed and use levels changed (CLDS). The 22 'historic' sites not now considered 'active' either through EPA designation (CLDS and WLDS) or USACE selection (CSDS and NLDS) include the following (from west to east). The locations of these sites are shown in Figure 4-3, and listed in Table 4-5.

Table 4-5 **Historic Open Water Placement Sites in Long Island Sound (Not Currently Active)**			
Placement Site Name	Dimensions (Nautical Miles)	Area in Square Statute Miles	Last Used
Stamford Disposal Site (DS)	2 NM x 1 NM	2.73	Until 1977
Norwalk Disposal Site and South Norwalk Disposal Site	1 NM Square	2.28	Until 1977
Eaton's Neck Disposal Site	2.2 NM x 1.9 NM	4.84	Until 1977
Eaton's Neck East Disposal Site	1.21 NM X 1.15 NM	3.42	1977-1980
Western Long Island Sound II	Rectangle	2.42	Unknown
Western Long Island Sound I	1 NM x 1.5 NM	3.51	Never Used
Norwalk Dumping Ground	1 NM Diameter Circle	1.81	Unknown
Southport Disposal Site	1 NM Square	1.32	Until 1977
Smithtown Bay Disposal Site	1 NM Square	1.32	Until 1977
Bridgeport Disposal Site	2 NM x 1 NM	2.64	Until 1977
Bridgeport East Disposal Site	1.08 NM Square	1.54	Never Used
Port Jefferson Disposal Site	1 NM x 0.6 NM	1.37	Until 1977
Milford Disposal Site	1.35 NM Square	2.4	Unknown
Branford Disposal Site	1.08 NM Square	1.54	Unknown
Guilford or Falkner Island (DS)	1.35 NM Square	2.4	Unknown
Mattituck Disposal Site	1.35 NM Square	2.4	Unknown
Clinton Disposal Site	1.35 NM Square	2.4	Unknown
Six-Mile Reef Disposal Site	1.5 NM x 0.8 NM	1.6	Never Used
Orient Disposal Site	1.35 NM Square	2.4	Unknown
Niantic Disposal Site	1.35 NM Square	2.4	1971
Mystic (North Dumpling) Disposal Site	0.67 NM Square	0.6	1957
Stonington Disposal Site	0.67 NM Square	0.6	1957

Other Open Water Sites Studied: Since the 1970s a number of other open water sites have been considered for use or designation in eastern LIS and western Block Island Sound. Most of these were investigated as part of the U.S. Navy's deepening projects for New London Harbor and the lower Thames River as larger classes of submarines (Trident and Seawolf) were scheduled to enter the fleet. Figure 4-4 is a map of the Navy's alternative dredged material placement study sites from the 23 March 1979 Trident study which includes a number of alternative sites in Block Island Sound.



Long Island Sound Dredged Material Management Plan
Figure 4-4 - U.S. Navy Site Alternatives – 1979 Trident EIS

4.9.4 Ocean Placement Alternatives Outside of Long Island Sound

Dredged sediments from LIS projects have been transported longer distances to ocean sites outside of the Sound in the recent past. The two sites that are most often raised as alternatives for projects in LIS are the Rhode Island Sound and Historic Area Remediation sites, located off the Rhode Island and New Jersey coasts, respectively.

Rhode Island Sound Disposal Site: The Rhode Island Sound Disposal Site (RISDS) was designated in December 2004. This one square nautical mile site lies approximately 11 nautical miles south of the entrance to Narragansett Bay, Rhode Island, and 31 nautical miles (36 statute miles) east of Race Rock at the east entrance to LIS. It is situated within the separation zone for the Narragansett Bay inbound and outbound traffic lanes and lies within a topographic depression, with water depths from 118 to 128 feet. Prior to its site designation, it was selected for temporary use and was employed during 2003-2004 for placement of over 4.5 million cubic yards of sediment from the maintenance dredging of the Providence River FNP. A total of 5.3 million cubic yards of dredged material has been placed at this site since 2003. The site has an estimated remaining capacity of 16.5 to 19.5 million CY.

Historic Area Remediation Site: The Historic Area Remediation Site (HARS) is the site of the former Mud Dump site, as well as the area surrounding the Mud Dump site. The Mud Dump had been the Port of New York and New Jersey area's principal ocean placement site for many decades. The HARS was designated by US EPA on a final basis at 40 CFR 228.15(d)(6). The HARS is located approximately 5.3 nautical miles east of Sandy Hook, NJ and 7.7 nautical miles south of Rockaway, NY (on the south shore of Long Island). The site has an area of approximately 15.7 square nautical miles, of which a 9.0 square nautical miles area (the Priority Remediation Area – PRA) receives dredged material with the goal of covering the PRA with at least one meter of dredged material as a cap for earlier deposits. The HARS is only available for placement of material that meets the definition of remediation material for this ocean site. Material for Remediation is defined in the HARS final rule preamble as "uncontaminated dredged material (i.e., dredged material that meets current Category I Standards and will not cause significant undesirable effects including through bioaccumulation)." Suitability of material for placement at the HARS requires an analysis similar to that normally applied under testing protocols for the MPRSA sites, with application of specific limits for test results applied to the risk analysis. The HARS evaluation methodology was adopted for that site to address its unique designation and management keyed to remedy past use for placement of more highly contaminated material. From 2009 through 2014, approximately 16,026,500 CY of material was placed at the HARS from Federal, state and city projects as well as from private enterprises.

Outer Continental Shelf Site: Use of a site on the outer continental shelf for placement of dredged material from LIS has been suggested by different parties over the past few decades. While no specific such site was identified or evaluated as part of this study, in order to provide a cost comparison with sites within and closer to LIS, a representative location was picked on the top of the continental slope southeast of Montauk Point east of the head of Block Canyon from which to measure distances for determining hauling costs.

The locations of these three sites is shown in Figure 4-5. Distances from selected Federal projects to various open water and ocean placement sites within and outside of LIS are shown in Table 4-6 below for comparison.

Table 4-6 - Comparative Distances to Alternative Placement Sites (in Statute Miles)						
Eastern and Central LIS	**To Central LIS DS**	**To Cornfield Shoals DS**	**To Niantic Bay DS**	**To New London DS**	**To Rhode Island Sound DS**	**To Representative Outer Continental Shelf Site (Block Canyon)**
New London Harbor at the Railroad Bridge	48.3	20.7	10.7	6.4	45.1	102.9
New Haven Harbor at the Upper Maneuvering Basin	10.6	34.1	43.5	49.0	85.9	145.7
Central and Western LIS	**To HARS**	**To Western LIS DS**	**To Central LIS DS**	**To New London DS**	**To Rhode Island Sound DS**	**To Outer Continental Shelf Site (Block Canyon)**
Bridgeport Harbor at the I-95 Bridge	86.4	21.4	20.1	63.0	99.8	157.1
US Merchant Marine Academy at Kings Point NY	43.9	20.8	53.6	96.6	133	190.8

4.9.5 Alternatives to Open Water Placement in General

A series of investigations were conducted to identify alternatives to open water placement for dredged material. These studies were conducted in phases to identify sites, provide a detailed review of site capacity and availability, and provide an inventory of sites that, while too limited in capacity for use by Federal projects, may provide useful for consideration by smaller private dredging projects. Review of the 102 sites identified as part of the final site inventory yielded 90 potential upland and beneficial use sites with capacity for dredged materials. Of these 90 sites identified with capacity, 44 are located in Connecticut, 40 in New York, five in Rhode Island, and one in Pennsylvania (Table 4-7). The majority of sites in Connecticut are beaches, with a total of 37 municipal, county, or state beaches, and Federal Shore Protection projects. Similarly, beaches comprise the greatest number of sites in New York, with a total of 25 municipal, county, or state beaches, and Federal Shore Protection Project sites with capacity for dredged material. Rhode Island has a total of three beaches with capacity. Four landfill sites, two in Connecticut and two in New York, were identified as potential locations. Two habitat (marsh) restoration sites that will accept dredged material were identified in New York. The dewatering sites identified in both CT and NY were classified as currently feasible or potentially feasible in the future. Of these viable sites, Connecticut has two locations that are currently feasible and three with potential in the future. New York also has two locations that are currently feasible, with seven additional sites that are potentially feasible in the future. Rhode Island has two sites that are potentially viable in the future.

Table 4-7 - Number of Alternative Placement Sites from Initial Screening by State

Category	CT	NY	RI	PA	Total
Beach – Municipal/County	17	10	2	0	29
Beach – State	2	8	0	0	10
Beach – Federal. Shore Protection	18	7	1	0	26
Mine	0	0	0	1	1
Landfill	2	2	0	0	4
Redevelopment/Construction	0	2	0	0	2
Habitat Restoration	0	2	0	0	2
Dewatering					
Currently Feasible	2	2	0	0	4
Potentially Feasible in the Future	3	7	2	0	12
Totals	44	40	5	1	90

In response to Hurricane Sandy the USACE has completed the North Atlantic Coast Comprehensive Study, published in January 2015. The report provides an identification of vulnerable areas in several states in the northeast, including Connecticut and New York, along with measures that might be appropriate in each area to mitigate the impacts of such storms. The assessment is very general but could assist the states in identifying locations where they would support and participate in the beneficial use of dredged material to provide shore protection and other coastal resiliency benefits.

4.9.6 Beach Nourishment Sites (Direct Beach Placement)

Beach nourishment is an increasingly valued beneficial use for sandy dredged material. Increasing the width and elevation of beaches can provide hurricane and storm damage reduction benefits for beachfront and backshore properties. The material can be placed directly on the beach by hydraulic cutterhead pipeline dredge, pumped ashore from a hopper dredge with pump-off capability, or trucked to the beach from a stockpile at another location. This is different from nearshore bar nourishment, which places material in the littoral zone offshore of the beach to build a feeder bar which will move material onto the beach. The beach nourishment volumes at the various sites evaluated for this DMMP as presented below provide both a conservative, low-end estimate calculated using the equilibrium beach profile theory methodology, and a higher estimate that adds 35% more material to account for nourishment capacity on the upper beach face and dune area. The volumes are considered recurring, as the beachfill will last only as long as erosion removes material back to the beginning beach profile, and renourishment then becomes necessary. These beaches thus need sand placement on a recurring cycle to offset losses to erosion.

Beach Nourishment from LIS Projects in the New England District: The FNPs along the Connecticut coast yield sandy beach compatible materials, primarily from entrance channel maintenance. Projects in recent years include material from the Little Narragansett Bay entrance channel which was pumped onto Sandy Point Island; material from the lower Housatonic River channel which was placed nearshore off Hammonasset State Park; the mid-channel reaches material from Guilford Harbor which were placed on adjacent beaches; material from the entrance to Clinton Harbor which was placed at Hammonasset State Beach; and material from the entrance to Patchogue River which has been placed on the adjacent Grove Beach Point. In recent years the State of Connecticut has been funding the additional cost involved with more distant or more costly beach and nearshore placement. These practices are expected to continue in the future and even expand as concern with coastal erosion and sea level rise grows. In the wake of Hurricane Sandy, the western Connecticut coast is under study for solutions to coastal damage and erosion with a view to developing effective regional strategies to enhance coastal resiliency.

Beach Nourishment in the New York District: Along the Atlantic Coast and North Shore of Long Island, sand removed from Federal channels, marinas, and other areas, is typically replaced on the adjacent beaches or behind bulkheads. Beach nourishment is a cost-effective practice with the added benefit of increasing beaches' ability to withstand storms. In some cases, nourishment can provide quantifiable hurricane and storm damage reduction benefits that can make any additional costs for such placement eligible for Federal participation under other USACE authorities such as Section 204 and Section 103. Sand dredged as part of Operations and Maintenance (O&M) of Federal Channels along Long Island from Brooklyn to Montauk Point is typically placed along adjacent shorelines as beach nourishment. From 2009 through 2014, a total of 720,110 CY of sand was dredged and placed on adjacent beaches as part of O&M work. In addition, approximately 2,751,000 CY of material were removed from Federal channels along the South Shore of Long Island in 2013 and 2014 as part of the USACE Flood Control and Coastal Emergencies Act, PL 84-99, emergency response to the deposition and shoaling of sand as a result of Hurricane Sandy. Under PL 84-99, the USACE is authorized to repair previously constructed projects, enabling both the dredging of the channels to remove excess sand and the placement of this sand on adjacent beaches for coastal storm risk reduction.

Beach Nourishment in the LIS DMMP Context: In general, most of the beaches considered in this study have capacity for clean, beach-compatible sand. Total site capacity for beaches in the study area ranges between 4.9 and 6.0 million CY. Three of the beaches in this study were not considered viable sites for beach nourishment. Two of these are surrounded by fringing marsh and the placement of beach nourishment would adversely impact the resource (Sites 443-Guilford Point Beach and 470-Chaffinch Island Park). The third, Site 81 (Breakwater Park Beach), is located up-drift of a jetty that protects a navigation channel into Mattituck Harbor, and the existing beach has already filled the jetty to entrapment. In this case, the USACE NAN considered alternatives to artificially bypass sediment from the up-drift side of the harbor to the down-drift side, and dredged the channel entrance in 2014 to accomplish that under the Corps Section 111 (River and Harbor Act of 1968, as amended) authority. As such, nourishment was not considered for that site in the immediate future. The locations of the various beach nourishment alternatives considered are shown in Figure 4-7.

The potential for various beaches throughout the study area to accept dredged material was determined using information gathered during the site visits, interviews with site operators, and review of aerial photography. Although present day conditions on the sites did not always suggest an immediate need for beach nourishment, capacity calculations were performed where feasible, to mitigate against future erosion and storm damages, and to enhance the recreational resource. The general approach for the beaches was to estimate a nourishment volume per unit beach length (CY/linear feet of beach), and to multiply this by the length of beach to be nourished. The unit nourishment volume was obtained by superimposing a basic beach nourishment template on the existing beach profile, and then computing the area between the two beach profiles. It was assumed that the profiles of the existing beaches could be described using equilibrium beach profile theory. This assumption was necessary since actual field surveys of beach conditions at each site were not available. The beaches and their capacities are listed below in Table 4-8 and locations are shown in Figure 4-6.

Table 4-8 - Beach Nourishment Sites with Capacities for Direct and Nearshore Placement

Site ID	State	Town	Site Name	Nourishment Volume (CY)	
				Nearshore Bar	On-Beach
323	CT	Bridgeport	Seaside Beach	130,900	176,700
433	CT	Fairfield	Southport Beach	15,700	21,200
434	CT	Fairfield	Sasco Hill Beach	6,300	8,500
436	CT	Fairfield	Jennings Beach	24,700	33,400
443	CT	Guilford	Guilford Point Beach	Not considered viable	
365	CT	Madison	Hammonasset State Park	562,700*	562,700*
457	CT	Madison	East Wharf Beach	4,300	5,700
364	CT	Milford	Silver Sands State Park	21,000	28,400
444	CT	Milford	Gulf Beach	5,300	7,100
451	CT	Milford	Woodmont Shore Beach	500	700
337	CT	New Haven	Lighthouse Point Park Beach	3,400	4,600
320	CT	Norwalk	Calf Pasture Beach	31,900	43,000
441	CT	Stamford	Cove Island Beach	20,100	27,100

Site ID	State	Town	Site Name	Nearshore Volume CY)	On-Beach Volume CY)
442	CT	Stamford	Cummings Park Beach	38,700	52,200
450	CT	Stratford	Short Beach	54,400	73,500
447	CT	West Haven	Prospect Beach	63,100	85,300
438	CT	Westport	Burial Hill Beach	2,800	3,700
440	CT	Westport	Compo Beach	65,800	88,800
449	CT	Westport	Sherwood Island State Park	71,400	96,300
181	NY	Bronx	Orchard Beach	33,750*	33,750*
453	NY	E. Hampton	Lake Montauk Harbor	400,000*	400,000*
63	NY	Huntington	Asharoken Beach	600,000*	600,000*
456	NY	Oyster Bay	Bayville	77,200	104,200
454-E	NY	Southold	Hashamomuck Cove CR-48	162,800	219,800
454-W	NY	Southold	Kenney's Beach	50,700	68,500
455/82	NY	Mattituck	Mattituck / Bailie's Beach	100,000*	100,000*
384	RI	Westerly	Misquamicut State Beach	32,000	43,200
367	CT	East Lyme	Rocky Neck State Park	10,400	14,100
368	CT	Groton	Bluff Point State Park	131,200	177,100
171	NY	Wading Rvr	Wildwood State Park	164,100	221,500
173	NY	E. Hampton	Hither Hills State Park	319,600	431,500
177	NY	E. Hampton	Shadmoor State Park	20,100	27,100
178	NY	E. Hampton	Camp Hero State Park	76,900	103,800
179	NY	E. Hampton	Montauk Point State Park	147,300	198,900
170	NY	Kings Park	Sunken Meadow State Park	160,600	216,800
180	NY	Orient	Orient Beach State Park	119,900	161,800
445	NY	Riverhead	Jamesport State Park	120,000	161,900
446	NY	E. Hampton	Theodore Roosevelt Cty Pk	427,400	577,000
343	CT	Clinton	Clinton Town Beach	1,200	1,600
474	CT	Fairfield	South Pine Creek Beach	100	100
339	CT	Guilford	Jacobs Beach	6,400	8,600
470	CT	Guilford	Chaffinch Island Park	Not considered viable	
459	CT	New Haven	Fort Nathan Hale Park	5,300	7,100
348	CT	Old Lyme	White Sands Beach	1,700	2,300
480	CT	Stonington	DuBois Beach	3,300	4,500
467	CT	Stratford	Long Beach	23,200	31,300
468	CT	Stratford	Russian Beach	31,700	42,800
325	CT	West Haven	Altschuler Beach	51,200	69,100
327	CT	West Haven	Bradley Point Park	11,600	15,600
329	CT	West Haven	Morse Beach	17,700	23,900
330	CT	West Haven	Oak Street Beach	17,700	23,900
331	CT	West Haven	Peck Beach	29,800	40,200
332	CT	West Haven	Sandy Point	27,700	37,400
333	CT	West Haven	Savin Rock	1,800	2,400
344	CT	Westbrook	Middle Beach	600	900

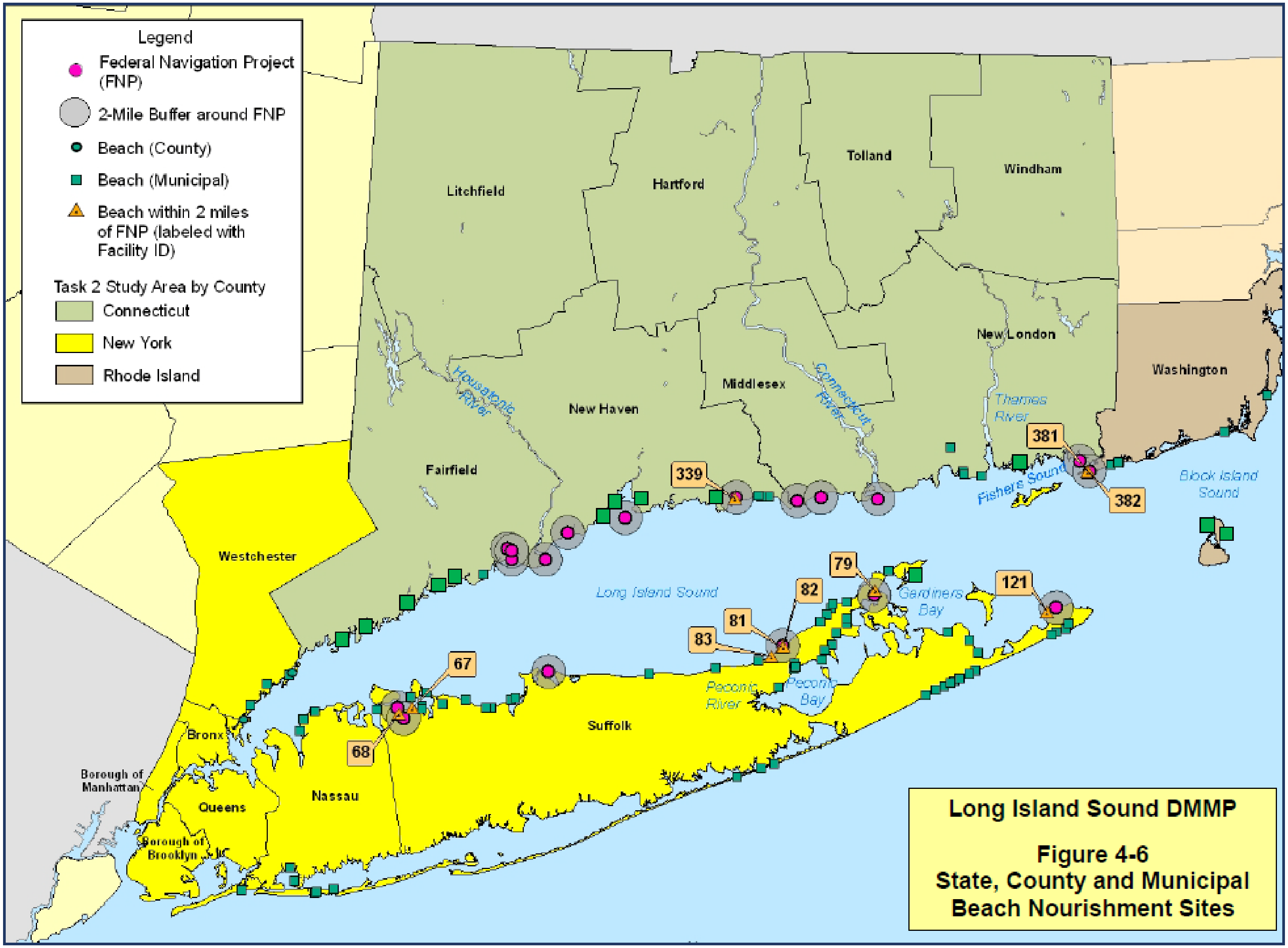
Site ID	State	Town	Site Name	Nearshore Volume CY)	On-Beach Volume CY)
345	CT	Westbrook	West Beach	42,200	57,000
121	NY	E. Hampton	Gin Beach	9,000	12,200
64	NY	Huntington	Hobart Beach	128,800	173,900
67	NY	Huntington	Crescent Beach Huntington	3,600	4,800
68	NY	Huntington	Gold Star Battalion Beach	2,400	3,200
81	NY	Mattituck	Breakwater Park Beach	Not considered viable	
111	NY	Shelter Isl.	Crescent Beach (Shelter Is)	23,900	32,200
76	NY	Southold	Southold Town Beach	23,200	31,300
79	NY	Southold	Gull Pond Beach	14,400	19,500
381	NY	Westerly	Watch Hill Beach	22,600	50,500
382	NY	Westerly	Napatree Point Beach	68,100	91,900
437	NY	Southold	Plum Island	41,600	56,100
			TOTAL	**4,935,500**	**6,068,550**
* Volume obtained from USACE or CTDEP Design Documents					

During the public review of the draft DMMP/PEIS a number of commenters suggested additional public and private beach areas in both Connecticut and New York that might benefit from receipt of sandy nourishment materials. The beaches cited in the DMMP/PEIS are those that were provided to the USACE through the surveys of state and local agencies that were conducted during the study. As specific projects come up in the future, proponents should contact state and local officials to determine what areas in addition to those described in the DMMP may at that time be appropriate for consideration as alternative placement sites.

4.9.7 Nearshore Bar Nourishment and Berm Placement

Natural beach systems typically include nearshore bars parallel to the beach which grow in size during the winter as sand is moved off the beach by more frequent high surf and storms, and grow smaller in the summer as some material is moved back up onto the beach. Sandy dredged material can be used to increase the volume of sand in the system by placement in nearshore bars or berms which then can nourish (or feed) the beach.

Constructed nearshore bars and berms are submerged, high-relief mounds, generally built parallel to the shoreline. They are commonly constructed of sandy sediment removed from a nearby dredging project. There are typically two types, feeder berms and stable berms. Feeder berms contain predominantly clean sand placed in the nearshore zone directly adjacent to a beach, and are transient features. The physical benefits of feeder berms include the introduction of new sediment to the littoral system, beach nourishment through onshore sediment transport, and a reduction in nearshore wave energy along with reduced shoreline erosion. Stable berms are generally longer-lasting features constructed in deeper water or low energy environments, where sediment transport is limited. These berms can be constructed with finer-grained material since the environment is not conducive to wave or current-induced sediment transport. The physical benefits of stable berms include reduced wave energy along the shoreline, lower shoreline erosion, and enhanced habitat for fisheries.



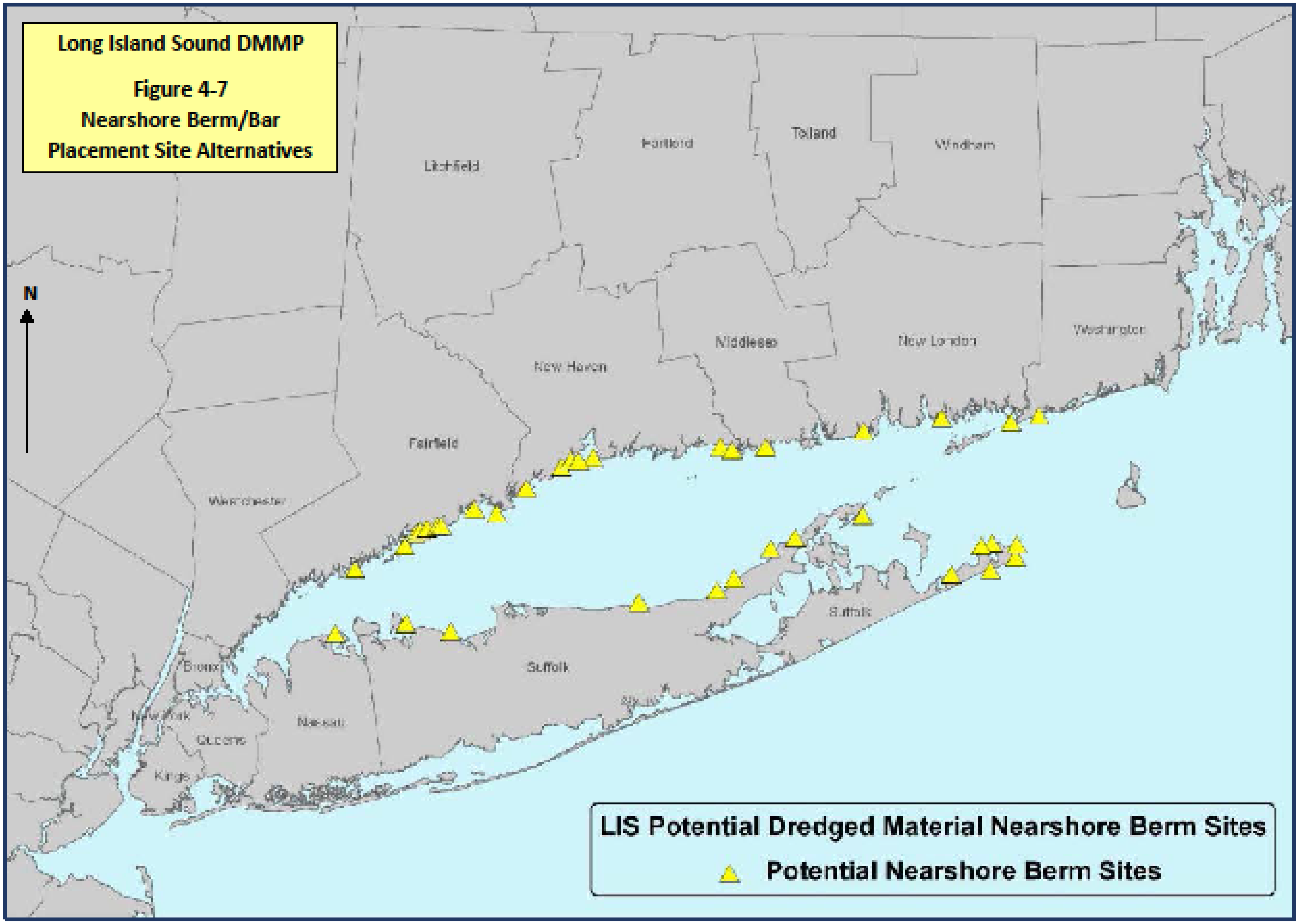
Long Island Sound DMMP

Figure 4-6
State, County and Municipal Beach Nourishment Sites

Nearshore berm construction is commonly used for the placement of dredged material. The technology offers an alternative to conventional open water placement or direct beach nourishment. Costs associated with nearshore berm construction are generally lower than hauling the dredged sediment to an offshore placement site, or in the case of clean beach-compatible material, less costly than pumping the sand directly onto the beach. With the added benefits that the berms can be designed to maintain sediment within the nearshore littoral drift system, attenuate wave energy, reduce shoreline erosion, and/or enhance aquatic habitat, this technology offers a viable alternative to conventional dredged material placement. Additionally, by linking the dredging activity with nearby beach needs through regional sediment management, a least-cost dredging and nearshore placement solution can often result in a beneficial use alternative.

Construction methods for nearshore berms include mechanical (clamshell or bucket dredge) and hydraulic (hopper or cutterhead dredge) options. Mechanical dredging involves placing dredged material in a bottom-release scow which is towed to the nearshore placement site. Once on location the dredged sediment is discharged into the water column to settle to the seafloor. Hydraulic dredging involves fluidizing sediments for pumping. Hopper dredges fluidize bottom sediments for pumping into their hoppers, and then discharge the sediment into the water column through doors or a split hull directly above the berm location. This technology works in much the same way as a bottom-release barge or scow used with mechanical dredging. Cutterhead dredges can also be used to hydraulically pump material to a nearshore berm site via pipeline, where the sediment is discharged into the water column directly above the desired berm location. However, the distances over which pipeline transport can be accomplished are often a limitation for hydraulic method applications. For smaller dredging projects and volumes a limit of two miles with one or more booster pumps in the discharge line is a typically accepted economical limit. For larger projects greater distances may be economical, with additional booster pumps of greater horsepower, and larger capacity pipelines. The location of the several nearshore alternatives are shown in Figure 4-7, with volumes provided in Table 4-9. The inventory of nearshore placement sites that survived the initial screening is provided below. Also listed separately are those beaches that were eliminated during initial screening due to their proximity to navigation channels, which were added back into the inventory either because they were sometimes used for placement, or were Federal shore protection projects that required periodic nourishment.

While the closer a bar or berm can be placed to the beach increases the likelihood of availability of that sand to move onto the beach, the type and size of equipment used can limit that distance by restricting the depth of water at the placement site. Hopper dredges and scows require sufficient depth to navigate, open their pocket doors, and deposit material, without grounding the vessel. With smaller dredging project that move only a few scow loads a day, placement can be timed with the tide to reduce the bar placement distance from the beach. But with larger project that require a continuous cycle of disposal throughout the tidal cycle, placement sites must be accessible at all stages of the tide, increasing distance from the beach.



Long Island Sound DMMP

Figure 4-7
Nearshore Berm/Bar
Placement Site Alternatives

Table 4-9 - Nearshore Bar/Berm Placement Sites				
Site ID	Site Name	Berm Length (Feet)	Berm Volume (CY)	Average Grain Size Classification
177	Shadmoor State Park	1,500	33,700	medium sand
178	Camp Hero State Park	3,700	84,300	cobble to coarse sand
179	Montauk Point State Park	5,800	131,100	cobble to coarse sand
121/446	Gin Beach & T. Roosevelt Cty Park	8,900	2 02,400	medium to fine sand
453	Lake Montauk Harbor	4,60	105,100	medium to fine sand
173	Hither Hills State Park	12,100	276,100	coarse sand
180	Orient Beach State Park	9,000	204,100	medium sand
454A	Hashamomuck Cove - Cty Rd #48	6,800	155,100	coarse sand
454B	Kenney's Beach	3,200	72,800	coarse sand
455 / 82	Mattituck Harbor / Bailie's Beach	1,500	35,100	medium sand
445	Jamesport State Park	5,700	129,600	medium to coarse sand
171	Wildwood State Park	8,700	197,800	coarse to medium sand
170	Sunken Meadow State Park	10,700	242,800	medium to coarse sand
63	Asharoken Beach	10,900	248,300	medium to fine sand
456	Bayville	4,200	96,200	medium sand
441	Cove Island Beach	1,200	28,200	coarse sand
320	Calf Pasture Beach	1,300	30,200	medium to coarse sand
440	Compo Beach	2,600	58,400	coarse sand
449	Sherwood Island State Park	4,600	105,900	coarse sand
438	Burial Hill Beach	600	12,700	coarse sand
433	Southport Beach	1,200	27,200	coarse sand
434	Sasco Hill Beach	900	20,100	coarse sand
323	Seaside Beach	6,300	143,100	medium sand
467	Long Beach	2,000	45,300	medium sand
364	Silver Sands State Park	1,100	25,400	fine sand
451	Woodmont Shore Beach	400	8,200	medium to coarse sand
447	Prospect Beach	2,400	55,000	medium sand
327	Bradley Point Park	9,400	214,700	medium sand
333	Savin Rock	See #327	See #327	N/A (no beach present)
330	Oak Street Beach	See #327	See #327	medium sand
337	Lighthouse Point Park Beach	2,400	55,600	medium sand
457	East Wharf Beach	400	8,700	coarse to medium sand
365	Hammonasset State Park	6,200	140,000	medium sand
NA	Grove Point Beach	2,800	62,800	medium sand
367	Rocky Neck State Park	2,100	48,600	medium sand
368	Bluff Point State Park	3,200	72,300	coarse sand
381/382	Watch Hill & Napatree Pt Beaches	6,800	154,900	medium to fine sand
384	Misquamicut State Beach	3,100	70,500	medium to fine sand

4.9.8 Confined Disposal Facilities

There are a number of different types of confined disposal facilities (CDFs), which are most often used to place dredged material that is unsuitable for beneficial use or open water placement, or where a nearby CDF location makes such placement economical compared to a longer haul to an open water site. Types of CDFs include diked upland CDFs, in-water CDFs (either island or along-shore sites), confined aquatic disposal (CAD) cells constructed beneath the seabed, confined open water sites (COW - existing seafloor pits and depressions). Cleaner dredged materials may also be temporarily stored at an in-water site and later moved to a final site such as when scows are used to place material at one location and then a hydraulic dredge is used to move it onto a beach, marsh, or other site. Each of these is discussed in more detail in the following sections.

<u>Confined Aquatic Disposal Cells and Confined Open Water Sites</u>: Confined aquatic disposal (CAD) is a placement method where dredged material (mainly those unsuitable for unconfined placement) are typically placed into a submerged depression or pit to isolate them from the environment. These can be pits created by past gravel mining operations, or cells that are constructed specifically for the placement of dredged material from a project. CAD cells can be filled via surface release or other controlled means (e.g., hydraulic offload or submerged diffuser). Lateral containment (i.e., the sides of the cell) is used to restrict movement of sediment from the CAD. The fill is then covered with clean sediments to form a cap layer that will isolate the material, control re-suspension, restrict movement of sediment from the CAD, and prevent upward migration of contaminants into the water column or surficial sediment layer. Occasionally, sediments will simply be mounded and capped rather than placed in a depression. However, in New England the practice has been to either use a former borrow pit or dredge a new pit to serve as the cell. The preferred foundation type is stiff clay, although CAD cells have been constructed successfully in sandy substrates (Hyannis Harbor, MA). The construction sequence usually involves multiple cells that are filled, capped if necessary, and closed in sequence within a single CAD footprint.

The primary issues associated with a CAD cell include: (1) the short-term effects from turbidity and potential contaminant release during placement; (2) cap stability under hydrodynamic stresses (waves, currents, and vessel wakes/prop wash); (3) cap integrity under biological perturbations (bioturbation); (4) chemical diffusion through the cap layer; and (5) uneven site consolidation. CAD cells have been successfully used in New England since the 1980s as a cost-effective means of isolating fine-grained and/or unsuitable sediments from the environment.

Another issue with CAD cells constructed within harbors is the suitability of materials excavated to form the cell, particularly the surface material which may be similar in terms of contaminant levels, to the harbor shoal materials that would be placed into the excavated cell. Temporary storage of these surface materials, often in combination with construction of one or more smaller ‘starter’ cells is one method of dealing with this problem. Where to place or beneficially use the remaining excavated CAD cell material from deeper elevations may also pose challenges. This material is often parent material (mainly of glacial or marine origin in New England) that is relatively uncontaminated, and itself suitable for open water placement, or beneficial use according to its sediment classification (fine or coarse).

When USACE-NAE first proposed the development of CAD cells they were a relatively new concept and some Regulatory agencies were concerned regarding some the potential issues identified in the paragraph above. The Corps conducted several field investigations both during the construction phase of dredge projects that included CAD cells, these included investigation immediately after CAD cells were capped and one and five years after capping to provide information to address any concerns related to the stability and viability of CAD cell caps. Other efforts included turbidity monitoring during placement of dredged material into CAD cells, monitoring of deep draft vessels over uncapped CAD cells to determine if sediments were being re-suspended into the water column from CAD cells from vessel wakes/prop wash, the viability of CAD cell caps related too biological perturbations and whether gases were being released through CAD cell caps. All of these investigations confirmed the viability of CAD cells and satisfied regulators concerns with potential issues related to CAD cells.

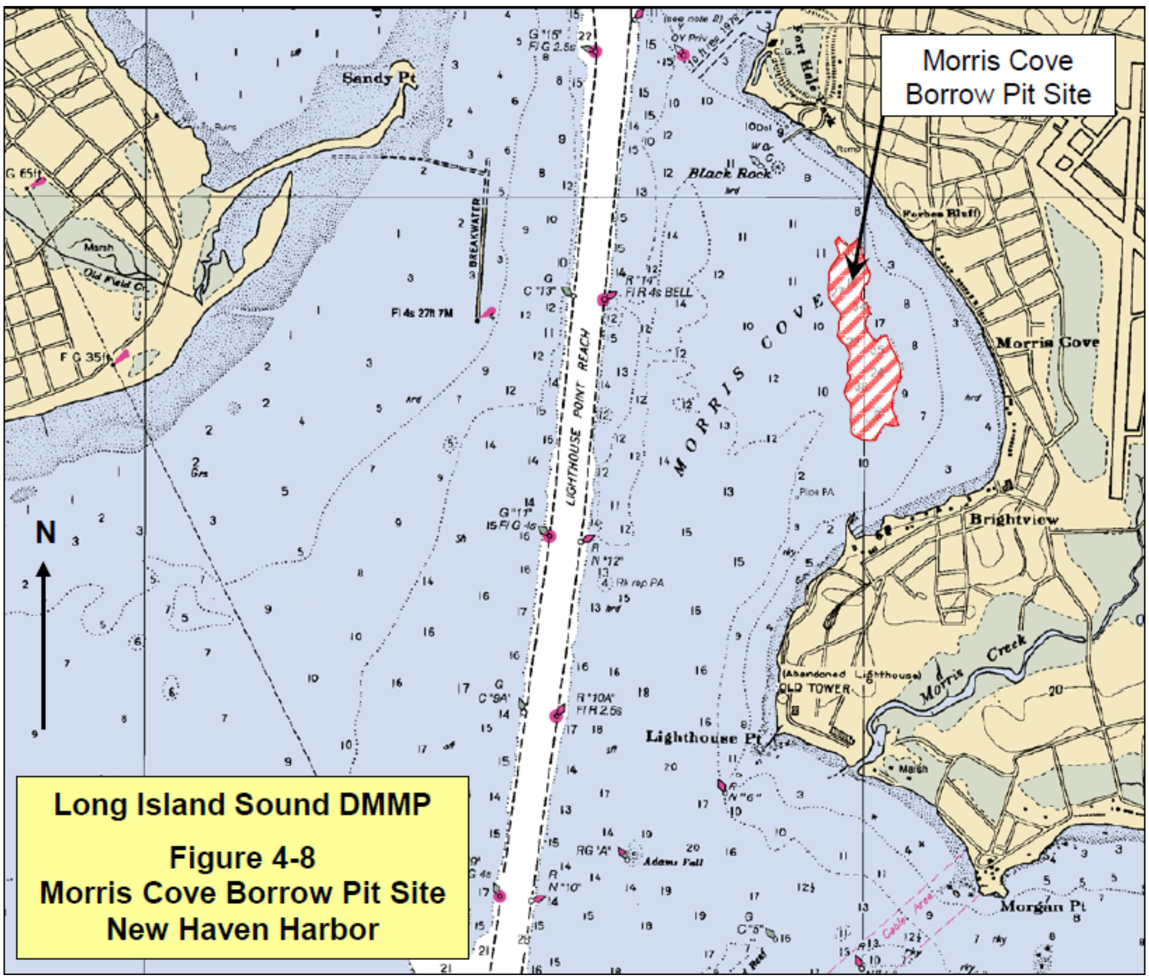
CAD cells have been constructed and used by the USACE-NAE at Norwalk Harbor, Thames River, Providence Harbor, Hyannis Harbor, and Boston Harbor. At Norwalk cells were dredged beneath the West Branch Channel to receive unsuitable materials dredged from that channel in the vicinity of the I-95 Bridge in 1980 and 2010. Additional CAD cells could be constructed beneath that channel feature in the future should unsuitable materials persist in future maintenance operations. The U.S. Navy has twice constructed CAD cells beneath the lower Thames River channel to place unsuitable materials from its berth maintenance projects at its Groton base.

The CAD cells constructed as part of the Boston Harbor Navigation Improvement Project (1997-2000) represented the first major usage of the technique in the United States. As such, multiple investigations were performed during and following the project to assess all aspects of the process: construction, operations/filling, consolidation, capping, and long-term performance. Following Boston, the Providence River and Harbor Maintenance Dredging Project (2003-2005) included CAD cells and provided the opportunity to compare computer model predictions of operational performance with field measurements. These investigations have demonstrated that contaminated sediment can be placed within CAD cells with minimal loss to the water column and that the CAD cells are effective at long-term sequestration of contaminants. References for CAD cell related investigations are provided in Chapter 8, Section 8.2.1.

In-harbor CAD cells could be developed in any harbor where unsuitable materials are found. Harbors in the LIS region where these materials are present include New London Harbor (Shaw's Cove), the lower Thames River (U.S. Navy berths), New Haven Harbor (Mill and Quinnipiac Rivers), Bridgeport Harbor (Johnsons River only, for purposes of this DMMP), Norwalk Harbor (West Branch), Stamford Harbor (East Branch), Greenwich Harbor, Port Chester Harbor, Eastchester Creek, and Glen Cove Creek (tributary to Hempstead Harbor). For cost evaluation purposes it was assumed that CAD cells could be developed to accommodate the immediate needs for placement of unsuitable materials at these locations.

Construction of CAD cells can limit future uses of the area of the sea floor where a CAD cell is located. Activities which involve excavation of the sea floor could remove a cell cap and expose the material placed in the cell below the cap to the environment. CAD cells placed beneath dredged navigation features such as channels could preclude future improvement dredging to deepen those features unless the cap elevation were designed at a greater depth to accommodate future harbor deepening.

Morris Cove Borrow Pit Site: At New Haven Harbor a former borrow pit in the outer harbor at Morris Cove has twice been used by the U.S. Coast Guard to place suitable fine-grained materials dredged from its LIS Station. This pit has about 610,000 CY of capacity remaining, of which 466,000 CY would be for fill and 144,000 CY would be for a cap. This site has been proposed for use as a starter cell for the maintenance dredging of unsuitable materials from Bridgeport Harbor, or could be used for the shoal materials from the Mill and Quinnipiac River segments of the New Haven Harbor project. Either the Bridgeport or the Mill and Quinnipiac maintenance operations would consume the entire fill capacity of the Morris Cove site. The Morris Cove borrow pit site is shown in Figure 4-8, with capacities provided in Table 4-10.



The existing Morris Cove borrow pit was included in the DMMP as a placement alternative for both suitable dredged material (suitable for placement in an aquatic environment with direct contact with the overlying waters) and for unsuitable dredged material (requiring confinement under a surficial cap because of elevated chemical concentrations or toxicity). There were some comments that were in support of using the borrow pit for placement of suitable dredged material as fill to bring the pit back up to the elevation and ecological functionality of the surrounding cove area. Virtually all of the Morris Cove related comments were opposed to using the borrow pit as a confined aquatic disposal (CAD) cell for placement of dredged material, with most noting opposition to dredged material from a specific project (Bridgeport Harbor). The information added to this section below is intended to address both the underlying general concerns with the use of CAD cells as well as specific concerns regarding the Morris Cove borrow pit. As a general note, it should be reiterated that the DMMP does not authorize the use of any given dredged material placement alternative. Rather, it provides ranking of potential alternatives based on the information at hand; for a specific project to move forward with a given alternative, additional investigations may be required to confirm the adequacy of that site and conditions for potential use.

A number of studies have been performed at the Morris Cove borrow pit dating back more than 30 years to evaluate the potential use of the pit for placement of dredged material. These include bathymetric surveys, a dye study, video transects, a sediment-profile imaging survey, a current meter study, and water quality investigations (see references in Chapter 8, Section 8.2.1). In summary, these investigations have determined the following:

- Ecological functionality is diminished in the deeper areas of the pit due to trapping of organic matter and resulting periodic anoxic conditions. The benthic system surrounding the pit is healthy, suggesting that returning to pre-borrow pit depths (i.e., filling it) would return the area to a healthy benthic habitat.
- The tidal currents and potential wave climate over the borrow pit are low enough such that if filled, scouring of the surface would not be expected.
- Lower salinity in the bottom waters of the pit was noted only in a limited number of measurements. Hence, a large and continuous discharge of groundwater to the pit is not expected. Although not discussed in the referenced reports, it is noted that it would be impossible for groundwater to transport contaminants from to pit to the shore unless there was a high amount of groundwater extraction near the shore (large and/or multiple pumping wells) to reverse the normal hydraulic gradient, which is normally seaward in coastal areas.

Although there is a large body of experience demonstrating the successful application of CAD technology in New England and elsewhere, the Morris Cove borrow pit represents a somewhat different application, as any unsuitable material placed there would not be originating from dredging in the immediate area. The DMMP identifies that the proximity of the borrow pit to recreational beaches and a residential district presents potential concerns and notes that any proposal to use the site would need to address the concerns. Hence, a specific proposal to use the site would need to clearly demonstrate how water quality and the existing ecological functionality and human uses of the surrounding area would be maintained during each phase of operation (filling, consolidation, capping, and long-term performance).

Sherwood Island Borrow Pit Site: In LIS there is one former borrow pit site located offshore of Sherwood Island State Park that was identified as a potential Confined Open Water (COW) placement site that could be filled and capped with suitable material; however, this site could not be used to place unsuitable materials as it is not within the waters of any river, harbor or FNP (see Figure 4-9).

In LIS the placement of dredged materials in the waters outside of the rivers and harbors (including the footprints of FNPs), is regulated under MPRSA (ODA) in addition to the CWA. Under US EPA, policy unsuitable materials cannot be placed in MPRSA regulated waters, even if they are "managed", with management interpreted to include placement in capped cells and capping of mounds. Therefore any CAD cells or borrow pits outside of the rivers, harbors, and FNP footprints, were classified separately as Confined Open Water placement sites, and are ineligible to receive unsuitable materials as fill. The two existing borrow pits and their capacities are listed below.

Table 4-10 - Confined Open Water Facilities Considered					
Site	Location	Type	Size (Acres)	Fill or Cap	Capacity (CY)
Morris Cove Borrow Pit	New Haven, CT	In-Harbor CAD	30	Fill	466,100
				Cap	143,900
Sherwood Island Offshore Borrow Pit	Westport, CT	COW	100	Fill	266,000
				Cap	484,000

At both Morris Cove and Sherwood Island, the proximity of the former borrow pits to recreational beaches could be a concern. At Morris Cove the beach is also backed by a dense residential district. Concern has been expressed with placement of unsuitable materials in the Morris Cove pit with respect to stability of any cap and introduction of contaminated material to the environment from erosion, burrowing organisms, and movement of water through the surrounding sediments. There have been investigations of Morris Cove's suitability as a CAD cell, but there have been no similar studies of the Sherwood Island borrow pit site. Any proposal to use these sites for placement of dredged material would need to address these concerns.

Shoreline and Island Confined Disposal Facilities: Shoreline and Island CDFs are constructed along a shoreline or in open water. Similar to other types of CDFs, the principal design and operation objectives of island CDFs are to, (1) provide adequate storage capacity for meeting dredging requirements, (2) maximize efficiency in retaining the solids and isolating them from the aquatic environment, and (3) control releases during filling and in the long-term.

A nearshore or island CDF involves placing dredged marine materials inside a diked nearshore area or island constructed with containment (dikes/walls) and control measures such as lining, covering and effluent control. The dikes are constructed to an elevation above the mean high water elevation to allow ponding of water and retention of dredged material. Direct interchange between the CDF and surrounding water is generally restricted; however, some island CDFs have been designed to create shallow wetland habitats that flood as a result of daily tidal action as well as upland habitat. Primary issues with CDF disposal include: (1) coastal land availability and costs; (2) wave protection; (3) short-term effects from effluent discharge during and after filling; (4) solids retention during filling; (5) contaminant containment structure design; and (6) long-term end use of the site after closure. Large-scale CDFs have been constructed to accommodate dredged materials at Norfolk Harbor, Baltimore Harbor, upper and middle Chesapeake Bay, Los Angeles-Long Beach Harbor and elsewhere.

Construction of Shoreline and Island CDFs in LIS has been studied by the Corps and others since at least the 1970s. Many sites have been proposed for such structures, some large enough to accommodate the entire region's long-term dredging needs, and others are smaller structures that would fill the needs of just one or several harbors. The Containment Alternatives Report (Supporting Technical Investigations Document #9) presents detailed information on the individual CDF sites considered. In this DMMP proposed CDF sites evaluated include Groton

Black Ledge, Twotree Island (Niantic), Duck Island Roads, Clinton Harbor, Falkner's Island, New Haven Breakwaters, Milford Outer Harbor, Stratford Point, Penfield Reef, Norwalk Outer Harbor Islands, Stamford Harbor, Greenwich Captain Harbor Islands, Byram Harbor, and Hempstead Harbor. All but Hempstead Harbor are in Connecticut.

Another type of CDF was considered at Bridgeport Harbor, where the idea of constructing a bulkhead to close off the upper Yellow Mill Channel above the bridges and use that as a CDF has been discussed in the past. For a CDF option, this would carry a relatively low cost, but would have limited capacity.

Construction of CDFs requires constructing dikes and or bulkheads around the perimeter of the disposal area. Exposed dike faces often require armoring with stone, while inner (leeward) faces can be armored with cobble, or coarse material. Dredged material transfer landings can be constructed outside the containment, or inside with open areas to allow vessel traffic. Sediments can then be placed into the fill area via bottom dump barge initially and then as the fill area becomes too shallow to allow access via barge, materials can be placed hydraulically or by offloading from scows. Bulkheads and dikes can be increased in height over time to increase the capacity of the CDFs but higher elevations may require mechanical transport rather than pumping. Internal dikes and weirs could then be used to drain the water from the fill areas. After filling and any dewatering, separate areas of the CDF can be developed as marsh, upland or other habitat, used for parkland, or paved to support various port facilities or other development.

Construction of CDFs that will hold materials requiring containment and isolation from the environment must also consider subsurface seepage of contaminants, which may reach adjacent surface water and groundwater if not properly managed. Depending on the type and concentrations of contaminants in the dredged sediment to be placed into a CDF and the hydro-geologic conditions of the site, management components could include specified permeability constraints for the containment berm and internal diking, a geotextile or constructed soil liner, and a system for collection/treatment of effluent from consolidation or precipitation. The several CDF alternatives evaluated in this DMMP are shown in Figure 4-10 and are listed in Table 4-11.

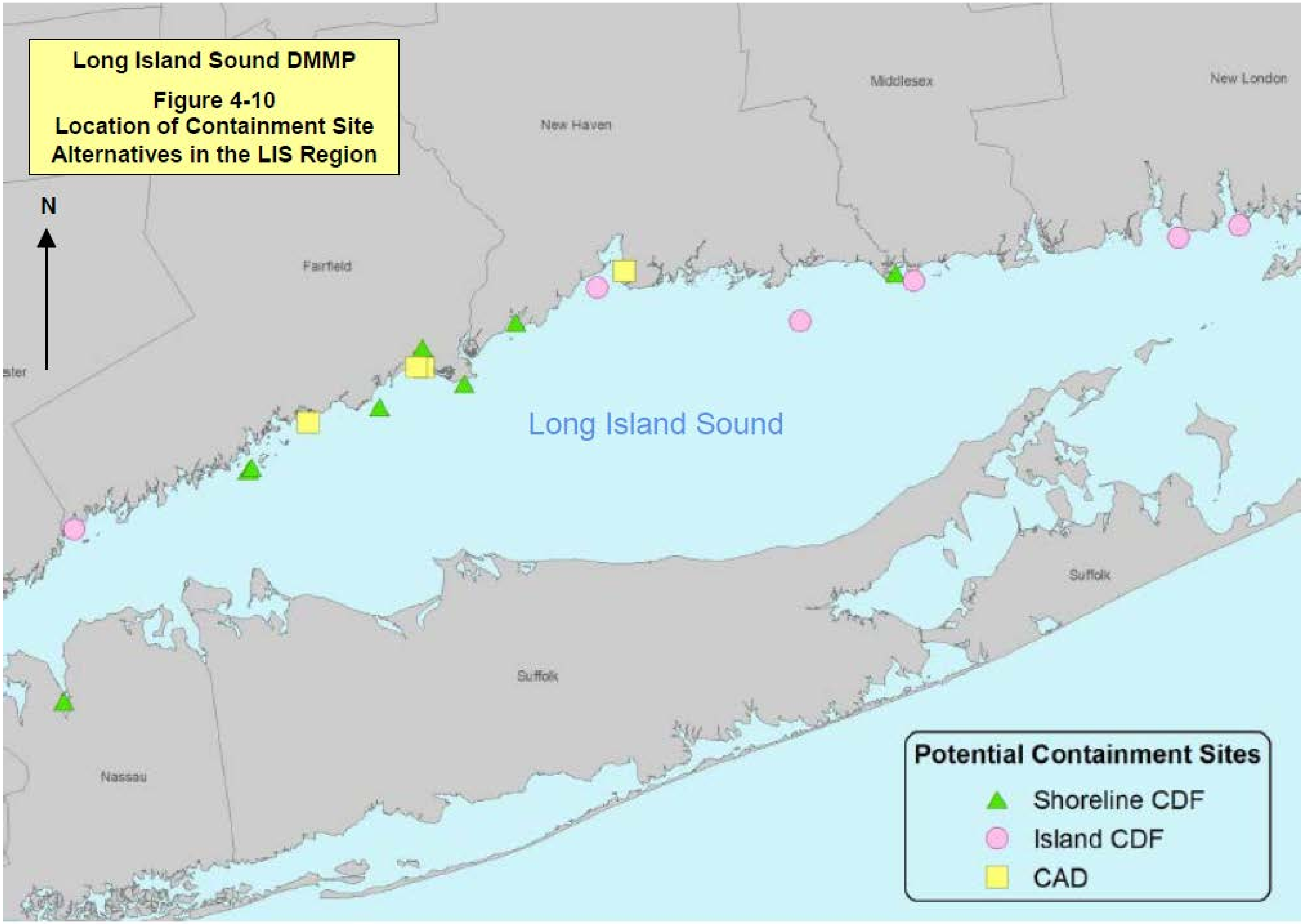
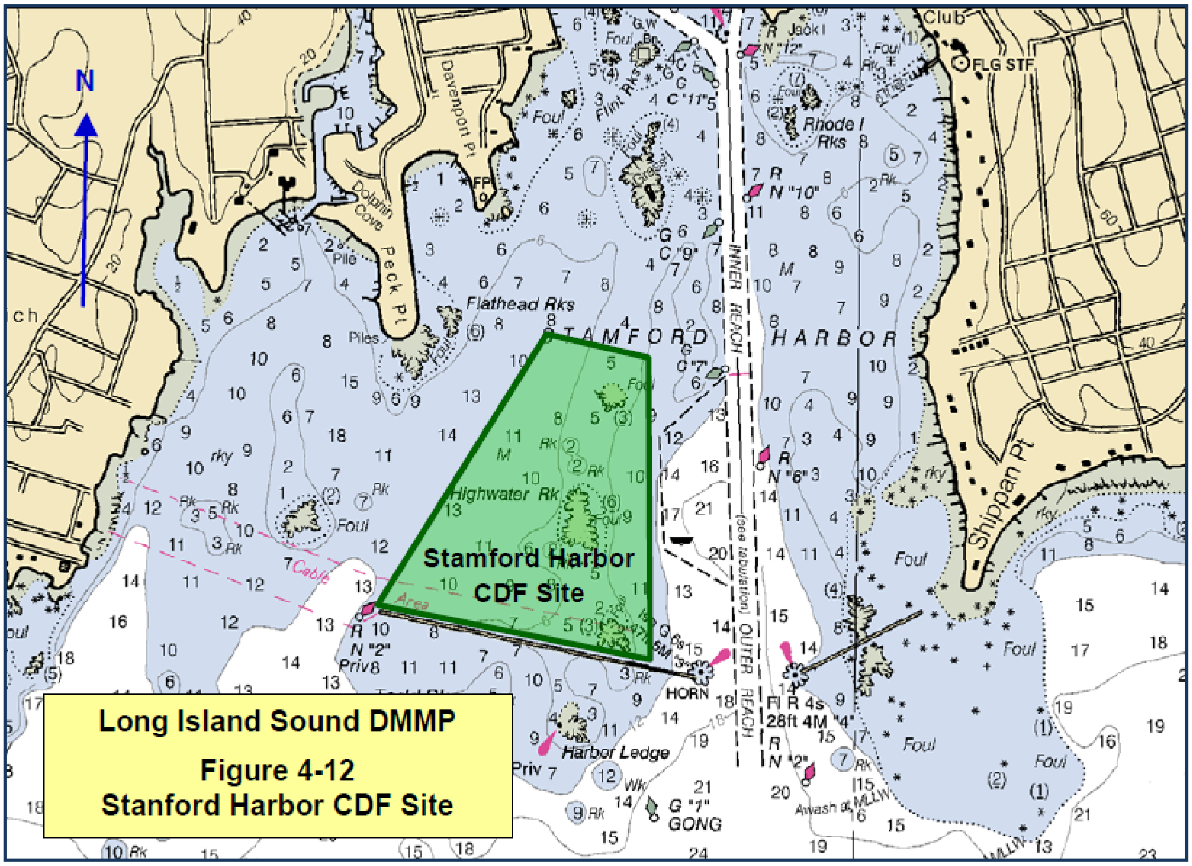

Long Island Sound DMMP
Figure 4-10
Location of Containment Site Alternatives in the LIS Region
N
New Haven
Middlesex
New London
Fairfield
Long Island Sound
Suffolk
Suffolk
Nassau
Potential Containment Sites
Shoreline CDF
Island CDF
CAD

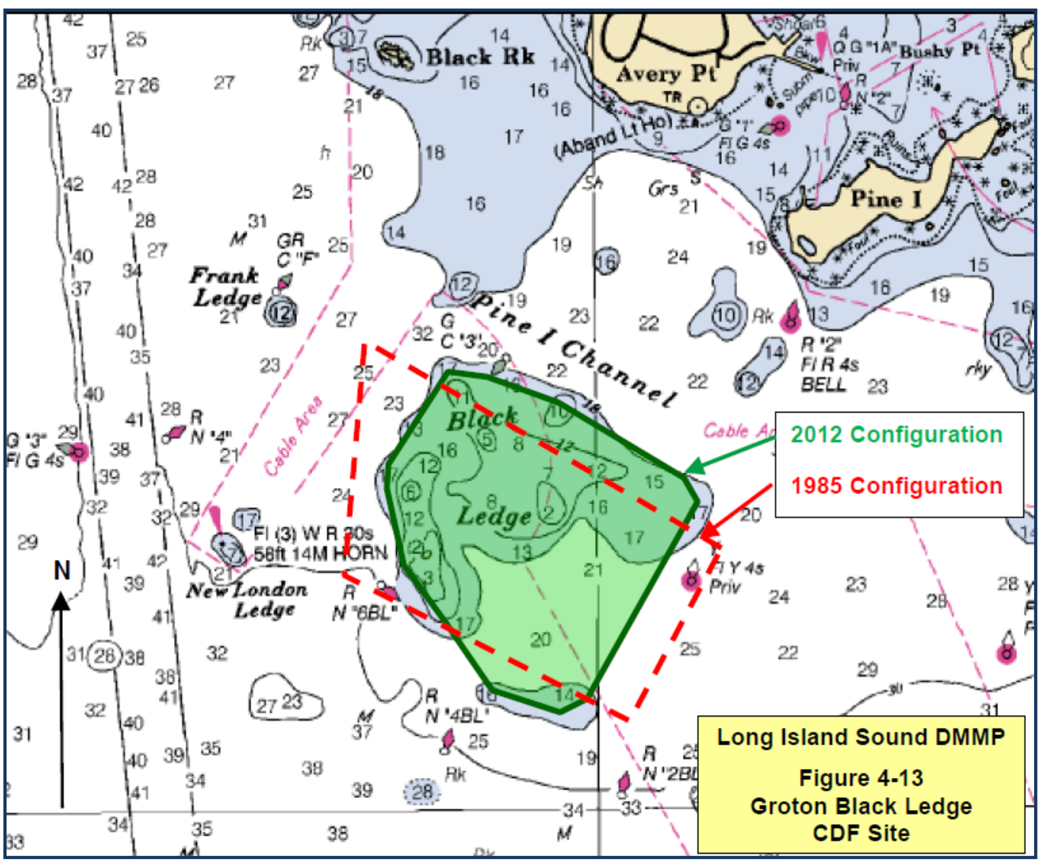
Table 4-11 - Confined Disposal Facilities Considered					
Site	Location	Type	Size (Acres)	Fill or Cap	Capacity (CY)
Groton Black Ledge CDF	Groton, CT	Island CDF	125	Fill	6,930,000
				Cap	570,000
Twotree Island CDF	Waterford, CT	Island CDF	80	Fill	2,966,200
				Cap	433,800
Duck Island Road CDF	Westbrook, CT	Island CDF	48	Fill	1,376,100
				Cap	233,900
Clinton Harbor CDF	Clinton, CT	Shore CDF	100	Fill	59,800
				Cap	640,200
Faulkner Island CDF	Guilford, CT	Island CDF	240	Fill	16,010,200
				Cap	1,169,800
New Haven Breakwaters CDF	New Haven and West Haven, CT	Island CDF	1,150	Fill	52,695,600
				Cap	5,554,400
Milford Outer Harbor CDF	Milford, CT	Shore CDF	11	Fill	219,100
				Cap	50,900
Stratford Point CDF	Stratford, CT	Shore CDF	1,090	Fill	33,666,900
				Cap	5,283,100
Bridgeport Yellow Mill Channel CDF	Bridgeport, CT	Riverine CDF	16	Fill	197,900
				Cap	102,100
Penfield Reef CDF	Fairfield, CT	Shore CDF	1,035	Fill	33,539,300
				Cap	5,010,700
Norwalk Outer Harbor Islands CDF	Norwalk, CT	Island CDF	33	Fill	554,000
				Cap	376,000
Stamford Outer Harbor CDF	Stamford, CT	Island CDF	70	Fill	1,700,000
				Cap	340,000
Greenwich Captain Harbor Islands CDF	Greenwich, CT	Island CDF	49	Fill	498,200
				Cap	331,800
Byram Harbor CDF	Greenwich, CT	Island CDF	60	Fill	750,000
				Cap	290,000
Hempstead Harbor CDF	North Hempstead, NY	Shore CDF	116	Fill	2,787,700
				Cap	712,300

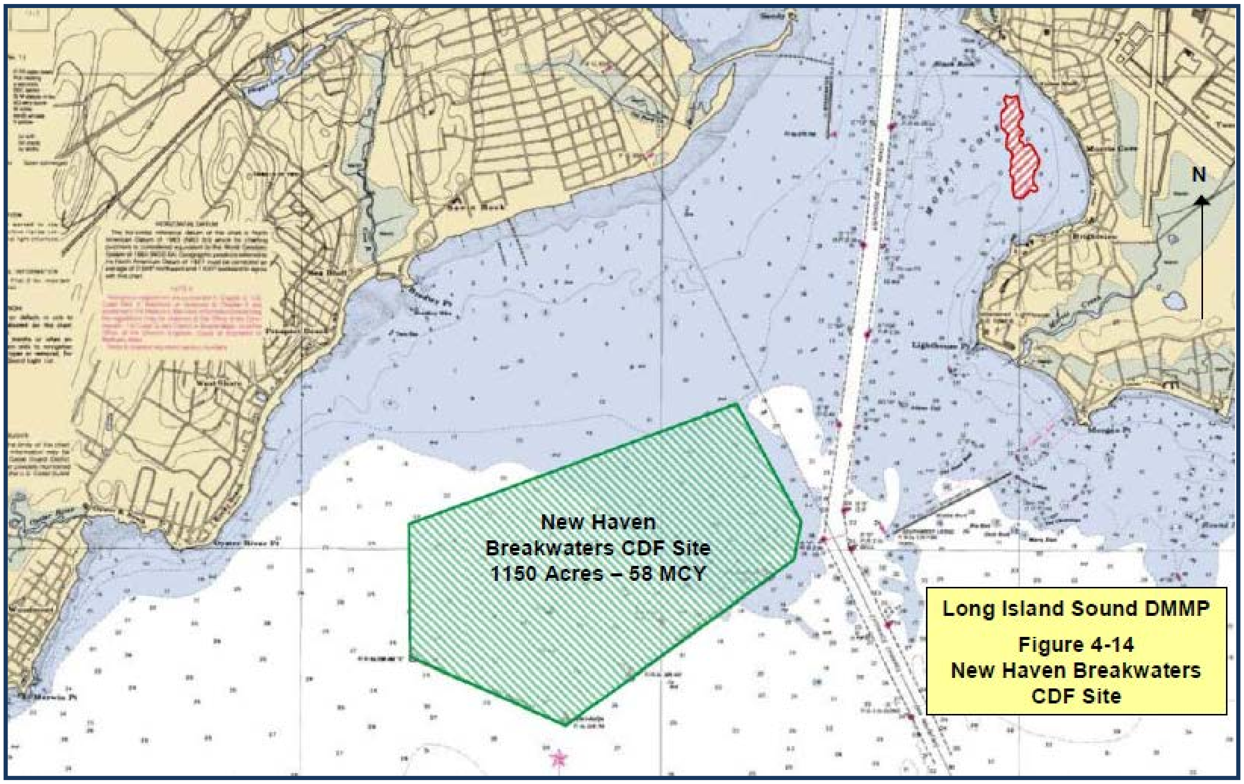
CDF site capacities range from a few hundred thousand CYs up to more than 50 million CY. Examples of site capacity range include the Yellow Mill Channel at Bridgeport Harbor on the lower end at about 300,000 CY which would fit one or a few small harbor projects, to Stamford Outer Harbor at about two million CY, (one large project or a few medium-sized projects), to a sub-regional CDF such as Groton Black Ledge at 7.5 million CY, to a regional CDF such as New Haven Breakwaters at about 58 million CY. These CDF sites are shown in Figures 4-11 through 4-14.

Long Island Sound DMMP

Figure 4-11
Bridgeport Yellow Mill Channel CDF Site


Stamford Harbor
CDF Site
N
Long Island Sound DMMP
Figure 4-12
Stanford Harbor CDF Site


2012 Configuration
1985 Configuration
N
Long Island Sound DMMP
Figure 4-13
Groton Black Ledge
CDF Site



Temporary Confined Disposal Facility Storage: Occasionally, clean and contaminated dredged sediments may be destined for reuse as future fill material or as feed material for a treatment program not yet fully implemented. In these instances, temporary storage either in aquatic or upland facilities may be a viable option, pending appropriate environmental review.

Dredged sediment may be stockpiled on a temporary basis at aquatic sites awaiting further transfer to end-use destinations if contaminant concentrations are sufficiently low enough that aquatic risks are not probable. Suitable types of aquatic stockpiling include placement in nearshore depressions, sub-aqueous mounds, or islands. The stockpiling sites need to be located in sheltered areas with minimum wave energy to ensure stability. The construction of temporary dikes or berms may be needed to confine the contaminated sediment within the stockpiling area. Given the involvement of unconfined, open-water placement of dredged material in the near-shore environment, aquatic stockpiling would be subject to the same regulatory constraints and requirements as for all discharges of dredged material in the nearshore, which calls for meeting the requirements of the Inland Testing Manual (ITM).

Emphasis in the suitability analysis would be placed on short-term impacts due to double handling in the form of placement and re-dredging within a relatively short period of time, and long-term bioavailability in case materials are not immediately utilized. These constraints would likely limit this option to include only clean to mildly contaminated sediments that are otherwise suitable for unconfined open water or ocean placement according to the testing requirements. Preparation of Site Management and Monitoring Plans (SMMP) to monitor and guide use, management and monitoring of the temporary storage site and stockpiled materials would be required. Additional requirements could prevent the creation of navigational hazards as a result of the alteration of existing nearshore bathymetry, among other aspects.

Dredged sediment may be stockpiled on a temporary basis at upland sites awaiting further transfer to end-use destinations. Suitable types of upland stockpiling include placement in existing sediment storage facilities in the ports and any new storage areas that can be designated for the same purpose on a temporary basis. Placement of dredged materials at upland facilities would be subject to the constraints of the Upland Testing Manual (UTM), and other regulatory constraints and requirements that are in place for these facilities, such as the regulation of return water from upland dewatering sites, which is considered a regulated discharge under the CWA. New stockpiling sites could include confined disposal facilities, and new holding basins similar to the existing facilities in the ports. Given the constraints on land availability and the limited capacities of existing sediment holding facilities, upland storage capacities are expected to be limited in the region. The logistics of land transportation, management of material within the site, and end-use timelines have to be integrated into storage plans to ensure efficiency and limited interruption of service at the facility.

No opportunities for development of aquatic temporary storage sites for dredged materials were identified by this DMMP. Upland temporary storage has been used on a small scale in small harbor improvement dredging projects in the past. In the 1950s the improvement project to deepen New Haven Harbor to 35 feet used the material as fill at Fort Nathan Hale Park, and used that area to dewater and transport material further upland as fill at the nearby airport. Similarly in the future, any onshore opportunities to temporarily store material are expected to be in conjunction with dewatering and trans-shipment upland.

Early in this DMMP study it was suggested that the impending Federal surplus and disposal of Plum Island, the U.S. DHS facility, could provide an opportunity for creating a dredged material dewatering/processing facility that could feed other non-open water uses or placement of material. The disposition of that facility and Plum Island are not yet known.

4.9.9 Habitat Restoration Sites

<u>New York District Marsh Creation on Long Island</u>: HARS-approved material, primarily sand removed from Ambrose Channel and other areas, has been used to restore and reconstruct marsh islands in Jamaica Bay, located in southern Kings and Queens Counties, along the Atlantic Coast. Despite intense development along its shoreline, Jamaica provides habitat for a variety of fish and wildlife species and is an important stop-over for migratory birds. Analyses have indicated that nearly 1,400 acres of tidal salt marsh have been lost since the early 20th century and most recently is has been estimated that salt marsh was being lost at approximately 47 acres per year. Under Section 207 of the Corps Continuing Authority Program, the Corps, in partnership with the Port Authority of New York and New Jersey, New York City Department of Environmental Protection and the New York State Department of Environmental Conservation, restored salt marsh habitat through the placement of sand from Ambrose Channel and other areas as part of the Corps' harbor deepening project being conducted in partnership with the Port Authority of New York and New Jersey.

In 2006 and 2009, approximately 80 acres of marshland were restored at Elders Point East Marsh Island and Elders Point West Marsh Island. Sand was placed in existing vegetated areas and exposed mudflats to raise the islands to an elevation suitable for low marsh growth. The areas were then vegetated. Subsequently, a total of 625,000 CY of sand was placed at Yellow Bar, Rulers Bar and Black Wall and included plantings to create a variety of salt marsh habitat. The marsh islands are being monitored and, although they suffered some damage during Hurricane Sandy, the islands are being maintained.

Habitat Enhancement and Marsh Creation Sites in the LIS DMMP Context: Two of the four habitat restoration sites in the study (Jamaica Bay Marsh Islands and Plumb Beach) may have capacity for additional dredged material (Table 4-12). The remaining two (Gerritson Creek and White Island) have no additional capacity, as the material required for these projects has been placed onsite, and the habitat restoration projects are underway. The Jamaica Bay Islands have capacity for over 600,000 CY of clean sand, and Plumb Beach is in need of beach compatible sand both to stem the severe erosion along the beach and roadway, and to enhance the beach and dune habitat. For Plumb Beach, a project design volume was not available for this report. Therefore a volume estimate was made based on the beach nourishment calculations presented in the methods section. The remaining fill capacity for the habitat restoration projects is shown below. To the extent any of these restoration projects still have capacity to accept material at the time any LIS projects are being dredged, Federal/non-Federal partnerships could be developed to share the cost of transporting and placing material at these sites.

Table 4-12 - Habitat Restoration and Enhancement Sites in Region

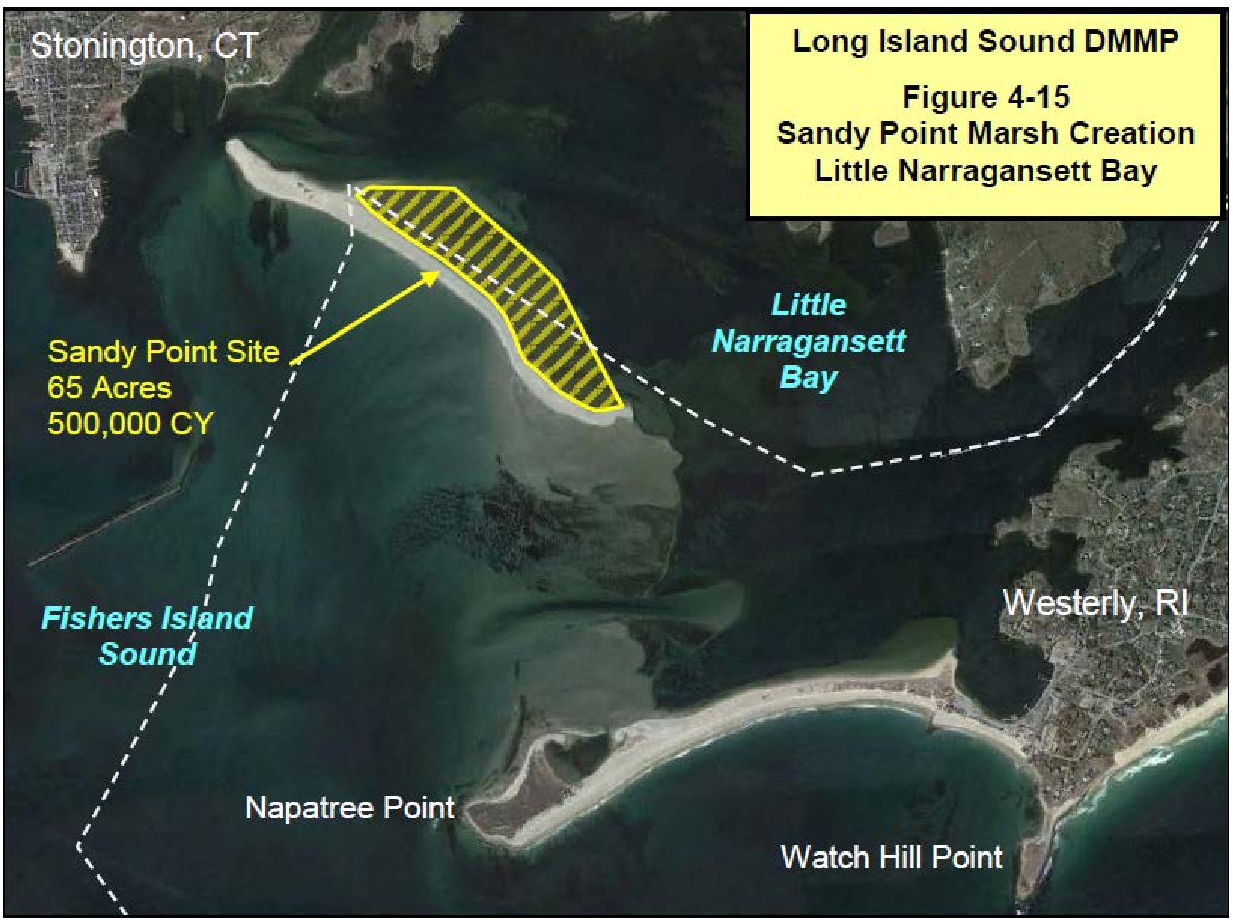
Site ID	State	Location	Site Name	Capacity (CY)
427	NY	Brooklyn	Plumb Beach	47,700 – 64,400
429	NY	Brooklyn & Queens	Jamaica Bay Marsh Islands	600,000 - 750,000
430	NY	Brooklyn	White Island	No additional capacity. Material has been placed.
431	NY	Brooklyn	Gerritsen Creek	No additional capacity. Material has been placed.
			TOTAL	647,700 – 814,400

During preparation of the several Technical Supporting Document studies of potential placement alternatives, no specific identification or recommendation for environmental enhancement sites were made by state or local interests, other than those described above for the USACE New York District. Other than shore protection and nearshore placement, beneficial uses of dredged material have not been pursued in Connecticut, this despite the loss of significant areas of coastal wetlands over the past century to port development activities and other infrastructure construction, and the availability of other Federal authorities such as the Continuing Authorities Program Section 1135 and Section 206. In an effort to move such beneficial use to the forefront the USACE NAE, during the development of the DMMP, made additional site suggestions within LIS, all for marsh creation in shallow water. One, at the Norwalk Outer Harbor Islands would be an enlargement of a CDF site proposed for that location and was included in the final screening process. The other two sites, Sandy Point in Little Narragansett Bay on the Rhode Island/Connecticut border, and Sandy Point in New Haven Harbor at West Haven, involve filling areas in the lee of an existing barrier spit or island to create substrate for salt marsh development, and were raised too late to be included in the screening. The two Sandy Point sites are shown in Figures 4-15 and 4-16, with capacities provided in Table 4-13. Any of these three sites would make a suitable pilot or demonstration project for habitat restoration and enhancement should the state wish to pursue a partnership with the USACE, and provided that the requirements for Federal participation could be demonstrated through appropriate study.

Thin-layer marsh placement has recently been experimented with on a small scale by the state of Rhode Island by discharge from a small pipeline dredge. While this is likely impractical for larger USACE maintenance projects, small private facility dredging projects of a few hundred CY may be able to use such an alternative placement method at short distances.

Table 4-13 - Additional Marsh Creation Sites Considered

Site Name	State	Municipality	Area (Acres)	Fill Capacity (CY)
Norwalk Outer Harbor Islands	CT	Norwalk	78	930,000
Sandy Point at Little Narragansett Bay	RI	Westerly	65	500,000
Sandy Point at New Haven Harbor	CT	West Haven	70	1,100,000



Marsh creation requires the more exposed (seaward) faces of the filled area be protected by existing landforms or dikes (potentially requiring some armoring). Less exposed faces can be protected with smaller dikes, or filled geotubes, to allow consolidation of the fill material before planting begins. Marsh creation sites can also be constructed to act as CAD cells by using internal diking and capping, and perhaps some excavation, to isolate materials of lesser chemical or physical quality to interior or more protected areas within the filled area.

Long Island Sound DMMP
Figure 4-16
Sandy Point Marsh Creation
West Haven, CT

A method of dredged material management that has been used extensively in the southeast United States is Geo-Textile Encapsulation (commonly called a GeoTube). In this process, a large bag constructed of Polypropylene (PP), Polyethylene (PE), and Polyester (PET) is filled with dredge material and then used for various purposes. If the material is clean, it may be placed on land and used to dewater the sediments, or submerged underwater to form dikes and support structures. For contaminated material, the geo-textile bag can be used to isolate and contain the dredge materials prior to use as aquatic fill material.

<u>Shallow Water Habitat Creation - Oyster Propagation Substrate</u>: Shallow Water Habitat Creation involves placing dredged material in a sub-aqueous containment area in shallow water and covering the material with a clean cap designed to provide the proper elevation and consistency needed to enhance the biological value of the site. Primary issues of concern with shallow-water habitat creation include determining the final cap elevation, cap material type and thickness, and target organism seeding and colonization, as well as all of the issues

associated with aquatic capping of dredged materials. Only suitable material can be placed in the waters of LIS outside of the confines of harbors, so this option is not available for unsuitable materials. This type of shallow water habitat could potentially be used to create oyster beds if the cap material were suitable coarse grained material to which oyster spat could be added.

No specific opportunities for this type of beneficial dredged material placement were identified in the DMMP study. However, developing areas for enhanced oyster propagation in LIS has been discussed for many years, hoping to build on the work done in Chesapeake Bay and elsewhere, but no funding for such studies has been made available.

4.9.10 De-Watering Sites

Dewatering site capacity calculations were performed to estimate the maximum amount of material that could be dewatered on a given parcel. While actual designs for dewatering sites must consider site-specific information on dredged material properties, as well as the size and characteristics of areas available for building dikes and effluent control, this study involved making approximate capacity estimates using a number of assumptions.

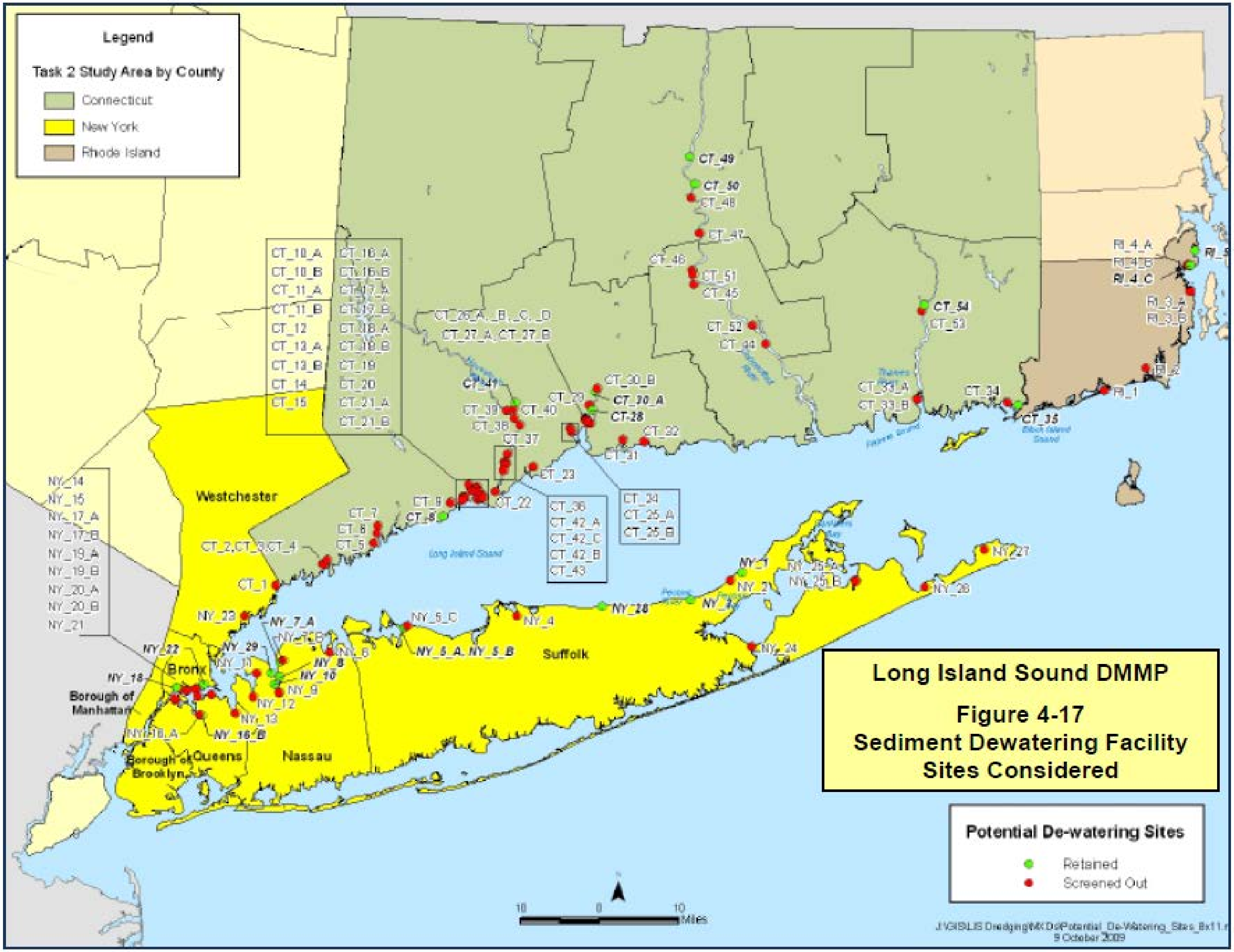
Generally, a dewatering facility is a single basin, as large as possible, that will be filled with dredged material in a series of individual lifts. The analysis for this report did not consider the complex processes or duration of time involved in achieving the final volume, nor the specifics on internal dikes that could facilitate drainage and drying. The analysis calculated the total capacity of fully dewatered and consolidated sediment in a single basin.

Areas available for dewatering were determined using the parcel boundaries and wetland delineations mapped and observed in the field. Setback distances to parcel edges and wetlands, according to the criteria provided above, were applied to the available dewatering areas. In addition, a minimum one-quarter acre was reserved outside the dewatering area, for staging such as storage of trucks, equipment, pipeline, and to support work on constructing and maintaining drainage features.

The dewatering sites were classified as currently feasible or potentially feasible in the future. Of these viable sites, Connecticut has two locations that are currently feasible and three with potential in the future. New York also has two locations that are currently feasible, with seven additional sites that are potentially feasible in the future. Rhode Island has two sites that are potentially viable in the future. The dewatering sites considered in this DMMP are shown in Figure 4-17, and listed in Table 4-14.

Other sites were identified as potentially able to accommodate a dewatering site, but the current land use is not compatible with dewatering, and/or the site owner was not amenable to dewatering at the site. For these “Potentially Feasible in the Future” sites, a dewatering capacity was calculated, as there may be potential for dewatering at the site in the future if the land use structure, or ownership changes. In other cases, the area originally identified for the site investigation was considerably larger than the area actually available for dewatering. Five of the sites investigated are infeasible, as they have been recently developed, or are under land use restrictions that do not allow placement of dredged material.

Table 4-14 - Potential Sediment De-Watering Sites				
Site ID	**State**	**Town**	**Site Name**	**Holding Volume (CY)**
Currently Feasible Dewatering Sites				
CT-28	CT	New Haven	Anastasio Trucking Site	23,100
CT-54	CT	Norwich	P&W Railroad Co. Site	17,500
NY-5-A	NY	Huntington	Northport Boat Ramp & Fields	122,000
NY-18	NY	Bronx	Barry St. Industrial Site	30,500
			Total Volume	193,100
Potentially Feasible in Future				
CT-30-A	CT	Hamden & North Haven	North Haven Tire Pond Site	99,600
CT-8	CT	Fairfield	Fairfield Public Works Site	47,800
NY-1	NY	Mattituck	Mattituck Agricultural Fields	2,085,000
NY-5-B	NY	Huntington	Northport Power Station	63,000
NY-29	NY	North Hempstead	North Hempstead Aerodrome	39,900
NY-28	NY	Brookhaven	Shoreham Power Station	42,600
NY-7-A	NY	Glen Cove	Garvies Pt. Remediation Site	27,300
NY-8	NY	North Hempstead	Glen Cove Industrial Site	11,000
NY-3	NY	Northville	Northville Agricultural Fields	35,200
CT-41	CT	Ansonia	Ansonia Target Store	1,000
RI-4-C	RI	North Kingstown	Quonset Point South	87,800
RI-5	RI	North Kingstown	Quonset Point North	102,200
Sites Found Not Feasible				
CT-50	CT	East Hartford	Goodwin College	NA
CT-49/373	CT	Hartford	CRRA Hartford Landfill	NA – Site Closed
CT-35	CT	Stonington	Osbrook Point Agricultural Fields	NA
NY-10	NY	North Hempstead	Port Washington Landfill	NA
NY-16-B	NY	Queens	Queens Parking Garage	NA



Long Island Sound DMMP

Figure 4-17
Sediment Dewatering Facility Sites Considered

4.9.11 Upland Sites - Landfills

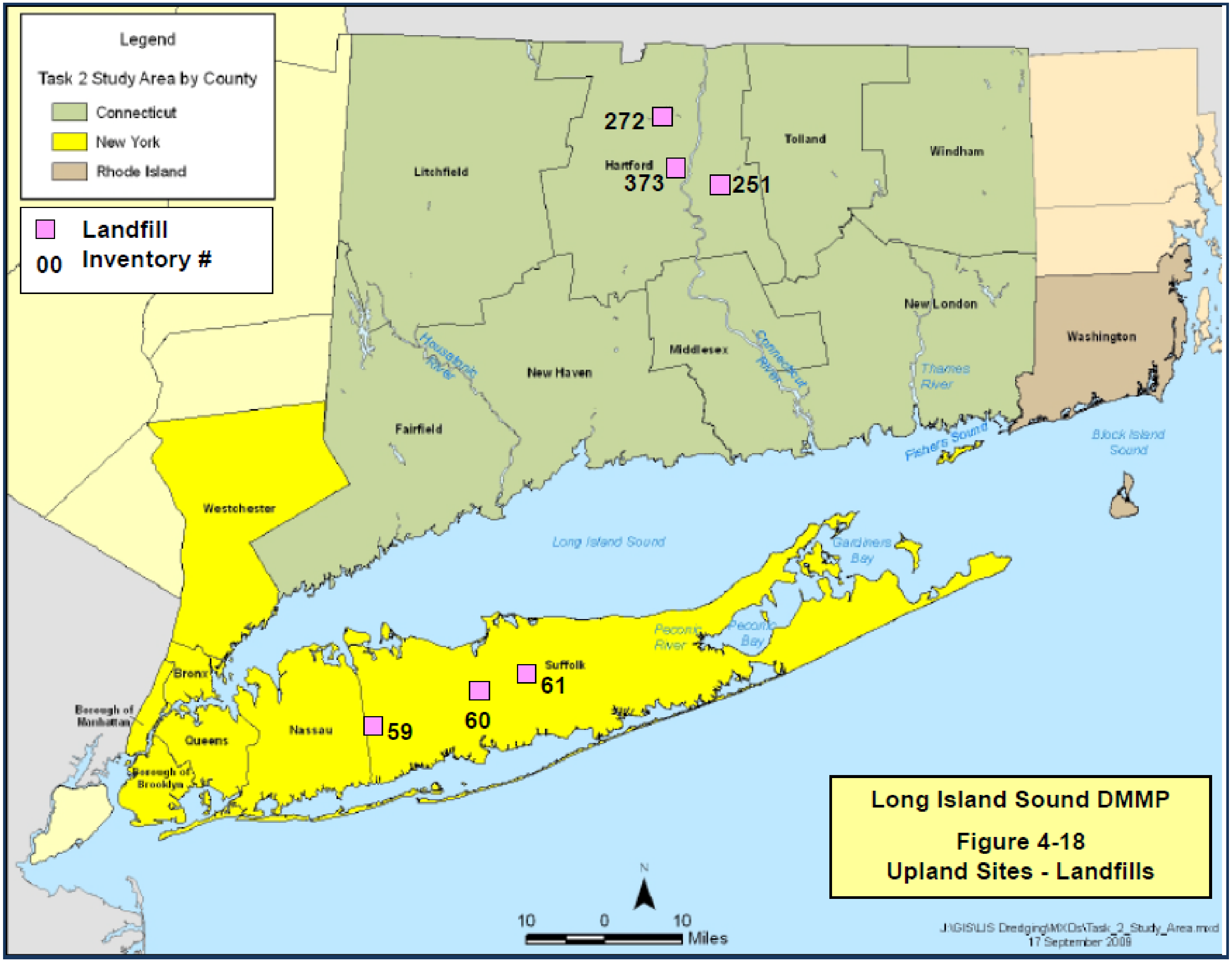
Placement of dredged material upland in landfills involves the dewatering, transport and placement of dredged material in an upland facility constructed with containment measures such as lining, diking, and covering. Typical upland disposal facilities include upland CDF and commercial landfills.

Dredged sediment may be used for landfill daily cover and closure works as beneficial use alternatives, subject to regulatory constraints and requirements. A particular concern regarding the use of marine dredged sediment at landfills is the water and salt contents in the material. Landfills typically require placed sediment to limit water and chloride content. Requirements for dewatering and chloride reduction tend to limit the economy of using marine dredged sediment at landfills, especially when large quantities of dredged materials are involved. Evidence suggests, however, that the mobility of chlorides tend to significantly decrease upon compaction of the material after placement. In addition to constraints on sediment quality for use at landfills, few active landfills in the region are within economic transport distance from potential dredge areas, and all but a few landfills have closed in recent years (Table 4-15). The available capacity for this end use in the region is, therefore, expected to be limited.

Table 4-15 - Summary of Landfill Sites

Site ID	State	Town	Site Name	Accepting Dredge Material	Comment
373	CT	Hartford	Hartford Landfill	No	Site Closed
251	CT	Manchester	Manchester Landfill	Yes	Under Special Waste Program for daily cover and capping
272	CT	Windsor	Windsor-Bloomfield Landfill	No	Site Closed
61	NY	Brookhaven	Town of Brookhaven Landfill	Yes	For daily cover or capping
60	NY	Islip	Blydenburgh Road Landfill	Unlikely	Site operator indicates prior problems with dredged material coming to the site.
59	NY	Melville	110 Sand Company	Yes	For daily cover or fill, but prefer freshwater sources

The sites identified in this DMMP are shown in Figure 4-18. Two of the landfills in the original study have since been closed. The Islip landfill is unlikely to accept dredged material. The other three landfills could accept dredged material for various uses, including fill (Site 59 only), daily cover, or as final cap material. The sites can accept fine-grained dredged material, although cap material is generally required to be higher in organics to support vegetative growth. Site 251 in Manchester, CT is the only landfill with the potential to accept contaminated dredged sediment.



Long Island Sound DMMP

Figure 4-18
Upland Sites - Landfills

Under Connecticut Department of Energy and Environmental Protection (CT DEEP) regulations this would require a special application for a Special Waste Disposal Authorization. Tipping fees vary between landfills, and tend to be relatively high for dredged material. The costs associated with dewatering and transport of dredged material to the landfills would also need to be taken in to account.

Upland Confined Disposal Facilities: An upland CDF is operated similar to a nearshore CDF, except that it is constructed entirely inland. Sediments are transported to the facility either via truck or hydraulically pumped into the containment area. The material is dewatered and reused or capped with clean soils. A clay base or synthetic liner may be required to prevent seepage of water from the CDF into the underlying groundwater. Decanted water leaving the facility is typically treated to remove solids or contaminants and then discharged back to the dredge location via pipeline. The primary issues with upland CDF include: (1) land availability and cost for the facility; (2) contaminant leaching; (3) effluent control, solids retention and surface runoff control; and (4) the long-term end use of the site after closure. Commercial landfills can potentially receive dredged material. The primary issues with placing large quantities of dredged material in such landfills include: (1) dewatering requirement; (2) contaminant and chloride leaching; (3) availability of suitable existing landfills; (4) land availability and cost for new landfill facilities; (5) land availability and cost for dewatering facilities; and (6) transportation cost.

4.9.12 Use of Dredged Material in Reclamation and Redevelopment Projects

Clean or contaminated dredged sediment may be used for reclamation fill as a beneficial reuse alternative, subject to regulatory constraints and requirements. Two types of reclamation fill were evaluated for this study: (1) use of the material as part of a Brownfield Re-Development project and (2) use of the material to backfill abandoned mines and gravel pits. Both are briefly described below. In Brownfield re-development, contaminated or clean dredged sediment may be used as fill for development projects at Brownfield sites such as abandoned industrial sites and cleanup/remediation sites. The in-situ soil at a Brownfield site under development may contain contaminants at levels that are deemed acceptable for the project. Opportunity, therefore, exists for such a project to use contaminated sediment with constituent levels that are consistent with those permitted for the project. For substantially clean Brownfield sites, leach testing of dredged sediment by may be required before placement as fill. The issue of chlorides may also have to be addressed depending on the location of the site and quantities of the fill. Reduction of chloride leaching upon compaction of the fill as discussed previously may also be taken into consideration in the acceptability determination. Because there are many historical industrial sites within close proximity of the Study Area, options for using contaminated dredged materials for Brownfield re-development should be available. Applicability will, however, be highly site dependent (e.g., proximity to underlying groundwater resources, local use of groundwater, proximity to residential areas, etc.) and final acceptance by the regulatory agencies would likely be determined based on these conditions and possibly the results of a risk assessment. Another consideration is the timing between needed dredging projects and the schedule for Brownfield redevelopment so that the site could use the dredged material.

The redevelopment/construction sites in the study have capacity for material. One of the sites, Plum Island in NY, has no firm redevelopment plan at present, so the capacity could not be estimated for a redevelopment project. The site does have a beach area that has been nourished in the past with sediment dredged from the Plum Gut harbor. This area has capacity for more material, and was evaluated in terms of capacity for beach nourishment. Another evaluated site; Flushing Meadows wetlands and uplands, has capacity for dredged material. The Flushing Meadows projects are required to use clean fill; such that placement of fine-grained dredged materials is allowable, provided they meet the sites' regulatory criteria. Whether the site will still be available to receive dredged material at a time when a project generating acceptable material is being dredged would need to be investigated in the alternatives analysis for future projects.

Mine and Pit Reclamation: Contaminated or clean dredged sediment may be used as backfill at mine reclamation sites subject to regulatory constraints and requirements. Some mine sites function as groundwater recharge features and backfilling these pits may conflict with regional conservation objectives. Most abandoned mine sites generally have ample supply of backfill material generated from mine development that has been stockpiled on site. Where mine closure projects are in need of dredged material as backfill, issues such as chloride levels in the marine sediments may be of concern. For the LIS DMMP one mine site in Pennsylvania, the Hazelton Mine, was identified as accepting dredged materials from marine sources as reclamation fill. The Hazelton Mine site will accept fine-grained marine dredged material as long as chemical analyses show that all state criteria have been met. The available reclamation and redevelopment sites and their capacities are listed in Table 4-16.

Table 4-16 - Reclamation and Redevelopment Sites

Site ID	State	Town	Site Name	Capacity (CY)
422/423	NY	Flushing	Flushing Airport Wetlands and Upland	140,000
417	PA	Hazelton	Hazelton Mine Redevelopment	15,000,000
			TOTAL	15,140,000

The available capacity at the Pennsylvania Hazelton mine is estimated in the tens of millions of cubic yards, though acceptance of dredged marine sediments can only be approved on a project-specific basis supported by extensive testing required by the state. Dredged material from New York Harbor areas that cannot be placed at other open sites has been transported to Pennsylvania for disposal at one of the mine sites. Mine reclamation as a beneficial use alternative has been pursued as a demonstration. There has been only one large-scale mine reclamation project in the northeast that used marine dredged materials; the Back Camp surface mine reclamation in Clearfield County PA constructed in 1998-2001 with about 425,000 CY from the Port of NY/NJ used to restore about 15 acres. Though others have been proposed and some completed, none has used marine dredged material. The cost of rail transport over significant distances to Pennsylvania, and the multiple re-handling operations required, makes such an option much more costly compared to other alternatives. It must also be noted that without a project specific proposal it is not possible to determine whether any reclamation opportunities would exist for particular materials. Project sediment testing to support such decisions would not occur until a specific dredging project was proposed. Further, whether such an alternative would be available in the future could only be determined at that time.

Rail transport was used in developing costs of beneficial use involving a typical mine reclamation project in central PA for the DMMP's cost matrix tool. Use of rail transport would only be possible for a portion of the transport route between dredge and placement sites, with re-handling and trucking required to move material from a waterfront processing facility to the rail access, then at the other end of the trip from the rail siding to the destination at the reclamation site. Multiple re-handling operations result in significant cost increases. None of the upland placement sites identified in the study had direct rail access, and all but the largest harbors in the region do not have waterfront rail access.

The Flushing Airport site has limited capacity. Another recently identified site in New York may have several million cubic yards of capacity. The cost of transportation from dredging centers in Connecticut and eastern New York to areas outside of the coastal zone within the LIS dredged material source area makes this an expensive option for all material, except that which cannot be placed at any of the existing sites, used for other more local beneficial uses, or placed in local containment facilities.

4.9.13 Other Dredged Material Placement Alternatives

Transportation Infrastructure: Dredged sediment may be used as construction fill for transportation infrastructure projects such as construction of roadways, railroads, and airports. However, engineering and regulatory requirements of construction fill for these types of projects can be substantial. In general, construction fill material is required to exhibit sufficient engineering properties as determined through geo-technical testing.

Construction Fill: Clean or contaminated dredged sediment may be used as construction fill in nearshore or upland applications as a beneficial reuse alternative, subject to regulatory constraints and requirements. Two examples are presented: (1) use as nearshore fill and (2) use as sub-grade fill for transportation projects (e.g., roadways, airports, parking lots, etc.). Historically port fill has been, by far, the most important type of end use of dredged material in the region. Dredged material placed by bucket or pipeline has been used to fill shallow water and low-lying areas around many harbors to develop port terminals for shipping and harbor landings for public access.

All material currently dredged from New York Harbor is beneficially used either as remediation material placed at the HARS, or at one of a number of Brownfields and development sites. Sand removed from Federal channels along the south shore of Long Island is placed on adjacent beaches. Most of New York's dredged material from New York Harbor, the East River and western areas of LIS, is used in a number of sites that require amended and un-amended dredged material for permanent and daily landfill cover, and for capping of Brownfields prior to development. Between 2009 and 2014, approximately 7,377,800 CY of New York's dredged material was placed in one of 32 sites. Starting January 2015, the New York/New Jersey Harbor Regional Dredging Team has identified a total of 12 sites for upland placement of dredged material, including two mine sites in Pennsylvania, and the Tire Pond located outside Hartford, Connecticut. The Tire Pond site however, is now undergoing closure and will only be available for another two to three years. It is estimated that the remaining available capacity of the open sites in New Jersey is approximately 1,277,400 CY.

4.9.14 Treatment

For this study, treatment refers to any method used to decontaminate, bind, or enhance previously unsuitable dredge material to make it more suitable for beneficial use elsewhere. In the case of uncontaminated, fine-grained sediments, treatment may include adding binding agents or sand to render the material suitable for use in structural fill applications. In the case of contaminated sediments, treatment will include a first step to remove or isolate contaminants to prevent them from leaching out of the sediment. A second step may include enhancing the physical qualities of the dredged material to make it more suitable for construction applications. For some treatment alternatives (e.g., cement stabilization) both of these steps may occur at the same time. Treatment technologies, including cement stabilization, sediment washing, sediment blending, sediment separation, thermal desorption, and hybrid or treatment, storage, and reprocessing (TSR) sites, are described in the following sections. The New York District's recent experience with treatment technologies, demonstrations and research in the Port of New York and New Jersey is provided in Appendix H and summarized as follows.

Cement Stabilization: The stabilization alternative involves stabilization and solidification of contaminated dredged material with cement-based additive mixes to convert contaminants in the material into their least soluble, mobile or toxic forms and enhances the physical properties of the material. The technology, commonly known as cement stabilization, has been widely used in upland soil remediation projects. Its application to contaminated marine dredged materials, however, has been relatively limited, due partly to the large volumes of the materials involved per project, special material handling requirements, and special physical and chemical characteristics of marine dredged materials.

Certain types of dredged material can be substituted as raw material for manufacturing Portland cement. Proprietary commercial processes, such as Cement-Lock/Ecomelt, have been developed to create a product that can be ground to a powder and mixed with Portland cement (up to approximately 40%) as filler. In 2005 a demonstration project sponsored by the New Jersey Department of Transportation, Office of Maritime Resources was initiated to determine if a decontamination processing plant could function to process dredged material into a product that could be used at a cost that was competitive with other management options (upland placement, CDF, etc) for dredged material. A demonstration plant in Bayonne successfully created Ecomelt and EcoAggMat containing low levels of contaminants using dredged material from Newark Bay. More highly contaminated sediment dredged from the Passaic River was used to conduct additional tests in a second project phase, after modifications to the plant to improve performance.

The additional tests suffered from equipment and weather-related issues that suggest further and more extensive plant modifications. The resulting Ecomelt was blended into Portland cement to create a blended concrete that was used in a general construction demonstration project at Montclair State University. Approximately one ton of Passaic River sediment processed in this manner was used as a partial replacement for Portland cement that was then used successfully as sidewalk and geotechnical fill. The results of this test program indicated that due to its high cost and limited capacity for processing the dredged material, that this technology was more appropriate for heavily contaminated materials, not dredged material that has far less concentrations of contaminates.

The Passaic River Coalition, a regional environmental group with a focus on the Passaic River Basin, received a grant to evaluate the technologies either being tested in other areas in the Harbor and for the Lower Passaic River, with a special consideration for the effect on dioxin contaminated sediments and how these technologies might be applied to the Diamond Alkali Superfund site located on the Lower Passaic River. Reviewers noted that the process seemed to be able to remove PCBs and dioxin from the final product and resulted in a high quality concrete paving material. The National Advisory Council for Environmental Policy and Technology, a US EPA advisory board, supports the use of the Cement-Lock technology in the cleanup of the Lower Passaic River and Newark Bay.

Sediment Washing: Sediment washing as a treatment technology for contaminated sediments typically refers to a process that involves slurrying the contaminated dredged material and subjecting the slurry to physical collision, shearing, and abrasive actions and aeration, cavitation, and oxidation processes while reacting with chemical additives such as chelating agents, surfactants, and peroxides. In doing so, the contaminants are transferred from the sediments to the water phase in the process. The washed material is then dewatered using hydrocyclones and centrifuges or by settling to a point where 70 to 80 percent of the solids remain. The process water containing the contaminants is collected and treated and the washed material beneficially reused. Primary issues of concern associated with the traditional sediment washing process include treatment requirements for the residual effluent water, and the end use of the dewatered fine material cake, which is a primary product if the dredged material consists predominantly of silt and clay.

In 2005 and 2006, BioGenesis Enterprises completed a pilot project and demonstration scale tests of their sediment washing technology at the Bayshore Recycling Facility in Keasbey, New Jersey. The technique involves aggressively mixing a slurry of dredged material and surfactants then extracting the mineral from the water/organic faction of the sediment. The clean aggregate that is left can be used as a base for topsoil manufacture. In its testing, BioGenesis treated about 15,000 CY of sediment from the Raritan River, Arthur Kill and Passaic River, in the vicinity of the Diamond Alkali Superfund site, and the treated material was used in the remediation of a Brownfields site. The decontamination successfully showed this technology has the potential to process dredged material. The material did have levels of arsenic that exceeded unrestricted use but when blended with a topsoil/sand mixture it met the standards for residential use in New Jersey and Connecticut. Some of the material was provided to a demonstration project at Montclair State University and to Connecticut. The projected cost based on an annual processing rate of 250,000 CY was anticipated to be competitive with other dredged material management costs (NJDOT/OMR 2015b; BioGenesis 2009). Some of the issues related to this process are that the economics are based on processing 24 hours a day, seven days a week which may not be possible in LIS communities, and any shutdown of processing due to site restrictions or the availability of dredged material requiring treatment would significant affect the treatment economics. With the limited treatment capacity another issue is the requirement of storage over and extended time period (from larger dredging projects), and the cost of those storage facilities which were not included in the project economics.

The Passaic River Coalition evaluated the BioGenesis sediment washing project in 2012. Based on their assessment, the reviewers determined that this treatment is not appropriate for sediments contaminated with PCBs or dioxin. Their concern is that the PCB contaminants would be present in the waste water that would be sent to the sewage treatment plant where they would contaminate the treated water. In addition, the Coalition was concerned that the dioxin would be present in the sewage treatment plant water as well as the manufactured soil (Kruger and Filippone 2012).

Sediment Blending: Sediment blending is not a true treatment technology in that is does not reduce or eliminate contaminant concentrations, except through dilution with cleaner material. The alternative involves blending the fine-grained contaminated dredged material with borrowed clean sandy material to create an aggregate that exhibits enhanced engineering properties and reduced apparent contamination levels. One of the primary issues of concern with sediment blending is the cost of obtaining large quantities of the clean sand required to achieve the treatment objective. Other issues include: (1) the availability of borrow materials; (2) costs associated with large-volume material handling; (3) the methods used to achieve the specified level of blending; (4) land availability for the blending facility; and (5) cost for dewatering. Also of concern are the environmental acceptability and the engineering properties of the material after blending.

Manufactured Topsoil: To create manufactured topsoil, processed dredged material is amended with organic matter, such as wood chips, yard waste, animal manure or other biosolids and composted. The resulting material can be used to supply organic content and nutrients to depleted agricultural soils. Dredged material with fine sediments processed in this way, may also be used to reduce the percolation rate of rainwater promoting soil moisture (IRC 2007).

In 2005 and 2006, approximately 205,000 cubic meters of dredged material was removed from Naval Weapons Station Earle (NWSE) located along Raritan Bay in New Jersey as part of maintenance dredging of the NWSE wharf. This material was transported to the Shirley Plantation confined disposal facility located in Virginia. The Shirley Plantation site was developed between 2000 and 2005 as a pilot project to determine if dredged material could be used to create agricultural soil using material dredged as part of the replacement of the Woodrow Wilson Bridge (Baker et al 2007; Haus 2011; Weaneck Land LLP 2012).

After dewatering for several years, common sunflower and German millet were over seeded but the salt levels in the soil stunted or killed all of the plants. No vegetation was present on the site before 2009, with the exception of a few clumps of salt-tolerant species. After 2009, a crop of winter wheat was established. The project also reported no negative environmental impact as a result of the placement of the saline dredged materials into the area (Haus 2011).

In 2010, 70,000 CY of saline dredge material from the US Navy Cheatham Annex in Yorktown, Virginia, was placed in the same area as the NWSE material. The Cheatham Annex material was lower in salt and had no contaminants. The purpose of this placement was to fill in low wet areas in the NWSE area to reestablish wheat production. By 2012, the site was dried and low enough in salts for winter wheat production. Some of the material from the NSWE cell has been used and is awaiting its next project for full agricultural production (Weanack Land LLP).

Sediment Separation: Sediment separation is a procedure where, through a series of mechanical processes, sediment particles are separated into sands and finer grained fractions for beneficial reuse. Since contaminants are typically bound to the organic layers of fine-grained particles, the first step (sand separation) is usually quite effective in producing a clean product, which can then be beneficially reused without further treatment, and a fine grained particle slurry containing most of the contaminants. The fine-grained particle slurry can then be subjected to a series of mechanical and chemical processes (e.g., flocculants) to further separate and concentrate the contaminants, eventually resulting in a manageable waste stream that can be de-watered and disposed of through conventional means. Issues of concern for the use of this alternative include: (1) contractor availability in the region; (2) high production costs due to variable dredge material supply; (3) nearshore space for a treatment facility; and (4) a disposal area or beneficial use for the treated product.

Thermal Desorption: Thermal desorption system is an ex-situ technology applying direct and indirect heat to contaminated material, such as sediment, soil, or sludge, to vaporize the contaminants. Thermal desorption system is a thermal induced physical separation process and is not designed to destroy contaminants. Contaminants and water are vaporized from a solid matrix and transported by either a carrier gas or vacuum system to a gas treatment system. The bed temperatures and residence times designed into these systems will volatilize selected contaminants but will typically not oxidize them. This gas can then be treated by a number of secondary treatment processes. The residual contaminant levels achieved are usually low to non-detect (EPA 2001; FRTR 2002; and NFESC 1998). There are a variety of thermal desorption systems available: rotary dryer, thermal screw, heated ovens, and hot air vapor extraction (HAVE).

Vitrification, another variant of this process is conducted at temperatures sufficiently high to melt the sediment particles, resulting in the formation of a glass aggregate. This process is currently offered for contaminated dredge sediments (McLaughlin et al. 1999) and has been shown to eliminate and sequester the contaminants, producing a final product that should be free from the liabilities associated with some of the less effective treatment alternatives. The downside to this technology is that the process requires significant electrical energy to generate extremely high heat produced by an electric arc furnace, and thus costs significantly more than many of the other treatment alternatives.

A similar concept has been developed in New Jersey by the New Jersey State Department of Transportation and has been in operation for several years. In this case, up to 382,300 m^3 of sediment are transported to a facility located in the port district, where is dried and treated to create beneficial use products such as manufactured topsoil and engineered fill material for use in construction projects. In addition to proving a stabilized manufactured fill material for use in roadway and Brownfield projects, the facility offers a low-cost disposal alternative for small quantity generators such as marinas.

Upcycle Associates completed a pilot project to manufacture lightweight aggregate from dredged material. After mixing the dredged material with shale fines, the material is pelletized and heated in a kiln, where the organics are vaporized. The remaining material is inert and suitable for use in concrete applications as lightweight aggregate. The pilot program indicated the material produced did not contain detectable organic pollutants and no leachable metals, thereby meeting the goals of the program (Upcycle Associates, 2004; NJDOT/OMR 2015b).

Chemical Oxidation: Based on the success of a pilot project to process and decontaminate about 650 gallons of dredged material, a demonstration project was initiated in 2005 to test the process' effectiveness on a commercial scale. The process used consisted of chemical oxidation through the addition of potassium permanganate to reduce contaminants. The potassium permanganate is added in an aqueous solution followed by mechanical dewatering with the addition of cement for solidification and stabilization. The results indicated that contaminant reduction could be achieved through the addition of chemicals and use the resultant material, with the addition of cement, as fill and/or capping material. Furthermore the economic analysis associated with the demonstration project indicated the range of processing costs (based on 2005 dollars) centered on the target cost of $35 per cubic yard (HREG 2005) for this processing method.

PROPAT® Additive for Fill Material: As part of the dredging of the Claremont Channel, NJ in New York Harbor, a demonstration project was conducted to evaluate the use of PROPAT® as an additive to condition dredged material for use as fill. The Claremont Channel project involved the removal of about 750,000 CY of unsuitable material between 2000 and 2003. PROPAT® is a trademarked product of Hugo Neu Schnitzer East, and is manufactured from the non-metallic materials recovered from scrap cars, white goods, and other objects, and combined with a proprietary mix of additives. The use of PROPAT® has been approved as interim daily landfill cover and as 'cushion material' above the liner at landfills in New Jersey (Hart Crowser, June 2005 Final Report).

Although a number of decontamination technologies were tested, and some indicated potential, none are currently used on a regular basis in the New York-New Jersey Harbor. Nor has any of these technologies become a measure that is regularly used to decontaminate sediments. The one exception is the Cement-Lock/Ecomelt technology, which may continue to be explored to remediate the sediments removed from the Lower Passaic River Superfund sites. The alternative currently in use is the capping and filling Brownfields, landfills and other sites with dredged materials.

4.10 Multi-Criteria Decision Analysis

Multi-Criteria Decision Analysis (MCDA), is a tool to allow for different viewpoints to be heard and add transparency to a decision-making process, while considering stakeholder views. Stakeholder values on evaluation factors for potential dredged material management alternatives as part of the Long Island Sound (LIS) Dredged Material Management Plan (DMMP) were identified by the US Army Corps of Engineers, New England District in partnership with members of the Engineer Research and Development Center (ERDC) Risk and Decision Science Team.

A working-group of representatives from various stakeholder organizations was formed and consulted to help identify priorities that would be used in screening potential sediment management alternatives for each dredging center in the LIS region. The working group collaboratively built a decision model that framed the problem of dredged material placement in terms of dredged material type, potential alternatives, criteria, sub-criteria, and metrics relevant to the LIS stakeholders. An elicitation of preferences, represented as criteria weights, was then conducted. By soliciting stakeholder preferences, the process sought to increase stakeholder involvement at the front-end of the prioritization and lead to improved stakeholder buy-in in the results.

Individual interviews were also conducted to elicit judgments regarding the importance of the developed criteria such as environmental media, ecological receptors, economics, and human welfare in relation to the alternatives. Through those interviews and surveys, each representative of a stakeholder organization was able to contribute their view of the relative value/utility of different environmental impacts, health risks, social benefits, economic costs, and other high-level criteria in the context of dredged material placement.

Typically, MCDA has a number of significant issues that should be communicated when results are presented; including that it doesn't account for the fact that participating parties may not be spending their own resources, so there is a bias to overestimate the importance of supported criteria. A balance of diversity among the participants is necessary.

The elicitation process was conducted to fairly and transparently integrate divergent stakeholder views in a way that lets all participants voice their preferences and concerns without one voice or viewpoint dominating the discussion. Results showed that, in general, stakeholders tended to agree that all criteria were at least somewhat important, with the exception of a few notable outliers that weighted the economics criterion extremely heavily. However, on average there was a strong relative agreement among the diverse stakeholder group of the importance of both navigation access and environmental protection.

The final report on the MCDA conducted for the LIS DMMP, titled, Stakeholder Elicitation for Long Island Sound Dredged Material Management Plan, December 2013, provides details on the MCDA process followed in this study and is included on the compact disk accompanying this report as supporting technical investigations document #12.

4.11 Real Estate Requirements for Federal Participation

With the exception of placement alternatives that are entirely subtidal (open water, nearshore bars/berms, CAD Cells, and island CDFs not connected to intertidal or supra tidal lands), real estate interests would need to be acquired to enable design and construction, monitoring, mitigation, and future maintenance activities. With limited exceptions (lands already in Federal ownership and some lands required for Section 111 shore damage mitigation projects), acquiring the necessary real estate interests is a non-Federal Sponsor responsibility under USACE civil works programs. While real estate must be acquired at 100 percent non-Federal cost, under some program authorities, credit may be available to the Sponsor to offset their cash contribution towards project implementation. This would need to be determined on a project-specific basis according to the project authority.

Where lands are needed to construct and operate upland placement facilities, generally fee title is required for disposal and borrow areas required for future maintenance work, and disposal areas located on fast land that are required for commercial navigation projects for harbors and inland harbors (See: ER405-1-12, Chapter 12, Section 12-9, b.(3) and (7)). Where a non-Federal Sponsor is paying the entire incremental cost of an alternative placement plan, real estate interests necessary to design, construct and monitor that project must still be secured by that Sponsor.

Where dredged material is used as beach nourishment, non-Federal Sponsors must at a minimum provide executed easements from landowners allowing access for design and construction, monitoring and future maintenance. Where Federal or State listed threatened or endangered species are present or may reasonably be attracted to the area, easements typically include provisions for future ecological monitoring, and restrictions on some land uses when these species are expected to be present.

In most instances where dredged material from a Federal project is used to directly nourish beaches, and that work is pursued under an eligible Federal authority, the nourished beach area must also allow for public access, typically for the 50-year economic life of the nourishment project. Real estate interests would need to include public access provisions, open to all on an equal basis without regard to residency, and local interests may also be required to provide parking, dune over walks and other amenities supporting public access and use of the beach.

The above are examples of typical real estate requirements for Federal participation in design and construction of onshore and upland placement projects and facilities. As specific projects are funded for future study, design and construction, and alternative placement options are investigated and proposed, real estate and other requirements will need to be identified, costs estimated, and responsibilities for securing such interests defined. Other considerations, such as Federal requirements for relocation expenses, and the impact of navigation servitude on the applicability of Federal payment and credit, may also require determinations.

Beyond the Federal requirements for real estate, states may have additional requirements that project proponents (sponsors in the case of Federal projects) would need to satisfy. One such example is the shellfish leases that Connecticut issues to oyster growers. If construction of a CDF, CAD cell, or other placement alternative included areas occupied by existing intertidal or subtidal leases, those interests would need to be acquired by non-Federal interests.

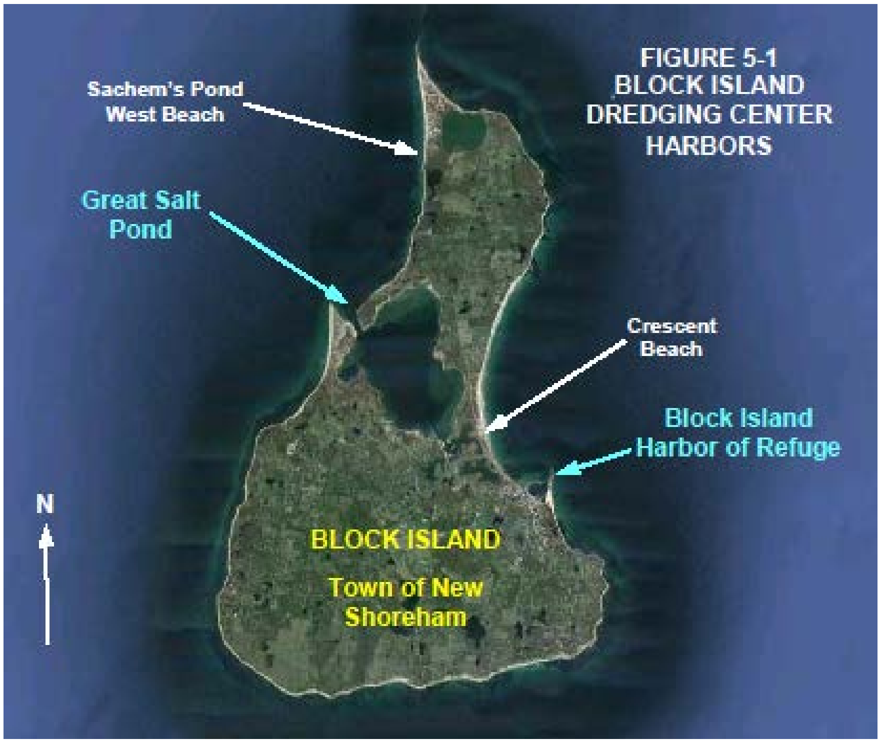
5 FORMULATION AND EVALUATION OF DREDGED MATERIAL MANAGEMENT PLANS BY DREDGING CENTER

Dredged Material Management Planning for the individual Federal Navigation Projects was accomplished by examining the needs of each FNP separately and the opportunities available for each dredging center as wells as regionally. Using the step-by-step process outlined in Chapter 4, each project and dredging center was examined for dredging history, future dredging needs, characterization of sediments likely to be dredged, alternative placement options currently available or that could potentially be developed for those sediments in each dredging center and regionally, a screening process (detailed in the PEIS), which ranked the available or potential options, and cost analysis of the options. The following sections of this chapter examine each dredging center, the USACE FNPs and facility needs of other Federal agencies individually, and the general needs of non-Federal interests by dredging center. Following these sections regional dredged material management measures, such as large-scale CDFs and potential out-of-region solutions will be discussed, along with potential Federal authorities for participating in solutions beyond the identified Federal base plans.

All distances from dredging to placement sites are in statute miles and are based on haul distances by water and/or road. All costs shown are per cubic yard, and include the cost of sediment sampling and testing, environmental documentation, coordination and permitting, preparation of design plans and specifications, contracting, mobilization/demobilization of construction plant and equipment, surveys, dredging, transport and placement of dredged material, processing of dredged material, construction of any containment facilities, tipping fees, capping, inspection and monitoring.

5.1 Block Island Dredging Center

The Block Island Dredging Center encompasses the harbors of Block Island, Rhode Island incorporated as the Town of New Shoreham. There are two harbors, each of which has a FNP. These are Block Island Harbor of Refuge (otherwise known as Old Harbor), and Great Salt Pond (New Harbor). Block Island is a remnant portion of glacial end moraine with many areas of eroding bluffs and beaches. These present a likely unlimited opportunity for beneficial use of dredged sand for nourishment purposes so long as other resources such as SAV and shellfish can be avoided.



5.1.1 Federal Navigation Projects - Maintenance

The dredged features of the two FNPs in this dredging center have each been maintained most recently as shown below.

Table 5-1
Federal Navigation Project Dredging History – Block Island Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Block Island Harbor of Refuge (Old Harbor) *Currituck* Dredging	2014	8,300	Nearshore	Suitable Sand
	2013	30,000	Nearshore	Suitable Sand
	2012	20,000	Nearshore	Suitable Sand
	2011	19,800	Nearshore	Suitable Sand
	2009	7,700	Nearshore	Suitable Sand
	2006	18,600	Nearshore	Suitable Sand
	2000	39,500	Nearshore	Suitable Sand
	1999	10,000	Nearshore	Suitable Sand
	1995	27,400	Nearshore	Suitable Sand

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Great Salt Pond (New Harbor)	2013	17,100	Nearshore	Suitable Sand
	2012	18,700	Nearshore	Suitable Sand
	2010	18,900	Nearshore	Suitable Sand
	2009	30,300	Nearshore	Suitable Sand
	2004	8,800	Nearshore	Suitable Sand
	2000	13,700	Nearshore	Suitable Sand
	1982	52,500	Nearshore	Suitable Sand
	1972	55,300	Nearshore	Suitable Sand

Block Island Harbor of Refuge: The dredged features of the FNP for Block Island Harbor of Refuge consist of a 15-foot entrance channel, a 15-foot anchorage, and an inner basin consisting of a 15-foot central portion and 9-foot corner portions. The FNP also includes two rubblestone breakwaters enclosing the harbor, and smaller stone walls enclosing the inner basin. In the past the timber wharves along the east and south sides of the inner basin were also included in the FNP and maintained by the Federal Government. Portions of the inner basin walls and wharves have been deauthorized and turned over to local control. Material dredged for maintenance of this harbor is predominantly sand; however, in the past more silty-sand material was sometimes found in the 9-foot areas of the inner basin.

The harbor was last maintained in 2014 when about 8,300 CY was removed from the entrance channel by the US hopper dredge *Currituck* and placed nearshore off Crescent Beach (Survey BHR-240, 2013). Since 1995 the harbor has been dredged nine times, all with nearshore placement. The average annual shoaling rate over this period has been about 9,600 CY. It is estimated that this project will continue to require maintenance dredging of the 15-foot entrance channel and inner basin about once every three years and generate about 28,800 CY per operation (3 x 9,600 CY). Use of the *Currituck* or another small hopper dredge on an annual or semi-annual basis could be expected to generate the same total volume over time.

The 15-foot anchorage was last surveyed in 2012, when a shoal volume of about 27,500 CY was estimated for that project feature (Survey BHR-238, 2012). The last prior maintenance of the anchorage was in 1982, yielding an annual shoaling rate of about 900 CY for this project feature. It is estimated that the anchorage will require maintenance within the next five years to remove accumulated shoal material. If anchorage maintenance were to occur in 2016 when the entrance channel is likely next maintained, then a total of 31,100 CY of shoal material could be expected in the basin (27,500 + 4 x 900 CY). In the future, should the anchorage be maintained on a 15-year cycle it could be expected to generate about 13,500 CY per operation (15 years x 900 CY/Year).

A small amount of material from the southwestern area of the inner anchorage was shown to be silty sand in the 1990s and has not been dredged since that time as it was determined unsuitable for beach or nearshore bar placement. That material totals only about 2,200 CY.

The dredging activity timeline over the DMMP planning horizon for the Block Island Harbor of Refuge FNP is shown below.

Table 5-2 Dredging Activity Timeline – Block Island Harbor of Refuge FNP, Rhode Island						
Block Island Harbor of Refuge FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Entrance Channel & Inner Basin	57,600	57,600	28,800	57,600	57,600	28,800
Anchorage	31,200		13,500			13,500
Anchorage (SW End)	2,200					
Total Sand	88,800	57,600	42,300	57,600	57,600	42,300

Great Salt Pond: The dredged features of the FNP for Great Salt Pond consist of an 18-foot deep entrance channel, 300 feet wide, connecting deep water in Block Island Sound to deep water in Great Salt Pond. The project also includes a 1,050-foot long rubblestone jetty on the south side of the inlet. Originally the channel was dredged in three stepped depths and widths, with a 25-foot center cut 150 feet wide, an 18-foot deep middle cut 300 feet wide, and a 12-foot outer cut 600 feet wide, all initially completed in 1908. Unconstructed portions of this project including a north jetty, widening the entrance channel, and a 12-foot deep channel and anchorage in the inner harbor (Trims Pond) were deauthorized, leaving only the 18-foot deep entrance channel. In recent decades only the 18-foot by 300-foot cut has been maintained, to a reduced depth of -12 feet deep at MLLW (the depth required by the deepest-draft vessels currently using the harbor), as available funds allow. Material to be dredged at this location is predominantly sand.

The harbor was last maintained in 2013 when about 17,100 CY was removed by the *Currituck* and placed nearshore off the beach west of Sachem's Pond (Survey GSP-178, 2013). Since 1962 the harbor has been dredged nine times, all with nearshore placement. The average annual shoaling rate over this period has been about 4,700 CY. It is estimated that this project will continue to require maintenance dredging of the 18-foot entrance channel, to a reduced depth of 12 feet, about once every three years and generate about 14,100 CY per operation. It is anticipated that this work would be done concurrently with maintenance of Block Island Harbor of Refuge. The dredging activity timeline over the planning horizon for Great Salt Pond is shown below.

Table 5-3 - Dredging Activity Timeline – Great Salt Pond FNP, Rhode Island						
Great Salt Pond FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Entrance Channel	28,200	28,200	14,100	28,200	28,200	14,100

5.1.2 Harbor Characterization for Federal Navigation Project Maintenance

Block Island Harbor of Refuge FNP: Dredged sediments at Block Island Harbor of Refuge have been sampled and tested seven times from 1973 to 1997. Material from the entrance channel, the majority of the anchorage and inner basin has been shown to be clean sand ranging from 0.1 to 12 percent fines (see the November 1999 and May 2006 Environmental Assessments for Maintenance Dredging). In some of these earlier testing events, materials from the inner areas of the inner basin and from the southwest slope of the anchorage were found to be silty sands to sandy silts of 24 to 69 percent fines and 22 to 32 percent fines, respectively. During those events, maintenance of those areas with finer-grained sediments was avoided.

Historically, sandy material dredged from this harbor was removed by mechanical bucket dredge, placed in scows and towed for nearshore placement off the state beach (Crescent Beach) located a short distance north of the anchorage breakwater. The Federal Government modified hopper dredge *Currituck* has also been used for dredging of the entrance channel with nearshore placement off Crescent Beach. Potentially, the material could be pumped directly onto the southern end of the beach at a greater cost than nearshore placement if a non-Federal party were willing to pay the difference in cost. Alternatively, the material could be pumped to beaches south of the harbor, or placed nearshore an even greater distance in either direction if needed to address erosion issues elsewhere on the island.

The sandy material could also be placed at an ocean site, the closest being the Rhode Island Sound site (RISDS), located several miles northeast of Block Island. However, this would not be the best use of sandy material that is typically beneficially used. The material could also be placed upland, with dewatering and re-handling if found cost-effective for some public purpose. However, no such upland purpose on the island was identified by this study.

Should silty material not suitable for beach or nearshore placement be encountered in the future in the anchorage or the inner basin, that material could be placed in an ocean site (if found otherwise suitable), with Rhode Island Sound being the closest site, or the material could be dewatered and placed upland. No sites of sufficient size for dewatering even a small portion of material were evident along the Old Harbor waterfront. However, there are several small public parks and parking lots in the vicinity that could be used, if necessary, for smaller volumes. Alternatively lined trucks could be used to transport material that would be dewatered on-site upland. If determined necessary this would require further investigation in the future.

Great Salt Pond FNP: Historically, sandy material dredged from the Great Salt Pond FNP has been placed in nearshore areas off beaches a short distance from the project. In recent operations material has been placed at Sachems Pond West Beach located north of the inlet. Dredging has been accomplished either by hopper dredge or by mechanical bucket dredge (placed in scows and towed for nearshore placement). The *Currituck* has also been used for dredging of the entrance channel with nearshore placement west of Sachem Pond.

There have been three recent NEPA documents covering maintenance dredging of the FNP for Great Salt Pond. An August 2000 Environmental Assessment (EA) covered emergency maintenance dredging of the inlet channel in that year, with placement of the material nearshore off Crescent Beach on the east side of the island. That EA relied on channel sediment sampling conducted in 1988 which showed the materials to be less than one percent fines. Sampling over a larger area of the inlet channel in 1991 showed a range of one to seven percent fines. Another EA for maintenance dredging finalized in June 2004 relied on those same sampling events and covered nearshore placement of the channel materials dredged that year nearshore off of Charleston Beach southwest of the inlet. That nearshore placement site had natural bottom materials that were siltier than the dredged materials. A May 2009 EA and its accompanying suitability determination, still relied on today, covered maintenance for a ten-year period with placement nearshore off the beach west of Sachem's Pond, located north of the inlet. That EA included results on channel sediment sampling and testing conducted in 2001 which showed materials of less than one percent fines.

In the future, dredged material from the inlet channel could be pumped directly onto the beaches north or south of the inlet, or placed nearshore elsewhere along the Island's shores as has been done in the past. The greater the distance of the placement site from the inlet the greater the cost for such placement. Use of any placement site other than the least cost environmentally acceptable site and method would only be undertaken if a non-Federal party were willing to pay the difference in cost.

The sandy material from Great Salt Pond could also be placed at an ocean site, the closest being the Rhode Island Sound Site, located several miles east of Block Island. Other open water sites in Connecticut and New York are more distant as shown in Table 5-6 below. However, this would not be the best use of sandy material that is typically beneficially used. The material could also be placed upland, with dewatering and re-handling if found cost-effective for some public purpose. However, no such upland purpose was identified by this study.

5.1.3 Other Federal Agency Dredging Activities

The US Coast Guard Station, Block Island, located at the entrance to Great Salt Pond, is manned as a search and rescue (SAR) operation during the summer months, under the command of Station Point Judith. This facility is located directly on the Federal inlet channel, and is not projected to require dredging during the DMMP planning horizon. There are no other non-USACE Federal dredging activities or facilities in the Block Island Dredging Center.

5.1.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Block Island Dredging Center. Large marina operations are located in Great Salt Pond. Municipal slip areas are located in the Inner Basin of the Block Island Harbor of Refuge and in the Trims Pond (Inner Harbor) area of Great Salt Pond. Several ferry operators work out of both harbors (seasonally at Great Salt Pond), connecting Block Island with Point Judith Harbor, Rhode Island, New London Harbor, Connecticut and Lake Montauk Harbor, New York. These private permit activities typically generate sandy dredged material, though not always suitable for direct beach placement. Where sand material is encountered, beneficial uses such as beach, nearshore or upland applications are available and should be considered when practicable. Ocean placement is an environmentally acceptable and cost effective alternative when other more beneficial uses are not practicable, with the RISDS being the closest approved site.

Table 5-4 - Dredging Activity Timeline – Block Island Area Dredging Center Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	6,000	6,000				
Improvement	6,000	18,000				
Total Non-Federal	12,000	24,000				

5.1.5 Placement Alternatives Available to Dredging Center Activities

This dredging center is expected to produce a large volume of sand suitable for beach nourishment, nearshore placement, and other beneficial uses over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance generating 30,000 CY or more every three years are anticipated. Most dredged material from this dredging center, over at least the past half century has been placed nearshore off nearby public beaches. Several investigations of dredged material management alternatives identified the following as potential opportunities for placement of dredged material for projects from this dredging center. Detailed descriptions of the alternative sites were provided in the Placement Alternatives section earlier in this DMMP.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells or COW sites. Placement alternatives that should be considered for suitable fine-grained materials in this dredging center include open water placement, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-5 - Block Island Dredging Center – Available Placement Alternatives				
Block Island Dredging Center	Site Type	CY Capacity	Years Available	Material Accepted
Crescent Beach Berm	Nearshore	192,300	Recurring	Suitable Sand
Crescent Beach	Beach	66,700	Recurring	Suitable Sand
Sachem's Pond West Beach Berm	Nearshore	194,500	Recurring	Suitable Sand
Sachem's Pond West Beach	Beach	66,700	Recurring	Suitable Sand
Shadmoor State Park Berm	Nearshore	33,700	Recurring	Suitable Sand
Misquamicut State Beach, RI	Nearshore	70,500	Recurring	Suitable Sand
Asharoken Beach, NY Berm	Nearshore	248,300	Recurring	Suitable Sand
Bradley Point, Savin Rock & Oak Street Beaches, West Haven, CT	Nearshore	214,700	Recurring	Suitable Sand
Theodore Roosevelt County Park & Gin Beach, NY	Nearshore	202,400	Recurring	Suitable Sand
Hither Hills State Park, NY	Nearshore	276,100	Recurring	Suitable Sand
Hashamomuck Cove Beach, NY	Nearshore	115,100	Recurring	Suitable Sand
Watch Hill/Napatree Pt Beaches	Nearshore	154,900	Recurring	Suitable Sand
Sherwood Island Borrow Pit Open-Water CAD	COW Fill	266,000	All Until Full	All
	COW Cap	484,000		All Suitable
Morris Cove Borrow Pit CAD cell	CAD Fill	466,100	Until Full	All
	CAD Cap	150,000		All Suitable
Faulkner Island CDF - Fill	Island CDF	16,010,200	All Once Built	All
- Cap		1,169,800		All Suitable
Rhode Island Sound DS	Ocean	16,500,000	All	All Suitable
New London Disposal Site	Ocean	7,796,500	All	All Suitable
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
110 Sand Co. Site, Melville, NY	Upland	1,000,000	All	All Suitable
Brookhaven Town Landfill NY	Upland	700,000	All	All
Manchester City Landfill, CT	Upland	1,200,000	All	All

Beach and Nearshore Nourishment Sites: The shoreline of Block Island is composed of long sandy beaches and high bluffs composed glacial end moraine deposits. The southern and eastern shores of the island are subject to rapid erosion due to their exposure to the North Atlantic. Dredged sand on Block Island is most commonly used for nourishment purposes either through direct placement on the beach or placement as berms in nearshore feeder bars. Crescent Beach in the east and Sachems Pond West Beach on the northwest shore have been nourished with dredged materials for the past several decades. Other beaches in southern Rhode Island and eastern Long Island New York were also identified as potential candidate receiving beaches for this material; however, it is unlikely that any would be used given the acute needs of Block Island.

Table 5-6
Scow Haul and Pipeline Distances to Beach and Nearshore Placement Sites

Project (Distances in Statute Miles)	Crescent Beach		Sachems Pond West Beach		Other Nearshore Sites by Scow		
	Nearshore by Scow	Pipeline	Nearshore by Scow	Pipeline	Misquam-icut	Watch Hill	Sandy Point
Block Island Harbor of Refuge	0.9	0.9	7.4	NA	18.6	22.0	24.5
Great Salt Pond Inlet Channel	8.4	1.4	1.9	1.9	14.2	17.0	19.5

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Rhode Island Sound Site (outside the LIS region). The New London, Cornfield Shoals, Central Long Island Sound, and Western Long Island Sound sites are located farther to the west in LIS. Any of these sites could receive any suitable material, either sandy or fine-grained. As part of its deepening project studies for New London Harbor and the lower Thames River, the U.S. Navy investigated several potential open water sites in Block Island Sound located between Block Island and Fishers Island. These sites were further investigated by the U.S. EPA in recent years as part of its ongoing study efforts in LIS and adjacent waters.

Table 5-7 - Scow Haul Distances to Open Water Placement Sites (in Statute Miles)

Project	RIS DS	SHDS	MRDS	NLDS	NBDS	Orient DS	Sherwood Island Pit
Block Island Harbor of Refuge	10.1	24.9	29.5	34.1	38.1	42.3	98.2
Great Salt Pond Inlet Channel	14.3	19.0	23.6	27.3	31.8	35.2	91.8

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites could be developed for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive suitable materials from this and other dredging centers, as either fill or cap material. Additionally, the Morris Cove borrow pit could receive unsuitable materials as fill, since this site is located inside the harbor and not in the waters of LIS.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites identified by the screening process as applicable to this dredging center were limited to the Falkner Island CDF site offshore of Guilford, CT.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. While no such opportunities were identified for Block Island one such marsh creation site is located at Sandy Point in Little Narragansett Bay, RI to the northwest.

5.1.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for dredged material management of dredged material from each Federal Navigation Project needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. Other alternatives can be recommended but those that cost more than the Federal Standard would require a non-Federal entity to provide funds for the additional cost

Block Island Harbor of Refuge: Future maintenance of the Block Island Harbor of Refuge FNP will yield predominantly coarse-grained sandy dredged materials suitable for direct beach placement or nearshore bar/berm placement, and a wide variety of other placement alternatives over the DMMP planning horizon. A small amount of suitable silty material that has accumulated along the northwestern slope the anchorage would be removed in the next maintenance operation for that feature and would not be suitable for beach or nearshore placement. This silty material would need to be placed upland, in an ocean site, in a containment facility (CDF), or may be suitable for use as marsh fill or cap. The table below, as well as other tables in this Chapter, shows the dredging needs by time period and the potential placement alternatives with estimated costs of those placement actions. The first ten alternatives are listed for each project and material type in their screening order (total score). Costs for the silty material are higher principally due to the small volume involved.

Table 5-8 - Block Island Harbor of Refuge Federal Navigation Project Placement Alternatives Screening				
Material Type	CY	Year	Placement Alternative	Cost/CY
Sand	88,800	2015-2020	Crescent Beach Nearshore	$35
	57,600	2021-2025	Crescent Beach	$35
	42,300	2026-2030	Sachems Pond Beach Nearshore	$69
	57,600	2031-2035	New London Disposal Site	$60
	57,600	2036-2040	Groton Black Ledge CDF - Cap	$146
	42,300	2041-2045	Sherwood Island Pit CAD - Cap	$148
			Shadmoor State Park NS	$102
			Misquamicut State Beach NS	$87
			Asharoken Beach Nearshore	$102
			Bradley Point/Savin Rock NS	$102
			Hither Hills State Park NS	$102
			Watch Hill Napatree Nearshore	$102
			Cornfield Shoals DS	$83
			Montauk Point State Park - Berm	$87
Suitable Fine	2,200	2015-2020	New London Disposal Site	$379
			Groton Black Ledge CDF - Fill	$473
			Sherwood Island Pit CAD Cap	$472
			Sherwood Island Pit CAD Fill	$472
			100 Sand Company Upland	$374
			Morris Cove Pit CAD – Fill	$366
			Manchester Landfill	$374
			Brookhaven Town Landfill	$374
			Western Long Island Sound DS	$472
			Central Long Island Sound DS	$472
			Falkner Island CDF - Fill	$482
			Duck Island Roads CDF - Fill	$482
			Rhode Island Sound DS	$364

The least cost placement alternative for the maintenance dredging of sand from the Block Island Harbor of Refuge FNP is placement as nourishment at Crescent Beach, either nearshore or directly on the beach. Placement in open water at the New London site would be a 70 percent increase in unit cost over placement at Crescent Beach. Nearshore placement off Sachems Pond West beach is about twice as costly per CY as the least cost alternative. Nearshore placement at beaches in Suffolk County, New York or at New Haven, Connecticut, was about three times as costly per CY as the least cost alternative.

The least cost alternative for placement of the small amount of fine-grained material from the Block Island Harbor of Refuge anchorage was open water placement at the Rhode Island Sound site, with placement as fill in the Morris Cove borrow pit being slightly more expensive. Upland placement at landfills in CT or NY was about three percent more costly than use of the RIS site. Use of the New London site was about four percent more costly. All other alternatives were about 30 percent more costly. One option that has not yet been considered but might be lower cost would be to dredge a small CAD cell in the middle of the anchorage, placing the sand excavated to form the CAD cell at Crescent Beach, putting the silty material in the CAD cell, and leaving the cell to be capped naturally by the continual shoaling of the harbor with sand. This may prove less costly than hauling the material by scow to the RIS site.

Great Salt Pond: Future maintenance of the Great Salt Pond FNP will yield only sandy dredged material over the DMMP planning horizon. This coarse grained material would be suitable for direct beach placement or nearshore bar/berm placement, and a wide variety of other placement alternatives over the DMMP planning horizon. However, the best use for such material would be for coastal resiliency applications such as beach or nearshore nourishment as has been practiced at Block Island for many years.

Table 5-9 - Great Salt Pond FNP - Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Sand	28,200	2015-2020	Sachems Pond Beach Nearshore	$70
	28,200	2021-2025	Sachems Pond West Beach	$70
	14,100	2026-2030	Crescent Beach Nearshore	$103
	28,200	2031-2035	New London Disposal Site	$93
	28,200	2036-2040	Twotree Island CDF – Cap	$183
	14,100	2041-2045	Groton Black Ledge CDF – Cap	$183
			Sherwood Island Pit CAD Cap	$156
			Morris Cove Pit CAD – Cap	$121
			Shadmoor State Park Nearshore	$162
			Misquamicut State Beach NS	$133
			Theodore Roosevelt Cty Park NS	$133
			Hashomomuck Cove Beach NS	$162
			Asharoken Beach NY Nearshore	$162
			Watch Hill/Napatree Beach - Berm	$133

The least cost placement alternative for the maintenance dredging of sand from the Great Salt Pond FNP is placement as nourishment at Sachems Pond West Beach, either nearshore or directly on the beach. Placement in open water at the New London site is the next least costly alternative at an increase of 33 percent over that of Sachems Pond. Nearshore placement off Crescent Beach is the next least costly alternative at an increase in cost of about 47 percent. The next least costly alternative was placement as fill in the Morris Cove borrow pit at 1.7 times the least costly alternative. Nearshore placement off Misquamicut Beach at 1.9 times, or used as cap material at the Sherwood Island COW site at 2.2 times, are the next least costly alternatives.

5.1.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-10 - Federal Navigation Project Base Plans
Block Island Dredging Center Projects

Project and Segment	Material Type	Federal Base Plan
Block Island Harbor of Refuge		
Channel & Anchorage Sand	Sand	Crescent Beach Nearshore or on Beach
Anchorage Fine Material	Suitable Fines	Rhode Island Sound Disposal Site
Great Salt Pond	Sand	Sachems Pond West Beach Nearshore or on Beach

Alternatives to the Federal Base Plan: The Federal base plans for the sandy material from both of the FNPs in this dredging center are beneficial uses, mainly nearshore nourishment of nearby beaches. Since much of Block Island's coastline is subject to erosion, state and local officials could be consulted as to whether additional areas could benefit from placement of dredged sand from future dredging operations, and to what extent that interest may include a willingness to pay the additional cost of such alternative placement. If infrastructure or other property is at risk at such sites, then the USACE may be able to assist in the additional cost under its section 204 authority, if the additional cost is offset by a similar or higher reduction in storm damages to existing infrastructure and property. For the silty material from the Harbor of Refuge's inner anchorage, the small volume of material and resulting high unit cost for removal could make upland placement at landfills on the island or in the region a practicable alternative should a site that would accept the material be identified and the cost difference remain minor. A CAD cell within the harbor might also prove cost-effective.

5.2 Fishers Island NY Dredging Center

The Fishers Island New York Dredging Center encompasses the harbors of Fishers Island, New York, part of the Town of Southold. There are four small harbors; East Harbor, West Harbor, Hay Harbor, and Silver Eel Cove. West Harbor has a Federal Navigation Project authorized as Hay (West) Harbor.

West Harbor and Hay Harbor are two distinctly different harbors. West Harbor (formerly known as Big Hay Harbor), site of the FNP adopted in 1930, is located along the northern shore of the island, while Hay Harbor (formerly known as Little Hay Harbor) is located along the western shore. Silver Eel Cove, site of the former US Quartermaster facility, US Navy Station and the present ferry terminal to the mainland, is located south of Hay Harbor along the western shore. The FNP name of Hay (West) Harbor arises from the language in the Congressional legislation authorizing the study and project. The actual FNP is located at West Harbor.

Fishers Island is a remnant portion of glacial end moraine with many areas of eroding bluffs and small pocket beaches. These present a likely unlimited opportunity for beneficial use of dredged sand for nourishment purposes so long as grain size is suitable for such placement, and other resources such as SAV and shellfish can be avoided.

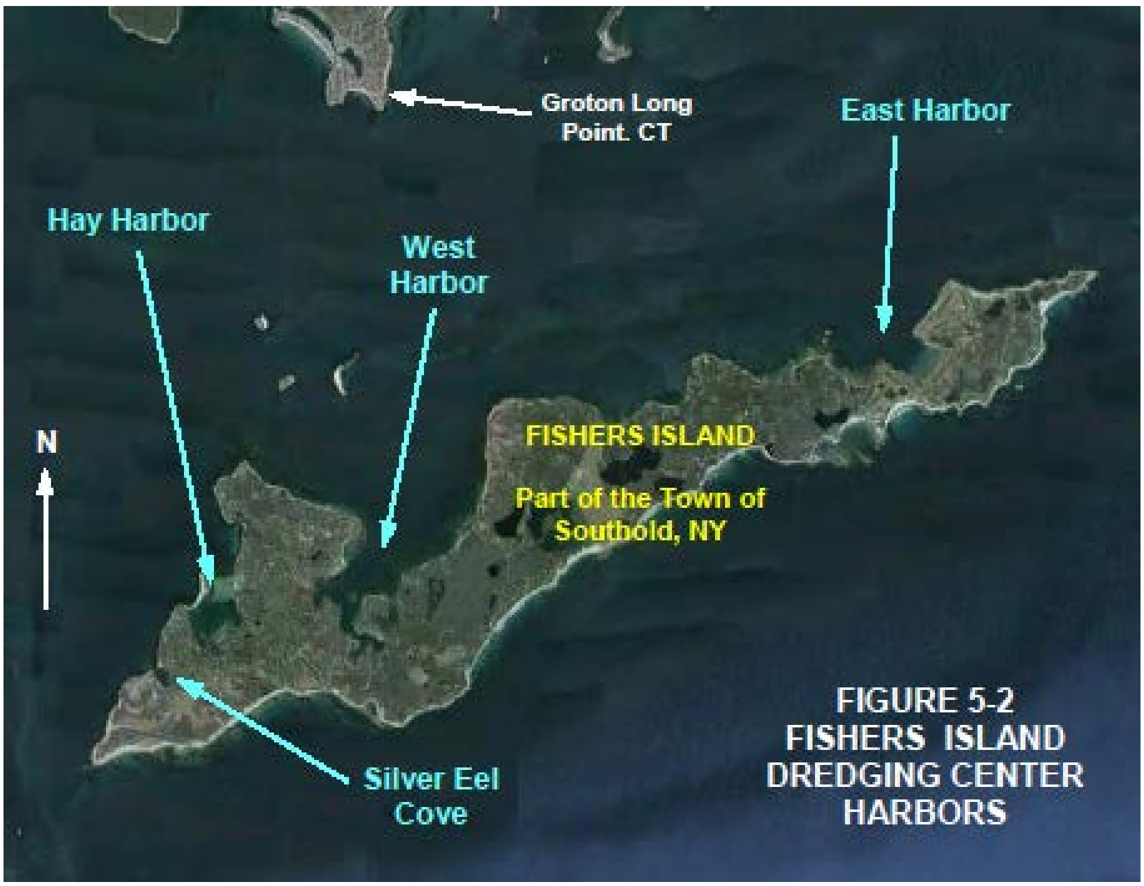


FIGURE 5-2
FISHERS ISLAND
DREDGING CENTER
HARBORS

5.2.1 Federal Navigation Project Maintenance – Hay (West) Harbor

The single FNP in this dredging center, Hay (West) Harbor was authorized in 1930 and constructed in 1931, when a total of about 23,400 CY was dredged as shown below.

Table 5-11 **Federal Navigation Project Dredging History – Fishers Island Dredging Center**				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Current Material
Hay (West) Harbor – 14-Foot Channel	1931	23,400	Open Water	Suitable Fine

Hay (West) Harbor: The dredged feature of the FNP consists of a 14-foot entrance channel from deep water in Fishers Island Sound into West Harbor to the site of the former Steamship Wharf. The project has never been maintained since its initial construction. The latest condition survey of the channel (HH-14, 2004) shows about 8,900 CY of shoal material has accumulated over the 73 years since the last dredging. This is a shoaling rate of about 120 CY annually. At that rate since 2004 another 1,300 CY would have accumulated since 2004 for a total of 10,200 CY. If the harbor were not maintained until 2021, about half-way through the planning horizon, then the total accumulated shoal material could be expected to be about 12,000 CY. It is expected that this project will require maintenance only once during the planning horizon.

Table 5-12 - Dredging Activity Timeline – Hay (West) Harbor, Fishers Island, NY						
FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
West Harbor 14-Foot Channel			12,000			

While no specific records were located concerning the placement option used for the 1931 improvement dredging, typically at that time material deemed not available for beach placement or shoreline fill for port development was dredged mechanically and placed in scows and towed for nearshore placement in open water at a site near the harbor. The nearest open water site appearing on charts from that period is the Mystic or North Dumpling site in Fishers Island Sound north of West Harbor. A 1934 survey (HH-6) of the harbor indicates that a placement site located north of the harbor entrance was used. Today the nearest active open water site is the New London site (NLDS) located west of Fishers Island and about a five mile haul distance from West Harbor. The Rhode Island Sound site (RISDS), located several miles east of Block Island, is about 36 miles haul distance by sea through Fishers Island Sound and Block Island Sound, or about 42 miles if transiting The Race.

5.2.2 Harbor Characterization for Federal Navigation Projects

In the 1931 Annual Report, which described the improvement dredging undertaken in that year, the material removed from Hay (West) Harbor was characterized as “sand and mud.” There are no sediment sampling and testing data on record for the FNP. An April 2013 dredged material suitability determination prepared in conjunction with an application for maintenance dredging of 13,600 CY by the Fisher’s Island Yacht Club included test results from sediment samples taken at that West Harbor facility in 2008. Those samples showed a range of 39 to 92 percent fines. A portion of the material was determined suitable for placement at the CLDS based on physical and chemistry data. There is no record of further biological testing to determine the suitability of the remaining materials. Sediment from shore facilities such as marinas and yacht clubs is typically finer-grained and exhibits higher levels of chemical parameters than materials from channels and anchorage areas due to deposition of finer grained materials in area of less current flow and due to vessel fueling and facility maintenance activities. The shoal material in the FNP is expected to be slightly coarser, but still classified as silty sand, not suited to direct beach placement, but likely suitable for unconfined open water placement.

Potentially material of this type could be used for salt marsh creation or for raising marsh surface elevation. Material could also be re-handled and dewatered for placement upland if a site were available and permitted, or if found cost-effective for some public purpose. However, no such upland beneficial use opportunities were identified by this study.

5.2.3 Other Federal (Non-USACE) Dredging Activities

The US Coast Guard Station Fishers Island, located at the entrance to Silver Eel Cove, is manned only during the summer months, under the command of Station New London. This facility is not projected to require dredging during the planning horizon. There are no other non-USACE Federal dredging activities or facilities in the Fishers Island Dredging Center. The former US Navy facility at Silver Eel Cove is now used by the ferry company and others. The former USCG station at East Harbor was declared surplus and transferred to the town several decades ago.

5.2.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Fishers Island Dredging Center. The Fishers Island Transportation Company operates the ferry service between the island and New London, CT, from its wharf at Silver Eel Cove. West Harbor is home to a number of small marina and boat yard operations and public landings for island residents. Hay Harbor, East Harbor, and Chocomount Cove each have a number of small private residential docks and landings.

Suffolk County Department of Public Works (SC-DPW) also dredged areas of West Harbor as follows:

Table 5-13 Suffolk County Dredging History – Fishers Island Dredging Center				
Suffolk County DPW Permit Activity	Last Dredged	Cubic Yards	Placement Method	Material Recorded
West Harbor, Fishers Island	1971	43,100	Unknown	Sand, Gravel and Cobble

The private permit dredging activities at Fishers Island typically generate sandy dredged material, though not always suitable for direct beach placement. Town dredging around the boat ramp and landing at West Harbor in 1992 placed material upland at the island landfill. Private facility berth dredging in West Harbor in 2008 placed material at the NLDS.

In general, where sand material is encountered, beneficial uses such as beach, nearshore or upland applications are available and should be considered when practicable. Ocean placement is an environmentally acceptable and cost effective alternative when other more beneficial uses are not practicable, with the NLDS being the closest approved site. The dredging center's non-Federal dredging needs volumes and timeline adapted from the 2009 Dredging Needs report are shown below.

Table 5-14 - Dredging Activity Timeline Fishers Island NY Dredging Center - Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	22,300	8,300	4,200	4.100	4,200	4,100
Improvement	6,000					
Total Non-Federal	28,300	8,300	4,200	4.100	4,200	4,100

5.2.5 Placement Alternatives Available to Dredging Center Activities

This dredging center is expected to produce a mix of sandy and sandy-silt materials. Some of this material may prove suitable for beach nourishment, nearshore placement, and other beneficial uses over the planning horizon. Projects from small marina maintenance activities generating a few hundred to several thousand cubic yards every few years, up to FNP maintenance generating 20,000 CY or more once during the planning horizon are anticipated. Siltier materials may require upland or open water placement. Investigation of placement alternatives identified the following as opportunities for dredged material placement for projects from this dredging center. Detailed descriptions of the potential alternative sites were provided in the Placement Alternatives sections in Chapter 4.

Table 5-15 Fishers Island NY Dredging Center – Available/Potential Placement Alternatives				
Alternatives Available	Site Type	CY Capacity	Years Available	Material Accepted
New London Disposal Site	Open Water	7,796,500	All	All Suitable
Cornfield Shoals Disposal Site	Open Water	200,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Groton Black Ledge CDF - Fill	Island CDF	6,930,000	All Once Built	All
- Cap		570,000		All Suitable
Twotree Island CDF - Fill	Island CDF	2,966,200	All Once Built	All
- Cap		433,800		All Suitable
Sherwood Island Borrow Pit Open-Water CAD	COW Fill	266,000	All Until Full	All
	COW Cap	484,000		All Suitable
Morris Cove Borrow Pit CAD cell	CAD Fill	466,100	Until Full	All
	CAD Cap	150,000		All Suitable
110 Sand Company Clean Fill Site, NY (LF Place-59)	Upland Sand Pit	1,000,000	All	All Suitable
Town of Brookhaven Landfill	Upland	700,000	All	All Suitable
Manchester Landfill	Upland	1,200,000	All	All Suitable
Sandy Point LNB, RI Marsh Creation	Marsh Fill	500,000	Once Built	All Suitable
Rhode Island Sound DS	Ocean	16,500,000	All	All Suitable
Generic Upland on Island	Upland	NA	NA	All Suitable

Placement alternatives potentially available for the suitable mixed sandy and fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the New London site located just seaward of New London Harbor in Long Island Sound. The Cornfield Shoals, Central Long Island Sound, and Western Long Island Sound sites are more distant. These sites could receive any suitable material, either sandy or fine-grained. Costs have been provided for placing material at the Rhode Island Sound site (outside the LIS region) for comparison purposes. The open water site previously used for the FNP, the North Dumpling or Mystic Disposal Site, is not currently in use.

Table 5-16 - Scow Haul Distances to Open Water Placement Sites in Statute Miles

Project	RIS DS via Race	SHDS	MRDS	NLDS	NBDS	CSDS	CLDS	Orient DS
West Harbor FNP	41.5	6.8	2.6	4.7	10.3	20.3	47.9	14.9
Hay Harbor	40.1	8.5	3.9	3.0	8.6	18.6	46.2	13.2
Silver Eel Cove	37.4	8.8	4.5	2.5	8.1	18.1	45.7	12.0
East Harbor	31.4	2.3	3.2	7.5	13.1	23.1	50.7	17.7

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meet their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites could potentially be developed for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive suitable materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites located near this dredging center include Groton Black Ledge, and Twotree Island (Waterford).

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in Little Narragansett Bay, RI.

5.2.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified potential placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Fishers Island, NY Dredging Center analysis matched the FNP and placement alternatives as follows.

Hay (West) Harbor: Future maintenance of the Hay (West) Harbor FNP will yield predominantly mixed fine-grained dredged materials likely suitable for open water placement or a variety of other placement alternatives over the DMMP planning horizon. This silty material could be placed upland, in an ocean site, in a containment facility (CDF), or may be suitable for use as marsh fill or cap. This material would not be suitable for beach or nearshore placement.

Table 5-17 - Hay (West) Harbor FNP - Fisher's Island Dredging Center Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	12,000	2026-2030	New London Disposal Site	$77
			Cornfield Shoals Disposal Site	$84
			Two Tree Island CDF Fill	$166
			Groton Black Ledge CDF-Fill	$166
			Duck Island Roads CDF - Fill	$196
			Clinton Harbor CDF - Fill	$196
			Sherwood Island Pit – Fill	$156
			Sherwood Island Pit - Cap	$156
			110 Sand Company NY	$150
			Morris Cove Pit CAD - Fill	$130
			Manchester City Landfill	$150
			Town of Brookhaven Landfill	$150
			Central Long Island Sound DS	$137
			Generic Upland on Island	$76
			Rhode Island Sound DS	$137
			Sandy Bay, RI Marsh Creation	$112

The least cost placement alternative for the maintenance dredging of fine-grained material from the Hay (West) Harbor FNP is open water placement at the New London site. While no upland placement site was identified by this study, if one could be located within a mile of the harbor then that work might be accomplished at about the same cost as placement at the NLDS. The next least costly placement alternative is the Cornfield Shoals site at a 36 percent increase in cost over the NLDS. Use in a marsh creation project at Sandy Point in Little Narragansett Bay would require a 47 percent increase over the cost of using the NLDS or an on-island site. The next least costly alternative is placement as fill in the Morris Cove Borrow Pit CAD cell site in

New Haven Harbor (about 69 percent more costly than the NLDS), or placement at the RIS site at a 70 percent increase. Upland placement at landfills in CT or NY would be about twice as costly as use of the NLDS, with use of a potential Groton Black Ledge or Twotree Island CDF site costing 2.3 to 2.5 times the cost of open water placement.

5.2.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-18 - Federal Navigation Project Base Plans
Fishers Island Dredging Center Projects

Project and Segment	Material Type	Federal Base Plan
Hay (West) Harbor FNP	Suitable Fines	New London Disposal Site or Upland On-Island

Alternatives to the Federal Base Plan: No cost-effective alternatives to the Federal base plans for the silty material from this FNP were identified. If an upland on-island site cannot be located, then open water placement appears to be the only practicable alternative based on project cost. The least costly beneficial use alternative would be use in a marsh creation project at Sandy Point in Little Narragansett Bay. If sufficient environmental benefits were projected to accrue from such a marsh creation, then USACE may be able to assist in the additional cost under its Section 204 continuing authority.

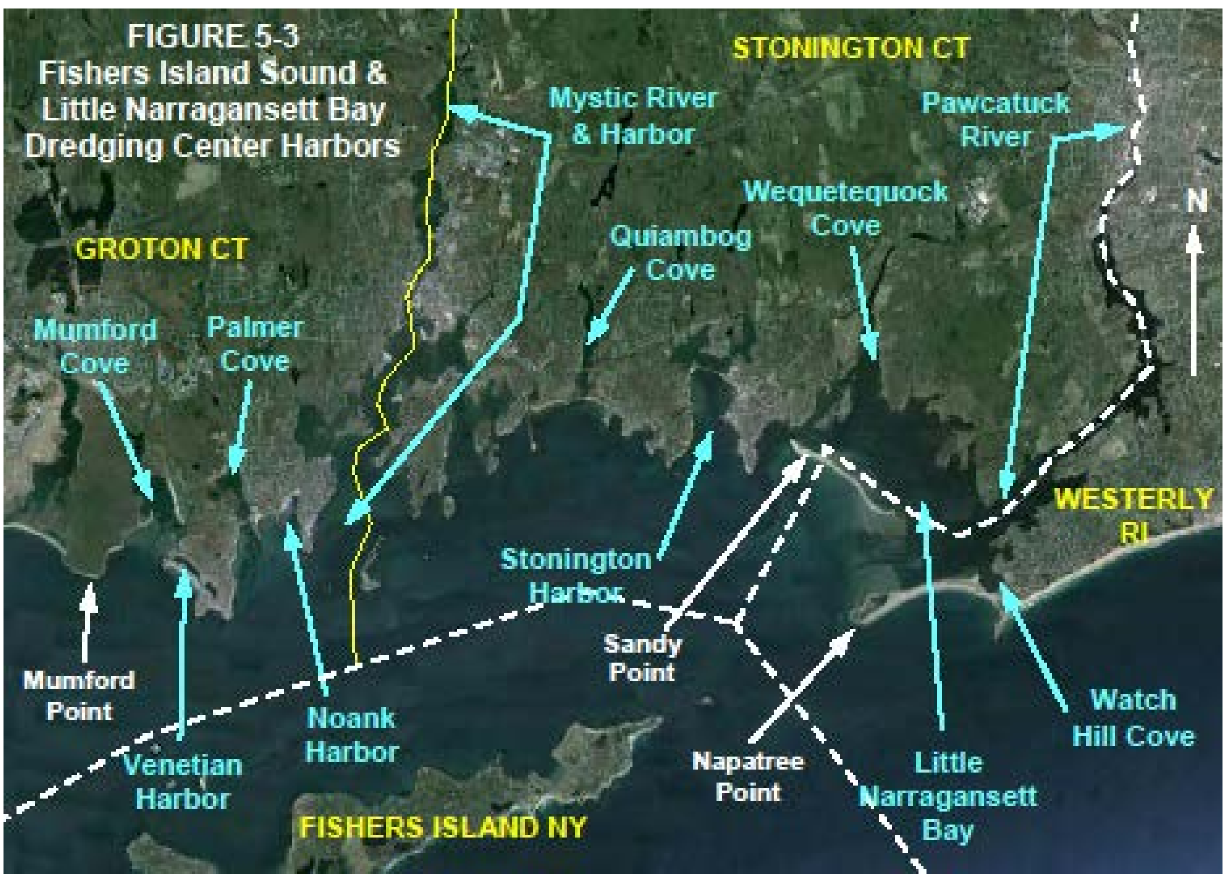
5.3 Fishers Island Sound and Little Narragansett Bay Area (CT & RI) Dredging Center

The northern (mainland) shore of Fishers Island Sound includes the Towns of Westerly, Rhode Island, and Stonington and Groton, Connecticut and constitutes the Fishers Island Sound/Little Narragansett Bay Dredging Center. Fisher's Island, New York separates Fisher's Island Sound from Long Island Sound to the west and Block Island Sound to the south and east. The same glacial terminal moraine that forms the north fork of Long Island and Fishers Island comes ashore at Watch Hill, Rhode Island. The dredging center includes the Federal Navigation Projects for the Pawcatuck River, Stonington Harbor, and Mystic Harbor. The dredging center stretches from Watch Hill, RI in the east to Mumford Point, CT in the west. The dredging center also includes a number of other small harbors, coves and rivers which provide navigation access to Fishers Island Sound and adjacent waters for commercial fishermen and boaters.

The principal waterways in this dredging center are:

Pawcatuck River, Little Narragansett Bay and Watch Hill Cove – Includes FNP
Wequetequock Cove
Stonington Harbor – includes FNP
Quiambog Cove
Mystic Harbor – includes FNP
Noank Harbor
Palmer Cove
Venetian Harbor
Mumford Cove

This dredging center also includes a number of offshore islands which require navigation access including the islands offshore of Mystic, CT and the Dumpling Island between Groton and Fishers Island. The waterways in this dredging center yield a mix of material types, all found suitable for unconfined open water placement. On the Connecticut shore where coastal estuaries empty into these harbors, material tends to be fine-grained, at least inside those harbors. In waterways without riverine inputs, or in exposed entrance channels such as Little Narragansett Bay, materials tend to be sandy, often sufficiently so to make it suitable for direct beach placement or nearshore bar nourishment.



5.3.1 Federal Navigation Projects – Maintenance and Harbor Characterization

The dredged features of the three FNPs in this dredging center, including the sub-projects for Pawcatuck River and Little Narragansett Bay, have each been recently improved or maintained as shown below.

Table 5-19 - Federal Navigation Project Dredging History
Fishers Island Sound and Little Narragansett Bay Dredging Center

FNP Recent Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Pawcatuck River FNP				
Little Narragansett Bay Entrance Channel	1996-97	47,000	Sandy Point Beach	Suitable Sand
	2014-15	61,900	Sandy Point Beach	Suitable Sand
Little Narragansett Bay Inner Bay Channel	1948	91,500	Stonington DS	Fine
Pawcatuck River Channel			Stonington DS	Fine
Watch Hill Cove	1948-49	206,000	Napatree Beach	Sand
Stonington Harbor	1956-57	28,400	Stonington DS	Fine
Mystic Harbor	1957-58	126,900	Mystic DS	Fine
Compensatory Turning Basin	1988	8,000	NLDS	Suitable Fine
Entire FNP (Estimated)	2014-15	159,200	NLDS	Suitable Fine

Pawcatuck River, Little Narragansett Bay and Watch Hill Cove: The FNP for the Pawcatuck River consists of three separable segments as follows:

(1) The Pawcatuck River Channel, which is further divided into 10 and 7-foot segments
(2) The Little Narragansett Bay Channel which is further divided into entrance and inner bay channel reaches with different material types
(3) The Watch Hill Cove Channel and Anchorage, which also includes a rubblestone jetty

<u>Pawcatuck River</u>: The Pawcatuck River enters from the eastern side into Little Narragansett Bay and the FNP provides for a 10-foot deep channel extending up the Pawcatuck River for about 3 miles to Westerly, with a narrower 7-foot channel above that to the vicinity of the highway bridge. The river channel was last improved in 1923-1924 when sections of the 10-foot channel were widened. Since that time the river channel has been maintained in 1928, 1933 and 1948, the last when about 91,500 CY were removed. That material was placed at the Stonington Dumping Ground in Fishers Island Sound (see May 1948 Plans and Specifications). The average annual shoaling rate over the 24-year period between improvement and maintenance was about 7,500 CY. The river channel currently has accumulated about 130,600 CY of shoal material (Survey PAW-611, 2012). When this volume is added to the maintenance record over the period between 1924 and 2012 the average annual shoaling rate drops to about 3,500 CY. If this project segment were not dredged until the 2021-2025 timeframe, then a total dredging volume of about 173,000 CY could be expected.

In the Annual Report from 1949 it was said that mud and sand made up the material dredged from the Pawcatuck River. Sediment samples taken from 14 locations in the river channel in 1971, the only USACE sediment sampling and testing data on record show a range of about 3 to 95 percent fines with a mean of 43 percent. Future maintenance of this segment of the project is expected to yield suitable fine-grained material.

Little Narragansett Bay: The 10-foot channel into and through Little Narragansett Bay connecting the Pawcatuck River with Fishers Island Sound is divided into two reaches. The entrance reach from the Sound around Sandy Point and into the bay in areas west of Wequetequock Cove yields clean sand (less than 2 percent fines – June 2003 sampling and testing) suitable for beach nourishment, which has typically been placed directly on or nearshore to Sandy Point Beach. The inner bay channel reaches yield silty material not suitable for beach placement. The two segments were dredged concurrently in 1932-1933. Since that time the entrance reach has been dredged alone four times, including in 1996-1997 when about 47,000 CY were removed by hydraulic pipeline dredge and placed on the ocean side of Sandy Point Beach. There have been four NEPA documents prepared for maintenance dredging of the entrance channel. A February 1977 EA covered sidecast maintenance of the entrance reaches around Sandy Point. A February 1978 EA prepared by Raytheon Corporation under contract to the USACE examined alternative in-water and upland placement options for all segments of the Pawcatuck River FNP, but did not identify any specific upland sites. An April 1996 EA covered hydraulic pipeline maintenance of the entrance channel with direct beach placement on the ocean side of Sandy Point. A May 2014 EA covered the 2014-2015 maintenance dredging of about 61,900 CY from the entrance channel with direct beach placement on the bayside of Sandy Point. An October 2015 EA covered the removal of rock and hard material of up to 2,600 CY from a small area of the entrance channel north of Sandy Point which was accomplished in December 2015.

Over the 63-year period between 1933 and 1996 the average annual shoaling rate for the entrance segment was about 1,580 CY. Hurricane Sandy accelerated shoaling of this entrance channel and contract solicitation documents prepared in 2014 estimated the shoal volume at 66,300 CY, with the pre-dredge survey for that action increasing the estimated yardage to 69,000 CY (Survey PAW-614, October 2014), and actual volume removed from the after-dredge survey was 61,900 CY (LNB-615, January 2015), with about 5,300 CY pay material remaining un-dredged. When this event is added to the record for the entrance channel, an annual shoal rate of 2,000 CY results, which is closer to the rate observed between the 1977 and 1997 dredging events. Based on the 1933 to 2015 record, a typical ten-year shoal volume for this segment is likely closer to about 19,900 CY. After completion of the post-Hurricane Sandy maintenance dredging in 2014-2015, the ten-year maintenance volume would be removed from the entrance channel three times during the 30-year DMMP planning horizon.

The inner bay channel reach east of Wequetequock Cove (east of approximately buoy G-13) has not been dredged since 1948 when it was maintained in conjunction with the Pawcatuck River Channel. The current shoal volume for the entire bay channel, including the entrance was 98,800 in 2013 (Survey PAW/LNB-613, April 2013 soundings). Subtracting the 2014 specifications survey (PAW/LNB-614) channel dredge template volumes from the bay channel total yields about 49,600 CY for the inner bay reaches not dredged in 2014-2015. This gives a low annual shoaling rate of about 800 CY for the inner bay. Controlling depths as of 2014 were reduced to about -7.3 feet in a few locations upstream of buoy RN-16A. Adjusting for the eleven years until an assumed maintenance operation in the 2030 timeframe yields an anticipated volume of about 62,600 CY, which adjusted for the entrance reach volume and the remaining yardage from the 2015 survey gives a total of 88,000 CY for this segment. This material is more variable in grain size than the entrance reach, with a range of 6 to 75 percent fines (June 2003 sediment sampling and testing), and is expected to be suitable for open water placement.

Watch Hill Cove: The authorized 10-foot MLLW channel and anchorage at Watch Hill Cove were last dredged during their initial improvement in 1948-1949 when about 206,000 CY were removed and placed on the ocean shore of Napatree Beach near the project site. Information about sediment type or chemistry is not available for this event, but it assumed to have been beach compatible sand. The cove channel and anchorage currently have accumulated about 10,300 CY of shoal material (Survey PAW/LNB-613, 2013) the bulk of which is in the channel, where controlling depth has been reduced to -4.7 feet in one outside quarter and -6.3 feet in the center half of the channel. Since 1949 this comes out to a shoaling rate of about 160 CY annually. If the cove features were not maintained until the 2021-2025 timeframe, then a total accumulated shoal volume of about 12,200 CY could be expected, and maintenance would be required only once during the DMMP planning horizon.

Sediment samples taken in the Federal project in 1975 showed a range of about 2 to 5 percent fines. Sediment sampling for the Watch Hill Yacht Club maintenance dredging in 2007 showed that material to be 0.3 percent fines. It is expected that any material dredged from either the Federal project or non-USACE permit activities at Watch Hill Cove in the future would generate clean sand, suitable for beach nourishment, as in the past, or for nearshore placement.

Stonington Harbor: The FNP for Stonington Harbor consists of two dredged anchorage areas, an inner harbor breakwater, and two offshore rubblestone breakwaters forming a harbor of refuge in the outer harbor. Two former constructed features of the project were deauthorized in 1950 including the stone shore protection at Stonington Point and a channel across Noyes Shoal outside the breakwaters. The 12-foot north (Penguin Shoal) anchorage was last dredged for its improvement in 1875 when 118,400 CY were removed. The 10-foot south anchorage was last dredged for its improvement in 1956-1957 with about 28,370 CY removed and placed in the Stonington Disposal Site located south of the harbor in Fishers Island Sound. No grain size information is recorded for this event. The two anchorage areas currently have accumulated about 4,400 CY (Survey SHC-585, 2012). From that survey, controlling depths have only been reduced a few tenths of a foot in limited areas of both anchorages. Given the low shoaling rate, it is not anticipated that maintenance of this project would occur before at least 2040, with a volume of about 6,600 CY.

There are no USACE sediment test results on record for the Stonington Harbor FNP. The most recent sediment classification information available (from an April 1990 Reconnaissance Report) described the sediments in Stonington Harbor as sandy-gravel to sandy-silt. A 2010 suitability determination for maintenance and improvement dredging of 20,000 CY at the Dodson Boat Yard included sediment test results indicating silty materials found suitable for open water placement at the CLDS, with some materials suitable for placement at the NLDS. Sediments from waterfront facilities are typically more fine-grained than those from channels and anchorage areas, and often show more elevated levels of chemical parameters due to activities such as vessel fueling and vessel and shore facility maintenance. For the Stonington Harbor FNP, future maintenance of this project is expected to yield shoal sediments classified generally as mixed coarse to fine-grained material likely suitable for open water placement.

Mystic River and Harbor: The FNP for Mystic Harbor consists of a 15-foot deep lower channel from deep water in the Sound off Morgan Point up to the US Route 1 highway bridge. The channel is 125 feet wide below Murphy Point and 100 feet wide to the bridge. The project also includes a 9-foot deep anchorage area east of the channel between Murphy and Pine Points, a 9-foot turning basin east of the channel just above the railroad bridge, and a 12-foot deep channel above the highway bridge to the Mystic Seaport. The 12-foot deep upper channel was initially constructed in 1913 and last maintained in 1941, with both operations conducted concurrent with maintenance of the 15-foot deep lower channel, and a total of about 123,500 CY removed. This would indicate an annual shoaling rate of about 4,400 CY for the two channels combined prior to the widening of the lower channel in 1957.

The lower project features, including the 15-foot channel, were last dredged in 1957-1958 in a joint maintenance and improvement dredging project, which included widening the 15-foot deep channel and initial construction of the 9-foot deep anchorage and turning basin. During this action about 17,200 CY of maintenance material were removed from the lower channel and about 109,700 CY for improvement. All material was placed at the North Dumpling (Mystic) Disposal Site in Fishers Island Sound southwest of the harbor. In 1988 compensatory dredging to relocate the Federal turning basin to the east side of the channel was accomplished by private interests as part of a settlement to resolve a marina encroachment, with about 8,000 CY being dredged and placed at the New London site (NLDS).

The entire FNP for Mystic River and Harbor had accumulated about 178,000 CY of shoal material based on soundings made in 2011 (Survey MYC-408, 2012). When this is measured since the last dredging in 1958 this yields an annual shoaling rate of about 3,300 CY for the project. Hurricane Sandy in October 2012 increased the shoal volume and resulted in funds being appropriated to maintain the project. Solicitation documents prepared in the summer of 2014 called for dredging of about 182,000 CY from the FNP (specifications survey made February 2014) with placement at the NLDS. Work was completed in February 2015 with a total of 159,200 CY removed, and 22,700 CY in pay overdepth material remaining un-dredged (Survey MYC-411, March 2015). At a shoaling rate of 3,300 CY annually added to the remaining yardage from 2015, in another 25 years after this latest maintenance operation, the project will have accumulated about 105,100 CY and will again require maintenance. Sediment test results for the 2014 operation indicate a range of 28 to 90 percent fines for this material, which was determined suitable for open water placement.

The dredging activity timeline over the planning horizon for the three FNPs in the Fishers Island Sound – Little Narragansett Bay Dredging Center is shown below.

Maintenance of the three FNPs has typically used either open water placement in Fishers Island Sound or at the NLDS in Long Island Sound for silty materials, or placement nearshore or directly on adjacent beaches for sandy materials. Maintenance of all three projects is expected to generate mainly these two types of dredged materials in the future. For all three projects, open water placement at the currently active NLDS and RISDS are options, as are potential resumption of placement activities at the historic Stonington and Mystic (North Dumpling) sites in Fishers Island Sound.

Table 5-20 - Dredging Activity Timeline – Fishers Island Sound and Little Narragansett Bay Dredging Center – Federal Navigation Projects Maintenance

Project and Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Pawcatuck River						
Little Narragansett Bay Entrance Channel	Completed	25,300		19,900		19,900
Little Narragansett Bay Inner Bay Channel		88,000				
Watch Hill Cove		12,200				
Pawcatuck River Channel		173,000				
Stonington Harbor					6,600	
Mystic Harbor						105,100
Suitable Sand		37,500		19,900		19,900
Suitable Fine-Grained		261,000			6,600	105,100

Dredged sandy materials from the Little Narragansett Bay entrance channel reaches and from Watch Hill Cove could be used, as in the past and currently, for nourishment of Sandy Point, Napatree Beach, Watch Hill, or Misquamicut Beach, with either nearshore or direct beach placement. If sandy materials of sufficient volume and concentrated distribution are found as part of any future maintenance of Stonington Harbor they could also be used in such a beneficial manner for coastal resiliency purposes.

Potentially the fine-grained materials could be used to create salt marsh in shallow tidelands to replace marsh lost in other areas to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. Opportunities for such use may be more likely in Little Narragansett Bay than elsewhere in this dredging center, with areas in the lee of Sandy Point having been suggested for marsh creation in the past.

Both material types could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping, port fill, or waterfront land surface elevation in response to sea level rise). However, no specific opportunities for such uses were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary, this would require further investigation in the future, and if conducted using materials dredged from FNPs, may require cost-sharing by a non-Federal sponsor.

5.3.2 Mystic Harbor Federal Navigation Project - Improvement

United States Senate resolutions in 2004 and 2006 called for a study of navigation improvements to Mystic Harbor, Connecticut. Consultation with state and local interests indicated that the focus of this request was to improve access and service in the river above the bridges, specifically for the benefit of the Mystic Seaport Museum. Channel and anchorage improvements were discussed. The initial study in response to the resolution has not yet been funded, and local interest has waned at present. However, a rough estimate of the proposed improvements is for the dredging of about 450,000 CY with upland placement intended to raise elevations in parts of the Seaport's property along the river. Alternatively open water placement would be a cost-effective means of dredged material management if beneficial uses are found impractical. For DMMP purposes it has been assumed that construction of this improvement project, if ultimately recommended, would not occur before near the end of the planning horizon. It is also assumed that port deepening would not increase the current maintenance dredging frequency or volume for the FNP.

Table 5-21
Dredging Activity Timeline – Mystic Harbor – Federal Improvement Dredging

	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Mystic Harbor FNP Improvements						450,000

5.3.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Fishers Island Sound - Little Narragansett Bay Dredging Center.

5.3.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests on the Connecticut shore of Fishers Island Sound and around Little Narragansett Bay and the Pawcatuck River. The associated dredging activities typically generate suitable fine-grained materials, with some sandy dredged material from the southern areas of Little Narragansett Bay, though not always suitable for beach or nearshore placement. Where sand material is encountered, beneficial uses such as beach or nearshore applications are available and should be considered when practicable. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the NLDS being the closest approved site. The RISDS is also available, though it would be a much longer (and costly) haul for scows under tow.

The 2009 dredging needs update report projected, based on facility surveys, that 583,700 CY of maintenance dredging and 497,100 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the table below. These activities could also take advantage of whatever alternative placement methods are used for the three FNPs in this dredging center if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-22 - Dredging Activity Timeline – Fishers Island Sound and Little Narragansett Bay Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	55,800	387,500	31,500	31,500	24,000	24,000
Improvement	88,100	59,000	0	0	0	0
Permit Projections	4,900	4,900	4,900	4,900	4,900	4,900
Total Non-Federal	148,800	451,400	36,400	36,400	28,900	28,900

5.3.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities and large private permit activities generating up to 150,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at the NLDS. However, port fill and upland fill for specific purposes have been used as well. The Morris Cove borrow pit in the outer harbor has also been used by the USCG for placement of dredged material from its New Haven facility. Several investigations of potential alternatives identified the following as opportunities for placement of dredged material for projects from this dredging center. Detailed descriptions of the alternative sites were provided in the Placement Alternatives section earlier.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by nearshore feeder bar/berm placement, or as cap material for potential CDFs, CAD cells, or COW sites. Potential placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of potential alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-23 - Fishers Island Sound and Little Narragansett Bay Dredging Center Available/Potential Placement Alternatives

Alternative		Site Type	CY Capacity	Years Available	Material Accepted
New London Disposal Site		Open Water	7,796,500	All	All Suitable
Cornfield Shoals Disposal Site		Open Water	200,000,000	All	All Suitable
Central Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Rhode Island Sound DS		Open Water	16,500,000	All	All Suitable
Twotree Island CDF	- Fill	Island CDF	2,966,200	All Once Built	All
	- Cap		433,800		All Suitable
Groton Black Ledge CDF	- Fill	Island CDF	6,930,000	All Once Built	All
	- Cap		570,000		All Suitable
Faulkner Island CDF	- Fill	Island CDF	16,010,200	All Once Built	All
	- Cap		1,169,800		All Suitable
Duck Island Road CDF	- Fill	Island CDF	1,376,100	All Once Built	All
	- Cap		233,900		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable
Norwalk Outer Harbor Islands Marsh Creation	- Fill	Island CDF Marsh	554,000	All Until Filled	All
	- Cap		376,000		All Suitable
Sherwood Island Borrow Pit Open-Water CAD		COW Fill	266,000	All Until Full	All
		COW Cap	484,000		All Suitable
Morris Cove Borrow Pit CAD cell		CAD Fill	466,100	Until Full	All
		CAD Cap	150,000		All Suitable
110 Sand Co., Melville, NY		Upland Sand Pit	1,000,000	All	All Suitable
Manchester City Landfill, CT		Upland	1,200,000	All	All Suitable
Brookhaven Town Landfill, NY		Upland	700,000	All	All Suitable
Sandy Point LNB, RI Marsh Creation		Marsh Fill	500,000	Once Built	All Suitable
Sandy Point Beach, RI		Beach	80,000	Recurring	Suitable Sand
Sandy Point, Westerly, RI		Nearshore	80,000	Recurring	Suitable Sand
Watch Hill Beach, Westerly, RI		Beach	30,500	Recurring	Suitable Sand

Alternative	Site Type	CY Capacity	Years Available	Material Accepted
Watch Hill Beach & Napatree Point Beach Bars, RI	Nearshore	154,900	Recurring	Suitable Sand
Napatree Point Beach, RI	Beach	91,900	Recurring	Suitable Sand
DuBois Beach, Stonington, CT	Beach	4,500	Recurring	Suitable Sand
Misquamacut State Beach, RI	Nearshore	70,500	Recurring	Suitable Sand
Misquamicut Beach, RI	Beach	43,200	Recurring	Suitable Sand
Cove Island Beach, CT	Nearshore	28,200	Recurring	Suitable Sand
Calf Pasture Beach, CT	Nearshore	30,200	Recurring	Suitable Sand

Beach and Nearshore Nourishment Sites: The shoreline of Little Narragansett Bay and the Connecticut shore of Fishers Island Sound is mix of narrow barrier spits and islands, low salt marshes, low headlands and bluffs composed glacial moraine deposits, and small coastal plain rivers and streams. Dredged sand from the Little Narragansett Bay entrance and Watch Hill Cove have been used for nourishment purposes, generally through direct placement on the adjacent beaches. Silty materials from the harbors and inner channels have been typically placed in open water sites in Fishers Island Sound or at the NLDS. Distances to nearshore and beach placement sites are shown below.

Table 5-24 - Scow Haul Distances to Nearshore Nourishment Sites in Statute Miles

Project	Rocky Neck SP	Ocean Beach	Bluff Point SP	DuBois Beach	Sandy Point Beach	Napatree Point Beach	Watch Hill Beach	Misqua-micut
Pawcatuck River at Westerly Bridge	26.1	18.1	15.7	7.8	7.6	10.2	10.8	13.6
Little Narragansett Bay Inner Channel	21.6	13.6	11.2	3.3	3.1	5.7	6.3	9.1
Little Narragansett Bay Entrance	19.4	11.3	9.0	1.1	5.3	7.9	8.5	11.3
Watch Hill Cove	22.2	14.2	11.9	3.9	3.6	6.2	6.8	9.6
Stonington Inner Harbor Anchorage	19.2	11.1	8.6	0.5	1.5	3.9	4.3	7.5
Mystic River at Railroad Bridge	11.0	9.2	6.7	8.1	8.9	9.7	10.1	13.3

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the New London site located just seaward of that harbor in Long Island Sound. The Cornfield Shoals, Central Long Island Sound, and Western Long Island Sound sites are more distant. These sites could receive any suitable material, either sandy or fine-grained. Costs have been provided for placing material at the Rhode Island Sound site (outside the LIS region) for comparison purposes.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Table 5-25 - Scow Haul Distances to Open Water Placement Sites in Statute Miles

Project	RIS DS	SHDS	MRDS	NLDS	NBDS	Orient DS	CSDS	CLDS
Pawcatuck River at Westerly Bridge	37.3	9.5	13.0	17.4	23.2	27.6	33.0	60.6
Little Narragansett Bay Inner Channel	32.8	5.0	8.5	12.9	18.5	23.1	28.5	56.1
Watch Hill Cove	33.2	5.5	8.9	13.4	19.1	23.6	29.0	56.6
Stonington Inner Harbor Anchorage	30.1	2.2	5.8	10.2	15.8	20.4	25.8	53.4
Mystic River at Railroad Bridge	35.6	7.4	4.3	8.9	14.5	19.1	24.5	52.1

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites could potentially be developed for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive suitable materials from this and other dredging centers, as either fill or cap material. Additionally, the Morris Cove borrow pit could receive unsuitable materials as fill, since this site is located inside the harbor and not in the waters of LIS.

Confined Disposal Facilities: Many locations around LIS have been proposed for potential CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDFs sites located near this dredging center include Groton Black Ledge, Twotree Island (Waterford), Duck Island Roads, Falkner Island, New Haven Breakwaters, Bridgeport Harbor Yellow Mill Channel, and Norwalk Outer Harbor Islands.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such potential marsh creation site is located at Sandy Point in Little Narragansett Bay, RI.

5.3.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Little Narragansett Bay – Fishers Island Sound Area Dredging Center analysis matched projects and placement as follows.

<u>Pawcatuck River, Little Narragansett Bay and Watch Hill Cove</u>: Future maintenance dredging of the Pawcatuck River, Little Narragansett Bay and Watch Hill Cove FNP will yield two types of dredged material; clean sand and fine-grained material suitable for open water placement. The entrance reaches of the Little Narragansett Bay channel and Watch Hill Cove will yield sandy material suitable for beach or nearshore bar placement or other uses. The inner Narragansett Bay channel and the Pawcatuck River Channel will yield silty fine-grained material. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites.

The least cost placement alternative for the maintenance dredging of fine-grained material from the Pawcatuck River and inner Little Narragansett Bay channels is open water placement at the New London site. The second least costly alternative, although located outside the LIS region, is open water placement at the Rhode Island Sound site at an increase in cost of 77 percent. Beneficial uses as fill material for a marsh creation project at Sandy Point in the southwestern part of the bay is the third least costly alternative at about twice the cost of using the NLDS. The next least costly alternative is placement as fill in the Morris Cove Borrow Pit CAD cell site in New Haven harbor at a cost about 2.1 times that of placement at the NLDS. Use of the Sherwood Island COW site or the CLDS and WLDS sites would be about three times the cost of the NLDS, while upland placement at landfills in CT or NY would be about 4.2 times as costly as use of the NLDS.

For sandy material dredged every ten years from the Little Narragansett Bay entrance channel, the least cost alternatives would be placement either nearshore at Napatree Point or Watch Hill Beaches, or placement at Sandy Point either on the beach or nearshore. Placement in open water at the New London site would be the next least costly alternative at about 30 percent more than the least costly alternatives. The next least costly alternatives (57 percent increase) would be placement at Misquamicut Beach, either nearshore or on the beach.

For sandy material dredged from the Watch Hill Cove FNP, the least cost alternatives would be placement either nearshore at Napatree Point or Watch Hill Beaches, or directly on the beach at either location. Placement at Sandy Point either on the beach or nearshore would be the second least costly alternatives at about 14 percent above Napatree/Watch Hill. The next least cost alternative would be placement in open water at the New London site (20 percent above the least costly alternative). Placement at Misquamitcut Beach, either nearshore or on the beach, would be about 46 percent higher than the least cost alternatives.

Table 5-26 - Pawcatuck River, Little Narragansett Bay and Watch Hill Cove FNP Placement Alternatives Screening				
Pawcatuck River and Inner Little Narragansett Bay FNP Maintenance				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	261,000	2021-2025	New London Disposal Site	$31
			Two Tree Island CDF - Fill	$123
			Groton Black Ledge CDF - Fill	$123
			Cornfield Shoals Disposal Site	$37
			Sherwood Island Pit COW - Cap	$97
			Sherwood Island Pit COW – Fill	$97
			110 Sand Company, NY	$130
			Morris Cove Pit CAD - Fill	$66
			Brookhaven Town Landfill	$130
			Manchester City Landfill	$130
			Central Long Island Sound DS	$55
			Western Long Island Sound DS	$97
			Falkner Island CDF - Fill	$155
			Duck Island Roads CDF - Fill	$155
			New Haven Breakwaters CDF - Fill	$155
			Rhode Island Sound DS	$55
			Sandy Point LNB Marsh Creation	$63
Little Narragansett Bay Entrance Channel FNP Maintenance				
Material Type	CY	Year	Alternative	Cost/CY
Sand	25,300	2021-2025	Watch Hill/Napatree Beach - Berms	$52
	19,900	2031-2035	Sandy Point Beach, RI – On Beach	$44
	19,900	2041-2045	Watch Hill Beach – On-Beach	$52
			New London Disposal Site	$57
			Napatree Point Beach – On-Beach	$52
			Two Tree Island CDF – Cap	$154
			Groton Black Ledge CDF - Cap	$134
			Sandy Point Beach, RI – Nearshore	$44
			Misquamicut Beach - Nearshore	$69
			Cornfield Shoals Disposal Site	$72
			Bluff Point State Park – Nearshore	$81
			Morris Cove Pit CAD - Cap	$106
			Shadmoor State Park, NY – Nearshore	$123
			T. Roosevelt Park, NY - Nearshore	$103

Watch Hill Cove FNP Maintenance				
Material Type	CY	Year	Alternative	Cost/CY
Sand	12,200	2021-2025	Watch Hill/Napatree - Nearshore	$69
			Sandy Point Beach RI – On Beach	$79
			Sandy Point Beach RI - Nearshore	$79
			Watch Hill Beach – On Beach	$69
			New London Disposal Site	$83
			Napatree Point Beach	$69
			Two Tree Island CDF – Cap	$177
			Groton Black Ledge CDF - Cap	$177
			Misquamicut Beach - Nearshore	$101
			Bluff Point State Park – Nearshore	$114
			Cornfield Shoals Disposal Site	$103
			Sherwood Island Pit COW - Cap	$156

Stonington Harbor: Future maintenance dredging of the Stonington Harbor FNP will yield a mixed material of sandy silts and silty sands. The material is expected to be found suitable for open water placement. The material is not likely suitable for beach or nearshore bar placement or other uses. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. Initial screening yielded the following alternatives for consideration for Stonington Harbor.

Table 5-27 - Stonington Harbor FNP – Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	6,600	2036-2040	New London Disposal Site	$120
			Twotree Island CDF - Fill	$237
			Groton Black Ledge CDF - Fill	$208
			Cornfield Shoals Disposal Site	$153
			Sherwood Island Pit COW - Cap	$198
			Sherwood Island Pit COW – Fill	$198
			110 Sand Company Site, NY	$224
			Morris Cove Pit CAD - Fill	$173
			Brookhaven Town Landfill NY	$224
			Manchester City Landfill, CT	$224
			Central Long Island Sound DS	$198
			Western Long Island Sound DS	$198
			Rhode Island Sound DS	$198
			Sandy Point LNB Marsh Creation	$189

The least cost placement alternative for the maintenance dredging of mixed sandy and fine-grained material from the Stonington Harbor FNP is open water placement at the New London site. The second least costly alternative is open placement at the Cornfield Shoals site at an increase of 28 percent over the NLDS. The next least costly placement alternative is placement as fill in the Morris Cove Borrow Pit CAD cell site in New Haven harbor at a 44 percent increase in cost. The next least costly alternative is placement as fill for a marsh creation project at Sandy Point in Little Narragansett Bay at an increase of 58 percent over the cost of using the WLDS. Placement in open water at either CLDS, WLDS, or the RIS sites, and placement in the Sherwood Island offshore borrow pit as either fill or cap material would all be the next least costly alternatives at about 65 percent above the NLDS.

Mystic River and Harbor: Future maintenance dredging of the Mystic River and Harbor FNP will yield a mixed material of sandy silts and silty sands. The material is expected to be found suitable for open water placement. The material is not likely suitable for beach or nearshore bar placement or other uses. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. Initial screening yielded the alternatives for consideration for Mystic River and Harbor as shown in Table 5-28.

The least cost placement alternative for the maintenance dredging of fine-grained material from the Mystic Harbor FNP is open water placement at the New London site. The second least costly placement alternatives are open water placement at the Cornfield Shoals site (40 percent increase over the cost of using the NLDS). The next least costly alternatives are placement at the Central Long Island Sound site, and as fill in the Sandy Point marsh creation project in Little Narragansett Bay, at 2.1 and 2.4 times, respectively, the cost of using the NLDS. The next least costly alternative would be placement as fill in the Morris Cove Borrow Pit CAD cell site in New Haven harbor at about 2.6 times the cost of using the NLDS. Placement in open water at the WLDS, and placement in the Sherwood Island offshore borrow pit as either fill or cap material would all be the next least costly alternatives at about 3.7 times the cost of the NLDS. The cost of transport and placement upland at landfills in Connecticut or New York would be more than four times the cost of open water placement at the NLDS.

For the proposed future improvement dredging of the upper Mystic River the least cost alternative is open water placement at the New London site. The second least costly placement alternative would be upland placement on adjacent property of the Mystic Seaport as fill to increase land elevation at about a 17 percent increase in cost. Open water placement at the Cornfield Shoals or Central Long Island Sound sites would be 2.1 to 2.8 times the cost of using the NLDS. Use as fill at a marsh creation project at Sandy Point in Little Narragansett Bay would be about 3.3 times the cost of the NLDS. Placement as fill in the Morris Cove Borrow Pit CAD cell site in New Haven Harbor would be about 3.7 times the cost of using the NLDS.

Table 5-28 - Mystic Harbor FNP - Placement Alternatives Screening				
Mystic Harbor FNP Maintenance				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	105,100	2041-2045	New London Disposal Site	$28
			Two Tree Island CDF Fill	$114
			Groton Black Ledge CDF Fill	$114
			Duck Island Roads CDF Fill	$130
			Cornfield Shoals Disposal Site	$39
			Sherwood Island Pit - Fill	$104
			Sherwood Island Pit - Cap	$104
			110 Sand Company Site, NY	$114
			Morris Cove Pit CAD - Fill	$72
			Brookhaven Town Landfill NY	$114
			Manchester City Landfill, CT	$114
			Central Long Island Sound DS	$59
			Western Long Island Sound DS	$104
			Falkner Island CDF Fill	$162
			New Haven Breakwaters CDF	$162
			Sandy Point LNB Marsh Creation	$66
Mystic Harbor FNP Improvement				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	450,000	2041-2045	New London Disposal Site	$18
			Two Tree Island CDF Fill	$111
			Groton Black Ledge CDF Fill	$111
			Duck Island Roads CDF Fill	$125
			Cornfield Shoals Disposal Site	$38
			Sherwood Island Pit - Cap	$80
			110 Sand Company Site, NY	$119
			Morris Cove Pit CAD - Fill	$67
			Manchester City Landfill, CT	$119
			Brookhaven Town Landfill NY	$119
			Western Long Island Sound DS	$80
			Central Long Island Sound DS	$51
			New Haven Breakwaters CDF	$145
			Sandy Point LNB Marsh Creation	$60
			Mystic Seaport Upland Fill	$21

5.3.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Alternatives to the Federal Base Plan: For the sandy material from Watch Hill Cove and the Little Narragansett Bay entrance channel, the Federal base plan is beneficial use as either beach or nearshore nourishment. There is at least one more distance nourishment alternative at Misquamicut Beach which could be pursued if there is a state or local sponsor willing to bear the additional cost of placement at this site.

Table 5-29 - Federal Navigation Project Base Plans
Fishers Island Sound and Little Narragansett Bay Dredging Center Projects

Project and Segment	Material Type	Federal Base Plan
Pawcatuck River FNP		
Pawcatuck River and Inner Bay Channel	Suitable Fines	New London Disposal Site
Little Narragansett Bay Entrance Channel	Sand	Sandy Point Beach, RI – On Beach Sandy Point Beach, RI – Nearshore Watch Hill/Napatree - Nearshore
Watch Hill Cove	Sand	Watch Hill Beach – On Beach or Nearshore
Stonington Harbor	Suitable Fines	New London Disposal Site
Mystic Harbor – Maintenance	Suitable Fines	New London Disposal Site
– Improvement	Suitable Fines	New London Disposal Site

For the silty material from the Pawcatuck project, or from the maintenance of Stonington or Mystic Harbors, there are no practicable cost-effective alternatives to open water placement. Upland placement would be four times the cost of using the NLDS. Use of the material in a marsh creation project at Sandy Point in Little Narragansett Bay carries costs between 58 percent increase (Stonington) and two to 2.4 times the least cost for maintenance of the Pawcatuck River and Mystic Harbor. The USACE Section 204 continuing authority could be used to assist with the additional cost if sufficient benefits are identified from marsh creation.

For the improvements proposed to the upper Mystic River, upland placement as fill in the Seaport vicinity may be a viable recommended alternative plan, at only a 17 percent increase in cost, if a sponsor willing to pay the difference is found. No likely alternatives to the Federal base plans for the silty material from this FNP that would be implemented were identified. Use of this material in a marsh creation project at Sandy Point in Little Narragansett Bay, at 3.3 times the cost, could be undertaken if a sponsor were found; however, that one project would consume nearly a marsh creation project's entire requirement for fill material.

5.4 New London Area Dredging Center

The New London Area Dredging Center stretches from Mumford Point in Groton, CT in the east to Goshen Point in the west. The dredging center also extends northerly upriver to Norwich, CT and includes several navigable coves tributary to the river. The dredging center consists of the cities of New London and Groton on the coast, and the municipalities along the Thames River to the head of navigation, including Waterford, Ledyard, Montville, Preston and Norwich, Connecticut, and includes the Federal Navigation Projects for New London Harbor and the Thames River. For planning purposes the Thames River is divided into two segments, above and below Cow Point at the upstream end of the U.S. Naval submarine base in Groton. The dredging center also includes several other small harbors, coves and rivers which provide navigation access to Long Island Sound for commercial fishermen and boaters. The principal waterways in this area are:

Poquonock River
Baker Cove
Pine Island Bay
New London Harbor – Includes FNP, Shaw's Cove and Greens Harbor
Lower Thames River – Includes FNP and U.S. Navy Channels
Upper Thames River – Includes FNP
Tributary Coves and Rivers to the Thames River
- Smith Cove
- Horton Cove
- Poquetanuck Cove
- Trading Place Cove
- Shetucket River

This dredging center also includes a few offshore islands within Groton at Pine Island Bay which require navigation access. The U.S. Navy and U.S. Coast Guard have major facilities at New London and Groton that require periodic maintenance and occasional improvement dredging. These waterways and facilities yield a mix of material types. While materials from the two FNPs have always been found suitable for unconfined open water placement, some materials from the U.S. Navy berths in Groton have needed to utilize CAD cells in recent decades. The Thames River and its tributaries, and other coastal watercourses contribute silty shoal material to the harbor, resulting in harbor maintenance materials which are predominantly fine-grained, and not recommended for beach nourishment or nearshore placement.

5.4.1 Federal Navigation Projects - Maintenance

The dredged features of the two FNPs in this dredging center have each been most recently dredged as shown in the following table. The U.S. Navy has improved the New London Harbor main channel, anchorage and maneuvering area by widening and deepening those areas to -40 feet up to the area of the Connecticut State Pier, and to -36 feet above that point to the bridges. Under interdepartmental agreement, and as provided by statute, the USACE maintains the depths and widths improved by the Navy so long as the Navy pays the cost of maintaining any additional width beyond that provided by Civil Works Authority. The USACE pays for all work within the limits of the Civil Works authorization plus any additional depth within the Civil Works widths. U.S. Navy work on the channels, anchorage and maneuvering areas is included under the FNP history and projections. U.S. Navy work for its berthing areas is included under other Federal work.

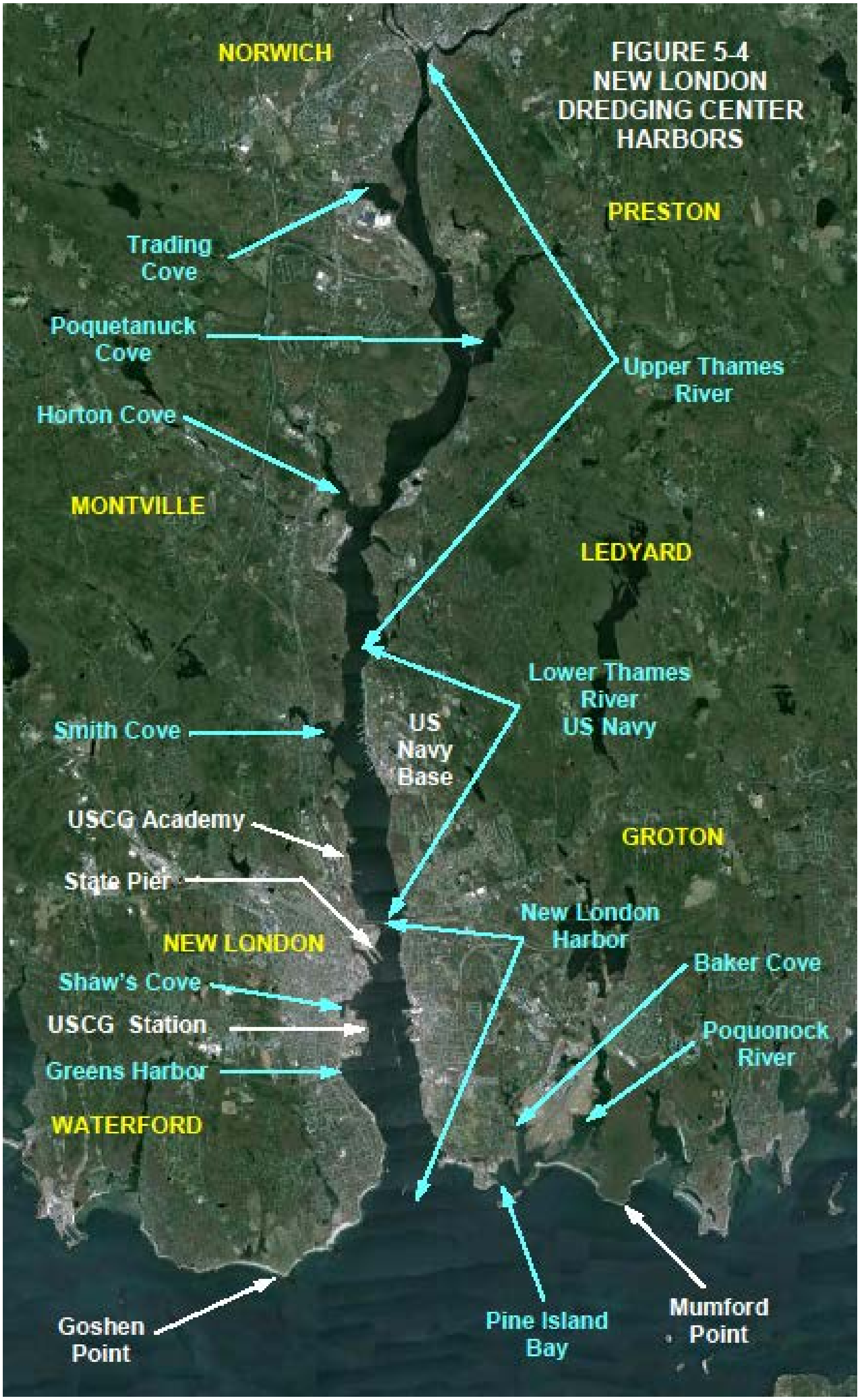


FIGURE 5-4
NEW LONDON
DREDGING CENTER
HARBORS
NORWICH
PRESTON
Trading
Cove
Poquetanuck
Cove
Upper Thames
River
Horton Cove
MONTVILLE
LEDYARD
Lower Thames
River
US Navy
Smith Cove
US
Navy
Base
USCG Academy
GROTON
State Pier
New London
Harbor
NEW LONDON
Baker Cove
Shaw's Cove
USCG Station
Poquonock
River
Greens Harbor
WATERFORD
Goshen
Point
Pine Island
Bay
Mumford
Point

Table 5-30 **Federal Navigation Project Dredging History – New London Area Dredging Center**				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
New London Harbor				
Main Channel & Anchorage	1984	Unknown	NLDS	Suitable Fine
	1980	3,260,000	NLDS	Suitable Fine
	1974	1,576,000	NLDS	Suitable Fine
	1942-43	89,800	Unknown	Unknown
23-Foot Waterfront Channels	1943	316,800	Unknown	Suitable Fine
	1938	30,800	Unknown	Unknown
15-Foot Shaws Cove	1934	19,000	Unknown	Suitable Fine
	1912	73,600	Unknown	Unknown
Thames River				
Lower Channels - U.S. Navy	1996	1,029,200	NLDS	Suitable Fine
Lower Channels	1986	331,400	NLDS	Suitable Fine
Lower Channels	1954	158,500	NLDS	Unknown
	1941	221,100	Unknown	Unknown
Upper - Norwich Channel	1966	237,400	NLDS	Suitable Fine
	1956-57	20,000	In-River	Unknown
	1949	219,600	NLDS	Unknown

New London Harbor: The FNP for New London Harbor consists of a main channel, anchorage, and maneuvering area all deepened by the U.S. Navy. Under the USACE Civil Works Authority these areas are authorized to -33 feet MLLW. The Navy has deepened the channel up to the vicinity of the State Pier to -40 feet along with the anchorage and turning area, and the channel above to the bridges to -39 feet. The remaining portions of the FNP include the 23-foot waterfront channel (north and south segments), anchorage, Winthrop Cove Channel and State Pier Channel, and the 15-foot channel and anchorage at Shaw's Cove. The man channel and features improved by the U.S. Navy, and the two USACE civil works project segments, are each treated separately in making projections of future dredging needs.

Main Channels Features: The 40-foot U.S. Navy main channel harbor improvement was constructed in 1980 as part of its Trident submarine project. About 3,260,000 CY were removed and placed at the NLDS. The 39-foot up-river improvement was constructed in 1996 as part of the Navy's Seawolf submarine improvements. Nearly all of the dredging for the 1996 project was performed in the lower Thames River, and that work is compiled in discussion of that project. Minor maintenance of the New London Harbor reaches of these features was carried-out in 1984 by the USACE hopper dredge *McFarland*, however, no record of the amount of material removed is available. Since that time, the U.S. Navy improved areas downstream of the bridges have accumulated about 243,300 CY of shoal material (Survey NLH-188, 2010). This represents an annual shoaling rate for these features of about 9,400 CY. It is not anticipated that these features would require further maintenance before about 2026, by which time a total shoal accumulation of about 393,000 could be expected. This material is expected to be suitable fine-grained material as in the past, and maintenance is anticipated to be required only once in the DMMP planning horizon.

<u>Waterfront Channels Features</u>: The waterfront project features consist of 23-foot channels to the north and south connecting the main channel to a 23-foot anchorage off the downtown waterfront, a 23-foot maneuvering area at the confluence of the main and north waterfront channels, and two 23-foot branch channels into Winthrop Cove and alongside the state pier. These areas were last dredged in 1938 to 1943 when the 23-foot improvements were completed. At that time about 347,500 CY were removed and placed in an unspecified open water site. Since 1947, these features have accumulated a total of about 316,700 CY of shoal material (Survey NLH-188, 2010). This represents an annual shoaling rate for these features of about 4,700 CY. As with the main channels, it is not anticipated that these features would require further maintenance before about 2026 when a total of about 392,300 CY of shoal material will likely have accumulated. This material is also expected to be suitable fine-grained, and maintenance is anticipated to be required only once in the DMMP planning horizon.

<u>Shaw's Cove Features</u>: The Shaw's Cove channel and anchorage were last maintained in 1934 when about 19,000 CY was removed. Prior to that action, improvement dredging to deepen these features to 15 feet was accomplished in 1912. A total shoal volume of about 22,600 CY had accumulated in these features at the time of the last condition survey (NLH-187, 2008), yielding an annual shoaling rate of about 440 CY. If Shaw's Cove were to be maintained when the main channels are assumed to next be dredged in about 2026, a total shoal volume of approximately 30,900 CY could be expected. This material is also expected to be fine-grained, and maintenance is anticipated to be required only this once in the DMMP planning horizon.

<u>Thames River</u>: The FNP for the Thames River as authorized under the USACE Civil Works authority consists of a 25-foot channel 250 to 200 feet wide from the head of the New London Harbor main channel at the bridges, upriver to a turning basin of the same depth at Norwich, at the confluence of the Shetucket and Yantic Rivers. A 20-foot maneuvering area 350 feet wide west of the channel opposite the U.S. Navy base at Groton is also included in the FNP. The U.S. Navy has further improved the channel from the bridges upriver to below Cow Point at the upstream limit of its base. The Navy channel is a 39-foot channel inside a wider 36-foot channel. The Navy channels entirely encompass the area of the USACE civil works features in this reach of the river. The Thames River project is thus divided into two segments; the lower river channel improved by the U.S. Navy, and the upper river channel to Norwich as improved by the USACE under its Civil Works authority. As with the New London Harbor project, the USACE maintains the channels improved by itself and by the Navy. The Navy is responsible for the cost of maintaining its improved depths outside of the widths previously improved under the USACE Civil Works authority.

Lower Thames River – U.S. Navy Channels: Maintenance of the 25-foot channel in the reaches below Cow Point was last accomplished by the USACE in 1954. All work in this area of the river since that time has been to greater depths and widths than the 25-foot channel, and was accomplished by the Navy or by the USACE for the Navy. The Navy began a series of deepening projects for New London Harbor and the lower Thames River in 1974 and continued that work in 1980 and 1996, as newer classes of submarines joined the fleet that required successively deeper channels to operate. Currently a -39-foot MLLW channel within a generally wider 36-foot channel exists between the bridges and the head of the Navy Base below Cow Point. The latest condition survey of this project segment (THA-869, 2008) with soundings made in August 2006 shows about 370,300 CY of shoal accumulated in the Navy-improved areas (147,800 CY in the 36-foot areas and 178,800 CY in the 39-foot areas). When adjusted for the differing years of construction for the two channel depths, this yields annual shoaling rates of about 7,400 CY and 17,900 CY for the 36-foot and 39-foot areas respectively. If the Navy channels were to be maintained in about 2026 (once during the planning horizon) total accumulated shoal in those channels would be expected to be 295,600 CY and 536,400 CY respectively, or a total volume of 832,000 CY at that time. This material is expected to be suitable fine-grained. Maintenance is anticipated to be required only once in the DMMP planning horizon.

Upper Thames River Channel and Basin: The 25-foot channel segment between Cow Point (U.S. Navy Base) and Norwich, including the Norwich turning basin, were initially constructed in 1941. Since that time this segment of the project has been maintained five times, most recently in 1966 when about 237,400 CY was removed and placed at the NLDS. The latest condition survey for this project segment (THA-869, 2008) with soundings made in August 2006 shows about 1,586,800 CY of accumulated shoal material. When included with the maintenance activity since 1941, this yields an annual shoaling rate of about 37,600 CY. If maintenance of the upper Thames River were carried out once, in about 2041 near the end of the DMMP planning horizon, a total shoal accumulation of about 2,902,500 CY could be expected. This material is also expected to be suitable fine-grained. The dredging activity timeline over the planning horizon for the two FNPs in the New London Dredging Center is shown below.

Table 5-31 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance New London Area Dredging Center

Project & Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
New London Harbor						
Main Channel & Anchorage			393,000			
23-Foot Waterfront Channels			392,300			
15-Foot Shaws Cove			30,900			
Thames River						
Lower - U.S. Navy Channels			832,000			
Upper Norwich Channel						2,902,500
Total – Suitable Fine			1,617,300			2,902,500
Total – Unsuitable Fine			30,900			

5.4.2 Harbor Characterization for Federal Projects

Maintenance of these two FNPs has most often used a mechanical bucket dredge with open water placement at sites in eastern Long Island Sound. At New London Harbor a hopper dredge has also been used (1985), with open water placement at the NLDS.

New London Harbor – Main Channel: USACE sampling and testing of shoal materials in the New London main ship channel in the 1970s, mainly core samples, showed a range of largely fine-grained materials from 23 to 99 percent fines, with a mean value of about 79 percent. This material was removed, along with nearly three million CY of parent glacial material and marine clays, during the U.S. Navy's 1980 improvement to deepen the main channel to 40 feet. That material was placed at the NLDS. Minor maintenance dredging of the channel by the USACE in 1984 also placed material at the NLDS. Sampling of the channel sediments for the 1984 maintenance operation showed the material to be fine silt and clay ranging from 66 to 93 percent fines. Bioassay and bioaccumulation testing was performed on the 1984 samples and the material found acceptable for open water placement. It is anticipated that future main channel maintenance will yield similar fine-grained materials suitable for open water placement.

New London Harbor – Waterfront Channels: The only sediment sampling of the Federal project features of the waterfront branch channels and anchorage on record is a single sample from the 1984 testing which showed silty clay of 100 percent fines. It is anticipated that the waterfront channel and anchorage maintenance, including the approach channels to Winthrop Cove and the state pier will yield similar fine-grained materials suitable for open water placement, subject to future testing and evaluation.

New London Harbor – Shaw's Cove: No dredging has been accomplished for Shaw's Cove since the 1934 maintenance operation. Sampling and testing of Shaw's Cove shoal sediments was last undertaken in 1978 when maintenance was contemplated but never funded. With the exception of one sample in the entrance which showed sand with approximately six percent fines, the samples showed a range of 68 to 86 percent fines. A number of chemical parameters were elevated in the 1978 bulk chemistry testing. Biological testing was also undertaken on the 1978 samples which showed the material was acceptable for open water placement. Any future dredging of the Federal project features at Shaw's Cove would likely encounter sandy silts similar to the 1978 test results. Further sediment tests, including chemical and biological testing would need to be conducted at that time to determine suitability for various placement alternatives. For DMMP planning purposes, the 1978 biological results may be problematic in view of today's test evaluation procedures. There is some risk that Shaw's Cove shoal materials, if subjected to today's testing protocols and evaluation procedures, would be found unsuitable for unconfined open water placement. These materials will therefore be treated as unsuitable fine-grained materials for DMMP purposes.

Lower Thames River: The lower Thames River channel between the railroad bridge at New London and Cow Point in Groton above the submarine base was extensively improved by the Navy from the 1970s through the early 2000s for deeper-draft warship access. The channel deepening removed largely fine-grained silty clayey sediments which were placed at the

NLDS. Maintenance and deepening of berths at the Navy base has recently yielded fine-grained sediments that were determined to be not suitable for unconfined open water placement, and which were instead placed in a series of CAD cells excavated beneath the river channel downstream of Goss Cove. Materials excavated to form the CAD cells were placed in open water at either the NLDS or more recently at the CLDS. The berth dredging materials were placed in the cells and capped with cleaner material. In the future, it is expected that channel maintenance for access to the Navy base will yield shoal material similar to what was encountered in this area prior to the Navy's deepening projects. Samples in this reach of the river channel from 1971 to 1975 showed a range of 91 to 99 percent fines.

Upper Thames River: The sediments in the 25-foot upper Thames River channel above Cow Point (above the area improved by the U.S. Navy) were last sampled in 1973. These samples yielded largely silty material with up to 95 percent fines (68 percent mean), with only one sample showing sandy material (9 percent fines). Since these areas were last maintained in 1954, these results likely reflect the nature of the material still present in those upper channel reaches.

Maintenance of both New London Harbor and the Thames River FNPS is expected to generate fine-grained materials suitable for unconfined open water placement. Potentially these fine-grained materials could be used to create salt marsh in shallow tidelands, or pumped onto existing marsh areas as adaptive management in response to sea level rise. In the 1950s and earlier material dredged from the upper Thames River appears to have been either placed in shallow areas behind the river's stone training dikes, or placed upland along the river to create filled land for industrial development as rail yards, power plants, and other commercial uses. Such opportunities are most likely today to arise along the reaches of the Thames River above the U.S. Navy base. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

Should creation of a confined placement facility in eastern Long Island Sound for habitat development be pursued by the state or others, then New London Dredging Center projects could potentially provide material towards that purpose. Sites have been considered in the past both southeasterly and westerly of the mouth of the New London Harbor. These materials could also be placed at an ocean site as at present, the closest being the NLDS.

Table 5-32 - Scow Haul Distances to Open Water Placement Sites (in Statute Miles)

Project	RIS DS via Race	SHDS	MRDS	NLDS	NBDS	CSDS	CLDS	Orient DS
New London Harbor at Railroad Bridge	42.3	13.6	9.1	6.4	10.7	20.7	48.3	16.6
Lower Thames River at Navy Base	45.8	17.1	12.6	9.9	14.2	24.2	51.8	20.1
Upper Thames River at Norwich Basin	54.3	25.6	21.1	18.4	22.7	32.7	60.3	28.6
Pine Island Bay	41.8	8.9	4.3	3.5	7.7	17.7	45.3	13.7

The fine materials could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary this would require further investigation in the future.

5.4.3 Other Federal (Non-USACE) Dredging Activities

As described above, the U.S. Naval Submarine Base New London (SUBASENLON) has made extensive improvements to the navigation channels and other dredged features of the FNP for both New London Harbor and the Thames River. The Navy also maintains and occasionally improves its dredged access and berth areas at the Navy base in Groton. In the past these efforts have yielded both suitable and unsuitable fine-grained materials. Suitable materials have been placed at the NLDS or the CLDS, while unsuitable materials have been placed in CAD cells dredged beneath the channel along the Navy Base south of Goss Cove. By memo of 15 April 2005 the USACE selected the NLDS for placement of about 187,800 CY of parent material dredged for creation of a CAD cell in the lower Thames River to confine unsuitable materials dredged from the Navy's berths. The same determination was made for placement of materials excavated for a second CAD cell at the NLDS in 2009. Due to objections to the use of the NLDS from the state of New York, and the Navy's required schedule for completing that work, the Navy and its contractor elected to use the CLDS instead, adding 84 miles round trip to the scow haul distance above that required to transport material to the NLDS. The Navy's berth dredging activities are expected to continue to generate these types of material in the future, and the Navy has indicated it will likely continue its improvement dredging program as well.

In a letter dated October 9, 2015, the SUBASENLON Commander noted that the Navy is planning to conduct additional improvement dredging of about 60,000 CY in the next three years to support basing of the newest Virginia class submarines. The Navy confirmed the DMMP's other projections of the Navy's maintenance dredging needs.

The U.S. Coast Guard has two facilities in the New London Dredging Center. The New London Station is located on the west shore of the harbor just north of Fort Trumbull. The U.S. Coast Guard Academy is located on the west shore of the Thames River a short distance above the bridges and below the U.S. Navy base.

For the purposes of this DMMP, the Navy's improvement dredging materials and the Coast Guard's maintenance materials will be assumed to be suitable for open water placement or any other use for fine-grained suitable materials. The Navy's maintenance dredging materials will be assumed to be partly suitable (60%) and party unsuitable (40%) for open water placement.

Table 5-33 - Dredging Activity Timeline – New London Area – Other Federal Activities						
Other Federal Facility	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
U.S. Navy - Maintenance	50,000					
	75,000					
USCG Station - Maintenance			4,000			
USCG Academy - Maintenance		10,000	50,000	50,000		
U.S. Navy - Improvement	200,000	150,000				
Total – Suitable Fine	275,000	160,000	54,000	50,000		
Total - Unsuitable	50,000					

5.4.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the New London Area Dredging Center that periodically generate dredged material. These include the deep draft commercial facilities along the east shore of New London Harbor and in the Thames River, large and small marina, yacht club, and boat yard operations in the harbor, the river, and the three small waterways to the east, and the ferry terminals at New London. Private residential and public access facilities are found at many other locations throughout the dredging center.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 1,001,200 CY of maintenance dredging and 172,000 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the table below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the NLDS being the nearest regularly used approved site. These activities could also take advantage of whatever alternative placement methods are used for the two FNPs in this dredging center if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-34 - Dredging Activity Timeline – New London Area Dredging Center Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	180,900	170,100	45,600	45,500	90,300	90,300
Improvement	112,000	60,000				
Total Suitable Fine	292,900	230,100	45,600	45,500	90,300	90,300

5.4.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to very large-sized range of dredging project sizes over the DMMP planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to large private permit activities, FNP maintenance, and Navy and USCG activities that would generate up to nearly the 3 million cubic yard range are anticipated. Most material from this dredging center over at least the past half century has been placed at the NLDS. Several investigations of placement alternatives identified the following as potential opportunities for projects from this dredging center. Detailed descriptions of the alternative sites were provided in the Placement Alternatives section in Chapter 4.

Placement alternatives that could be developed or utilized for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement of unsuitable materials projected to be dredged from the Shaw's Cove segment of the New London Harbor FNP and from the U.S. Navy's continued maintenance of its facility would require containment, either in potential CDFs and CAD cells, or upland at approved landfills.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

<u>Open Water Placement Sites</u>: The closest currently active open water placement site to this dredging center is the New London site located just seaward of the harbor in Long Island Sound. The Cornfield Shoals, Central Long Island Sound, and Western Long Island Sound sites are more distant. These sites could receive any suitable material, either sandy or fine-grained.

<u>Upland Landfills</u>: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

<u>Confined Aquatic Disposal and Confined Open Water Sites</u>: CAD cells and COW sites could be developed for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive suitable materials from this and other dredging centers, as either fill or cap material. Additionally, the Morris Cove borrow pit could receive unsuitable materials as fill, since this site is located inside the harbor and not in the waters of LIS. CAD cells designed specifically for placement of Shaw's Cove or U.S. Navy maintenance materials could also be constructed when needed in New London Harbor or the lower Thames River, much as the Navy has already done.

Table 5-35 - New London Area Dredging Center Available/Potential Placement Alternatives					
Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
New London Disposal Site		Open Water	7,796,500	All	All Suitable
Central Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Western Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Cornfield Shoals Disposal Site		Open Water	200,000,000	All	All Suitable
Twotree Island CDF	- Fill	Island CDF	2,966,200	All Once Built	All
	- Cap		433,800		All Suitable
Groton Black Ledge CDF	- Fill	Island CDF	6,930,000	All Once Built	All
	- Cap		570,000		All Suitable
Faulkner Island CDF	- Fill	Island CDF	16,010,200	All Once Built	All
	- Cap		1,169,800		All Suitable
Duck Island Roads CDF	- Fill	Island CDF	1,376,100	All Once Built	All
	- Cap		233,900		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable
Clinton Harbor CDF	- Fill	Island CDF	59,800	All Until Filled	All
	- Cap		640,200		All Suitable
Norwalk Outer Harbor Islands Marsh Creation	- Fill	Island CDF Marsh	554,000	All Until Filled	All
	- Cap		376,000		All Suitable
Greenwich Captain Harbor CDF	- Fill	Island CDF	498,200	All Until Filled	All
	- Cap		331,800		All Suitable
Sherwood Island Borrow Pit Open-Water CAD		COW Fill	266,000	All Until Full	All
		COW Cap	484,000		All Suitable
Morris Cove Borrow Pit CAD cell		CAD Fill	466,100	Until Full	All
		CAD Cap	150,000		All Suitable
110 Sand Comp., Melville, NY		Upland	1,000,000	All	All Suitable
Manchester City Landfill, CT		Upland	1,200,000	All	All
Brookhaven Town Landfill, NY		Upland	700,000	All	All
Sandy Point LNB Marsh Creation		Marsh	500,000	Once Built	All Suitable
New London Harbor CAD		CAD Fill	To Design	As Built	Unsuitable
US Navy Thames River CAD		CAD Fill	USN Design	As Built	Unsuitable

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites located near this dredging center include Groton Black Ledge, Twotree Island (Waterford), Duck Island Roads, Clinton Harbor, Falkner Island, New Haven Breakwaters, Norwalk Outer Harbor Islands, and Captain Harbor (Greenwich).

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in Little Narragansett Bay, RI.

5.4.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable management alternative, as evaluated and determined consistent with the Federal Standard. For the New London Area Dredging Center, analysis matched projects and placement alternatives as follows.

New London Harbor: Future maintenance of the New London Harbor FNP will yield two different types of dredged material over the DMMP planning horizon. Fine-grained material from the waterfront channels and anchorages, and mixed sandy fine-grained materials from the main channel and turning basin are expected to continue to be found suitable for unconfined open water placement. Materials from Shaw's Cove are expected to be found unsuitable. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. Unsuitable materials must be either contained or treated before placement or use.

The U.S. Coast Guard Station's periodic maintenance of its access and berths is expected to yield fine grained materials suitable for open water placement. This material will have placement options and applications similar to that of the suitable material from the FNP.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the New London Harbor FNP is open water placement at the New London site. The second least costly alternative is open water placement at the Cornfield Shoals site at about twice the cost of using the NLDS. The next least costly alternatives are open water placement at either the Central Long Island Sound or Rhode Island Sound sites (at 2.7 times the cost of using the NLDS). The least costly non open water alternative for suitable material is use as fill in a marsh creation project at Sandy Point in Little Narragansett Bay (3.3 times the cost of the NLDS). Placement in a CDF at either Twotree Island or Groton Black Ledge would cost 6.1 to 6.6 times the least cost alternative. Placement upland at a landfill would be between 7 and 8 times as costly as using the NLDS.

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained material from the Shaw's Cove segment of the New London Harbor FNP is as fill in a CAD cell that would need to be constructed for that purpose in New London Harbor and capped with other suitable dredged materials from New London.

Table 5-36 - New London Harbor FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	785,300	2026-2030	New London Disposal Site	$13
			Cornfield Shoals Disposal Site	$27
			Twotree Island CDF – Fill	$109
			Groton Black Ledge CDF - Fill	$88
			Duck Island Roads CDF – Fill	$124
			110 Sand Co., Melville, NY	$127
			Manchester City Landfill, CT	$127
			Western Long Island Sound DS	$65
			Central Long Island Sound DS	$48
			Falkner Island CDF – Fill	$141
			New Haven Breakwaters CDF - Fill	$141
			Rhode Island Sound DS	$48
			Sandy Point Marsh Creation	$59
Unsuitable Fine (Shaw's Cove)	30,900	2026-2030	Twotree Island CDF – Fill	$124
			Groton Black Ledge CDF	$112
			Duck Island Roads CDF – Fill	$145
			Clinton Harbor CDF – Fill	$145
			Morris Cove Pit CAD - Fill	$94
			Falkner Island CDF – Fill	$175
			Bridgeport Yellow Mill CDF – Fill	$175
			New Haven Breakwaters CDF - Fill	$175
			Norwalk Islands CDF - Fill	$175
			Captain Harbor CDF - Fill	$175
			New London Harbor CAD	$93
USCG Station Maintenance - Placement Alternatives Screening				
Suitable Fine	4,000	2026-2030	Two Tree Island CDF – Fill	$262
			Groton Black Ledge CDF	$262
			Duck Island Road CDF – Fill	$320
			Cornfield Shoals Disposal Site	$192
			New London Disposal Site	$175
			Clinton Harbor CDF – Fill	$320
			110 Sand Co., Melville NY	$301
			Morris Cove Pit CAD - Fill	$234
			Manchester City Landfill, CT	$301
			Brookhaven Town Landfill	$301
			Falkner Island CDF – Fill	$369
			Sandy Point LNB Marsh Creation	$247
			Central Long Island Sound DS	$283

The second least costly alternative would be as fill in the Morris Cove Borrow Pit CAD cell site in New Haven Harbor at roughly the same cost as creating a new CAD at New London. The next least costly alternatives are placement in a proposed CDF at Groton Black Ledge or at Twotree Island at 1.3 to 1.5 times the cost of a New London Harbor CAD. Placement in a more distant potential CDF facility would be about 1.9 times as costly as a New London Harbor CAD.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the U.S. Coast Guard's New London Station is open water placement at the New London site. The second least costly alternative is open water placement at the Cornfield Shoals site at about 1.3 times the cost of using the NLDS. The next least costly alternative would be as fill in the Morris Cove Borrow Pit CAD cell site in New Haven Harbor also at roughly 1.3 times the cost of using the NLDS. The least costly beneficial use alternative for suitable material is as fill in a marsh creation project at Sandy Point in Little Narragansett Bay (1.4 times the cost of the NLDS). Placement in a CDF at either Twotree Island or Groton Black Ledge would cost 1.5 to 1.6 times the least cost alternative. Placement upland at a landfill would be more than 1.7 times as costly as using the NLDS.

Thames River: Future maintenance of the Thames River FNP will yield two different types of dredged material over the DMMP planning horizon. In the lower river reaches up to Cow Point at the upper end of the Naval base, dredging of the FNP will yield suitable fine-grained materials. The Navy's continued maintenance and improvement of its access and berth areas is expected to yield materials both suitable and unsuitable for unconfined open water placement, as has been the case in recent actions. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. Unsuitable materials must be either contained or treated before placement or use.

Maintenance dredging materials from the upper channel reaches above Cow Point to Norwich are expected to yield suitable fine-grained materials. In the past these materials have typically been placed upland or in shallow waters behind the river training dikes. Areas available for upland placement exist along most reaches of the upper river. Alternatively, the material could be hauled downriver by scow to open water placement sites in LIS if found suitable for unconfined open water placement.

The U.S. Coast Guard Academy's periodic maintenance of its access and berths is expected to yield fine grained materials suitable for open water placement. This material will have placement options and applications similar to that of the suitable material from the FNP.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the lower channel reaches (below Cow Point) of the Thames River FNP is open water placement at the New London site. The second least costly alternative is open water placement at the Cornfield Shoals site at about 1.5 times the cost of using the NLDS. The next least costly alternatives are open water placement at either the Central Long Island Sound or Rhode Island Sound sites (at 2.7 times the cost of using the NLDS). The least costly beneficial use alternative for suitable material is as fill in a marsh creation project at Sandy Point in Little Narragansett Bay (3.9 times the cost of the NLDS). Placement in a CDF at either Twotree Island or Groton Black Ledge would cost 6.7 times the least cost alternative. Placement upland at a landfill would be about eight times as costly as using the NLDS.

Table 5-37 - Thames River FNP Maintenance - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine (Lower River)	832,000	2026-2030	Cornfield Shoals Disposal Site	$26
			New London Disposal Site	$17
			Two Tree Island CDF - Fill	$107
			Groton Black Ledge CDF - Fill	$107
			Duck Island Road CDF – Fill	$122
			110 Sand Co., Melville NY	$125
			Manchester City Landfill, CT	$125
			Central Long Island Sound DS	$47
			Western Long Island Sound DS	$63
			Falkner Islands CDF - Fill	$139
			Rhode Island Sound DS	$41
			Sandy Point LNB Marsh Creation	$58
Suitable Fine (Upper River)	2,902,500	2041-2045	New London Disposal Site	$23
			Two Tree Island CDF - Fill	$100
			Groton Black Ledge CDF	$100
			Central Long Island Sound DS	$59
			Western Long Island Sound DS	$59
			Falkner Islands CDF - Fill	$133
			Cornfield Shoals Disposal Site	$41
			New Haven Breakwaters CDF Fill	$133
			Duck Island Road CDF – Fill	$121
			Stratford Point CDF - Fill	$133
			Generic Upland Along River	$19

For the upper river channel reaches above Cow Point to Norwich, past dredging operations have placed the material at the NLDS or at onshore sites along the river, either upland or behind the training dikes built to confine the channel. Sufficient land appears to exist along the river banks to continue the practice of adjacent upland placement, particularly where the material could be placed to increase the elevation of lands in the floodplain. If these areas can in fact be identified and used for this purpose today, then upland placement along the river shore areas of the reaches being dredged would be the least cost alternative. The second least costly placement alternative for the maintenance dredging of suitable fine-grained material from the upper channel reaches of the Thames River FNP is open water placement at the New London site. The next least costly alternatives are open water placement at either the Cornfield Shoals or Central Long Island Sound sites, at 1.5 and 2.7 times the cost of using the NLDS, respectively. Placement in a CDF at either Twotree Island or Groton Black Ledge would cost 6.7 times the least cost alternative. Placement in any of the other CDF sites evaluated would be about 8 to 9 times the cost of using the NLDS.

Table 5-38 - USCG Academy Maintenance - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	10,000	2021-2025	Two Tree Island CDF – Fill	$120
	50,000	2026-2030	Groton Black Ledge CDF	$120
	50,000	2031-2035	Duck Island Road CDF – Fill	$137
			Cornfield Shoals Disposal Site	$42
			New London Disposal Site	$34
			110 Sand Co., Melville NY	$109
			Morris Cove Pit CAD - Fill	$82
			Brookhaven Town Landfill	$109
			Manchester City Landfill, CT	$109
			Clinton Harbor CDF – Fill	$137
			Sherwood Island Borrow Pit - Fill	$118
			Bridgeport Yellow Mill CDF - Fill	$166
			Rhode Island Sound DS	$68
			Sandy Point LNB Marsh Fill	$75

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the U.S. Coast Guard Academy is open water placement at the New London site. The second least costly alternatives is open water placement at the CSDS (a 38 percent increase over the NLDS). The next least costly alternative is open water placement at the Rhode Island Sound site at twice the cost of using the NLDS. The least costly beneficial use alternative is placement as fill at a marsh creation site constructed at Sandy Point in Little Narragansett Bay (2.2 times the cost of the NLDS), or placement as fill in the Morris Cove CAD cell at New Haven Harbor (2.4 times the cost of the NLDS). Placement in the Sherwood Island COW site, or at an upland landfill site in Connecticut or New York would cost about 3.2 times the cost of open water placement at the NLDS. Placement in one of the several CDF sites would cost between 3.5 and 4.9 times the cost of using the NLDS for this project.

Maintenance dredging of the U.S. Navy facilities in the lower Thames River is expected to generate both suitable and unsuitable fine-grained material over the DMMP planning horizon. For suitable maintenance material, the least cost placement alternative would be placement at the New London site. The next least costly alternatives are open water placement at the CSDS (a 22 percent increase over the NLDS), at the CLDS or RISDS (both more than twice the cost of using the NLDS), or in the Morris Cove CAD cell at 2.6 times the cost of the NLDS. Use in a marsh creation project at Sandy Point in Little Narragansett Bay would be about 2.3 times the cost of using the NLDS. Use of one of the Connecticut or New York landfills would be 3.4 times as costly as the NLDS. Use of the Sherwood Island COW site would cost 3.8 times the cost of open water placement.

Table 5-39 - US Navy – Thames River – Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine Maintenance	75,000	2015-2020	New London Disposal Site	$31
			Cornfield Shoals Disposal Site	$38
			Two Tree Island CDF – Fill	$117
			Groton Black Ledge CDF – Fill	$117
			Duck Island Road CDF – Fill	$134
			Clinton Harbor CDF – Fill	$134
			Sherwood Island Pit COW Fill	$111
			Sherwood Island Pit COW Cap	$111
			110 Sand Co., Melville NY	$104
			Morris Cove Pit CAD – Fill	$81
			Brookhaven Town Landfill	$104
			Manchester City Landfill	$104
			Rhode Island Sound DS	$64
			Central Long Island Sound DS	$64
			Falkner Island CDF – Fill	$161
			Sandy Point LNB Marsh Fill	$71
Unsuitable Fine Maintenance	50,000	2015-2020	Two Tree Island CDF – Fill	$121
			Groton Black Ledge CDF – Fill	$121
			Duck Island Road CDF – Fill	$139
			Clinton Harbor CDF – Fill	$139
			Morris Cove Pit CAD – Fill	$83
			Falkner Island CDF – Fill	$167
			Bridgeport Yellow Mill CDF – Fill	$167
			New Haven Breakwaters CDF – Fill	$167
			Norwalk Islands CDF – Fill	$167
			Captain Harbor CDF – Fill	$167
			US Navy Thames River CAD – Fill	$79

Table 5-39 (Continued) - US Navy – Thames River – Placement Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	200,000	2015-2020	New London Disposal Site	$26
Improvement	150,000	2021-2025	Cornfield Shoals Disposal Site	$32
			Two Tree Island CDF – Fill	$113
			Groton Black Ledge CDF – Fill	$113
			Duck Island Roads CDF – Fill	$129
			Sherwood Island Pit COW – Cap	$101
			110 Sand Co., Melville NY	$123
			Morris Cove Pit CAD – Fill	$69
			Brookhaven Town Landfill	$123
			Manchester City Landfill	$123
			Central Long Island Sound DS	$57
			Western Long Island Sound DS	$101
			Rhode Island Sound DS	$57
			Sandy Point LNB Marsh Fill	$65

Maintenance dredging of unsuitable materials from the U.S. Navy facilities would have a least cost alternative of placement in a CAD cell in the lower river constructed for that purpose, as the Navy has done in its last two dredging operations. Placement as fill at the Morris Cove Borrow Pit CAD cell site would be slightly more expensive than a project specific CAD cell (a 5 percent increase). Placement in one of the two CDF sites near New London (Groton Black Ledge or Twotree Island) would entail a 50 percent increase in cost over a Thames River CAD cell. Use of one of the many other CDF sites would be at least twice as costly as a Thames River CAD cell.

Projected continued improvement dredging of the Navy's facilities would generate suitable fine-grained material for which the least cost placement alternative would be placement at the New London site. The second least costly alternative is open water placement at the CSDS (a 23 percent increase over the NLDS). The next least costly alternatives are placement at either the Central Long Island Sound or Rhode Island Sound sites (both 2.2 times the cost of using the NLDS). Use in a marsh creation project at Sandy Point in Little Narragansett Bay would be about 2.5 times the cost of using the NLDS. Placement as fill at the Morris Cove CAD cell would be 2.7 times the cost of using the NLDS. The WLDS would cost 3.9 times the cost of using the NLDS, while use of one of the two nearby CDF sites would cost 4.3 times the cost of the NLDS, and placement at one of the upland landfills in Connecticut or New York would be more than 4.7 times the cost.

5.4.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for FNPs and other Federal agency projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-40 - Federal Navigation Project and Other Federal Agency Base Plans
New London Area Dredging Center Projects

Project and Segment	Material Type	Federal Base Plan
New London Harbor FNP		
Main Channel and Waterfront Channels and Anchorages	Suitable Fines	New London Disposal Site
Shaws Cove	Unsuitable	New London Harbor CAD - Fill
Thames River FNP		
Lower Channel	Suitable Fines	New London Disposal Site
Upper Channel to Norwich	Suitable Fines	Generic Upland Along River
U.S. Coast Guard Facilities		
USCG Station New London	Suitable Fines	New London Disposal Site
USCG Academy – Thames R.	Suitable Fines	New London Disposal Site
U.S. Navy Facilities – Thames R.		
USNSB Maintenance	Suitable Fines	New London Disposal Site
USNSB Maintenance	Unsuitable	US Navy Thames River CAD - Fill
USNSB Improvement	Suitable Fines	New London Disposal Site

Alternatives to the Federal Base Plan: For suitable fine-grained materials from either USACE, Navy. or Coast Guard projects, there are no lower cost alternatives to open water placement in LIS. This means that selection of other alternatives would require non-Federal funding of the additional cost of the selected alternative. The more distant haul outside of LIS to the RIS site would be at least twice the cost of using the NLDS. Upland placement is three times the cost of using the NLDS, while placement in CDF constructed nearby would be 4 to 7 times the cost, depending on the volume dredged.

The least costly beneficial use opportunity, marsh creation, would be two to three times the cost of open water placement at the NLDS. Moreover the more than two million CY of suitable fine-grained materials that would be generated by the three Federal agencies would require four sites of similar size to that at Sandy Point. As discussed earlier, the USACE Section 204 beneficial use authority could assist the states in developing such projects and sharing in their cost.

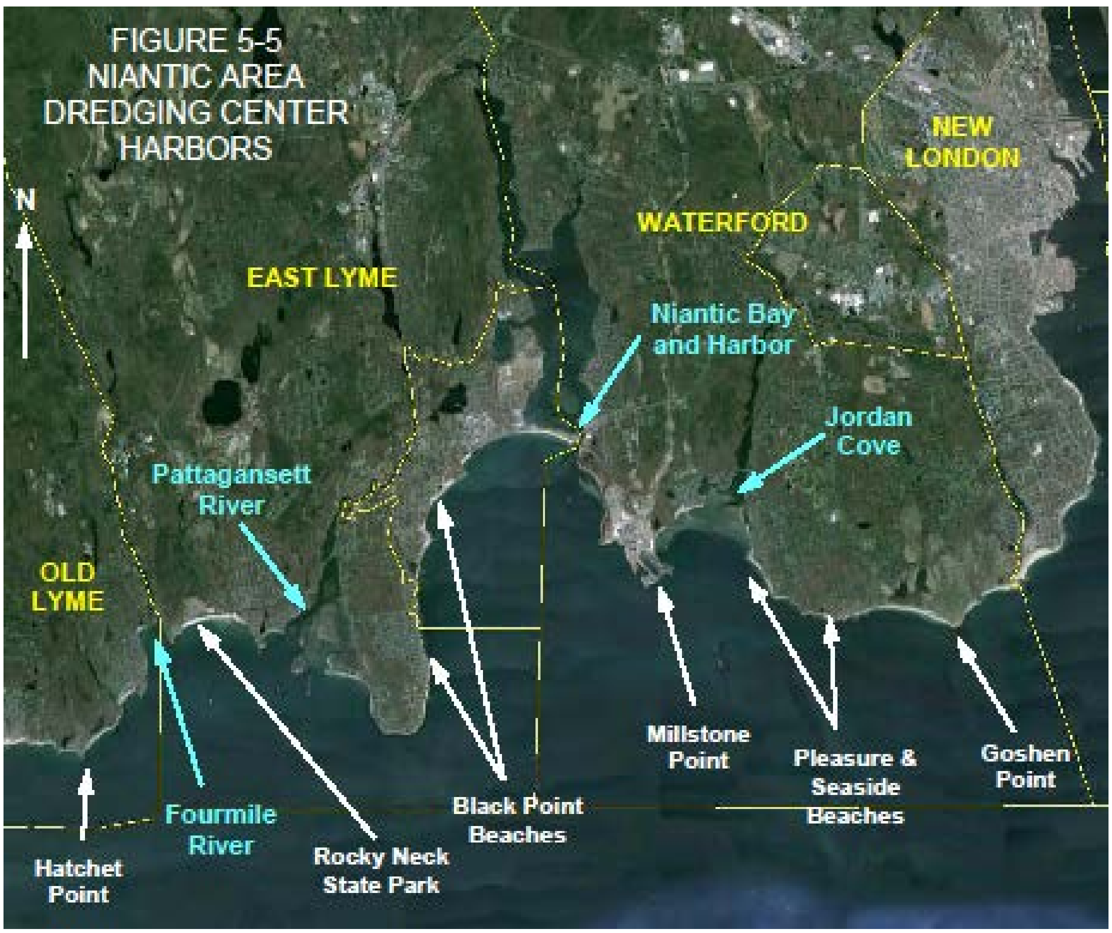
For the unsuitable material from the USACE Shaw’s Cove anchorage and the Navy’s continuing maintenance there are no options other than containment, with in-harbor or in-river CAD cell development as the least costly alternative. If a marsh creation project were developed in this area, a CAD cell could be constructed beneath the site before material is placed for the marsh project.

5.5 Niantic Area Dredging Center

The Niantic Dredging Center encompasses the coastal areas of the towns of Waterford, East Lyme and Old Lyme from Goshen Point west to Hatchet Point. The area includes the Federal Navigation Project for Niantic Bay and Harbor. Several small coves with navigation access to Long Island Sound are also included in this area. The area includes a number of beaches, including two state parks, and the Millstone nuclear power plant with its intake and discharge sluices.

The principal waterways in this area are:

Jordan Cove
Niantic River – Includes FNP
Niantic Bay
Pattagansett Bay
Fourmile River



The harbors in this dredging center, including the Niantic Bay and Harbor FNP, produce a mix of materials ranging from sands in entrance channels to silty sands and sandy silts in interior areas. Dredging projects in this area will be smaller-scale, with smaller dredge quantities, limiting the opportunity to employ multiple dredge plants on the same project. Where dredging methods that can accommodate both beneficial use of the sandy material, and a different placement method for the silty material (the same dredge plant can be used for both materials), than at least some portion of the project's dredged material may be economically placed beneficially. There are a number of beaches in the area that could benefit from direct or nearshore bar nourishment, provided that grain size is suitable for such placement and other resources such as SAV and shellfish can be avoided.

5.5.1 Federal Navigation Project Maintenance – Niantic Bay and Harbor

The single FNP in this dredging center, Niantic Bay and Harbor, was authorized in 1964 and constructed in 1970, when a total of about 35,000 CY was dredged and placed in open water at the Niantic DS located south of the harbor in Long Island Sound.

Table 5-41
Federal Navigation Project Dredging History – Niantic Area Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Current Material
Niantic Bay and Harbor	1970	35,000	Niantic DS	Suitable Fine

The dredged feature of the FNP consists of an 8-foot deep (MLLW) entrance channel from deep water in Niantic Bay to and through the inlet to a point just above the bridges, and then a 6-foot channel from the inlet into the harbor in the lower Niantic River.

The project has never been maintained since its initial construction. The latest condition surveys of the channel were in 2006 (Survey #NIA-262) and 2014 (NIA-263). The 2006 survey showed about 4,700 CY of shoal material (1,900 CY in the 8-foot channel and 2,800 CY in the upper 6-foot channel) while the 2014 survey showed 9,100 CY (4,400 CY in the 8-foot channel and 4,700 CY in the 6-foot channel). Over the 8 years between those two surveys this yields an annual shoaling rate of 560 CY (320 CY entrance, 240 CY upper channel). In the 44 years since the last dredging (1970 to 2014) action, an annual rate of 210 CY is indicated by the most recent shoal quantity. There is no information to indicate why shoaling has increased during the more recent survey interval; however, it could be due to Hurricane Sandy. The controlling depth in the middle half of the entrance channel is 6.8 feet, and 5.0 feet in the upper channel. This is not a significant reduction measured over the 45 years since the last dredging.

Using the more recent higher rate of 560 CY per year (320 CY entrance, 240 CY upper), if this project were to be dredged in 2031 when controlling depths have been reduced by nearly two feet, then shoal volumes of 9,500 CY in the entrance channel and 8,500 CY in the upper channel (18,000 CY total) could be expected. It is anticipated that this project will require maintenance only once during the planning horizon.

Table 5-42 - Dredging Activity Timeline Federal Navigation Project Maintenance – Niantic Area Dredging Center						
Niantic Bay and Harbor FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Entrance Channel				9,500		
Upper Channel				8,500		

5.5.2 Harbor Characterization for Federal Projects

The only sediment testing on record for the Federal channel shoal materials was performed in 1977. That testing showed that material in the 8-foot entrance channel and the lowest reach of the 6-foot upper channel in the harbor to be sand with four to ten percent fines. Materials in the 6-foot channel further upstream were 16 to 71 percent fines. Therefore, it is likely that material from the 8-foot channel could be characterized as sand, while material from the 6-foot channel can be characterized as suitable fine-grained. The sand material could be available for beach or nearshore bar placement as nourishment. The upper project materials could potentially be used for salt marsh creation or for raising marsh surface elevation. Material could also be re-handled and dewatered for placement upland if a site were available and permitted, or if found cost-effective for some public purpose. However, no such upland placement opportunities were identified by this study.

5.5.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal facilities in the Niantic Dredging Center that require dredging.

5.5.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of non-Federal maritime interests in the Niantic Area Dredging Center. There are commercial and public marinas, yacht clubs and boat yards in Niantic Harbor, Niantic Bay, and Fourmile River. There are public landings and private residential boating docks and landings in those locations and in Jordan Cove, the Pattagansett River and elsewhere in the area.

These activities will typically generate sandy material if located along the open shore, and will yield more silty material if located in rivers, or inner areas of coves and harbors. Similar to the FNP maintenance materials, sand generated by these smaller projects could be used for beneficial beach or bar placement as nourishment. Silty materials could be dewatered and placed upland, or used in marsh projects, where found economical to re-handle. Ocean placement is an environmentally acceptable and lower cost alternative when beneficial uses are not practicable, with the NLDS being the closest approved site.

The 2009 dredging needs study projected non-Federal dredging needs volumes for the Niantic Area Dredging Center at 226,500 CY for maintenance and 225,900 CY for improvement. If it is assumed that half of the maintenance needs will generate beach or bar placement compatible sand, and that the remaining materials, whether maintenance or improvement, will generate more silty materials, then the dredging needs and timeline for non-Federal permit activities as adapted from the 2009 Dredging Needs report are shown below.

Table 5-43 - Dredging Activity Timeline – Niantic Area Dredging Center Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance - Sand	83,000	15,000	2,600	2,600	5,000	5,000
Maintenance - Silty	83,000	15,000	2,600	2,700	5,000	5,000
Improvement	5,200	250,000	300	400	0	0
Total Non-Fed - Sand	83,000	15,000	2,600	2,600	5,000	5,000
Total Non-Fed - Silty	88,200	265,000	2,900	3,100	5,000	5,000
Total All NF Material	171,200	280,000	5,500	5,700	10,000	10,000

5.5.5 Placement Alternatives Available to Dredging Center Activities

As described above, this dredging center is expected to produce a mix of sandy and sandy-silt/silty-sand materials. Some of this material may prove suitable for beach nourishment, nearshore placement, and other beneficial uses over the planning horizon. Projects from small marina maintenance activities generating a few hundred to a few thousand cubic yards every few years, up to large marina improvements of 250,000 CY are expected. Maintenance of the sole FNP in this area is expected to generate more than 10,000 CY once during the planning horizon. Siltier materials may require upland or open water placement, or could be used for marsh creation/enhancement it such a project is proposed in the area. Several investigations of dredged material management alternatives identified the following as opportunities for dredged material placement for projects from this dredging center.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-44 - Niantic Area Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Cornfield Shoals Disposal Site (CSDS)	Open Water	200,000,000	All	All Suitable
New London Disposal Site (NLDS)	Open Water	7,796,500	All	All Suitable
Twotree Island CDF - Fill	Island CDF	2,966,200	All Once Built	All
- Cap		433,800		All Suitable
Groton Black Ledge CDF Fill	Island CDF	6,930,000	All Once Built	All
Cap		570,000		All Suitable
Faulkner Island CDF - Fill	Island CDF	16,010,200	All Once Built	All
- Cap		1,169,800		All Suitable
Sherwood Island Borrow Pit Open-Water CAD	COW Fill	266,000	All Until Full	All
	COW Cap	484,000		All Suitable
Morris Cove Borrow Pit CAD cell	CAD Fill	466,100	Until Full	All
	CAD Cap	150,000		All Suitable
110 Sand Company Clean Fill Site (59)	Upland Sand Pit	1,000,000	All Until Filled	All Suitable
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Sandy Point LNB, RI - Marsh Creation	Marsh Fill	500,000	Once Built	Suitable Fine
Sandy Point LNB, RI	Nearshore	80,000	Recurring	Suitable Sand
Bluff Point State Park, CT	Nearshore	72,300	Recurring	Suitable Sand
Rocky Neck State Park, CT	Nearshore	48,600	Recurring	Suitable Sand
Cove Island Beach, CT	Nearshore	28,200	Recurring	Suitable Sand
Calf Pasture Beach, CT	Nearshore	30,200	Recurring	Suitable Sand

Beach and Nearshore Nourishment Sites: The LIS coastline of the Niantic dredging center is characterized by a mix of small beaches and rocky headlands, with small coastal plain river inlets, and bays and small coves. There are a few small public beaches (Rocky Neck and Harkness State Parks), and a larger number of private beaches (the beaches of Black Point in East Lyme, and Pleasure and Seaside Beaches in Waterford). Adjacent dredging centers include numerous private beaches and New London's ocean beach park.

Table 5-45 - Scow Haul Distances to Beach/Nearshore Placement Sites in Statute Miles							
Project	Hammon -asset SP	Westbrook Town Beach	Rocky Neck SP	Harkness Beach SP	Ocean Beach Park	Bluff Point State Park	Napatree Beach RI
Niantic Bay at Highway Bridge	23.1	17.4	6.0	5.1	7.3	9.9	18.8
Jordan Cove	23.9	18.0	7.0	3.5	5.0	7.7	17.2
Fourmile River at Railroad Bridge	18.5	12.9	0.9	7.9	9.3	12.1	16.6
Pattagansett River	19.2	13.5	1.5	7.6	9.2	11.9	20.7

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the New London site located southeast of Niantic in LIS off New London Harbor. The Cornfield Shoals site is located offshore of the mouth of the Connecticut River further west. The historic Niantic site, last used in 1970, is located in LIS south of Niantic Bay. These sites could receive any suitable material, either sandy or fine-grained.

Table 5-46 - Scow Haul Distances to Open Water Placement Sites in Statute Miles								
Project	RISDS via Race	SHDS	MRDS	NLDS	NBDS	CSDS	CLDS	Orient DS
Niantic Bay at Highway Bridge	43.0	17.4	12.8	8.3	4.1	14.1	41.7	10.5
Jordan Cove	44.0	14.8	10.2	5.7	3.9	13.4	41.0	10.3
Fourmile River at Railroad Bridge	47.3	18.9	14.3	9.8	4.3	9.1	36.7	8.2
Pattagansett River	47.1	18.7	14.1	9.6	4.1	9.5	36.9	8.4

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meet their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites could be developed for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Existing open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDFs sites located near this dredging center include Twotree Island (Waterford), Groton Black Ledge, Falkner Island, and Duck Island Roads.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. Two such marsh creation sites are located at Sandy Point in New Haven Harbor, and at Sandy Point in Little Narragansett Bay, RI.

5.5.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement/management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Niantic Bay Area Dredging Center analysis matched the FNP with placement alternatives as follows.

Niantic Bay and Harbor: Future maintenance dredging of the Niantic Bay and River FNP will yield two types of dredged material; clean sand and fine-grained material suitable for open water placement. The entrance reaches of the channel seaward of the bridges will yield sandy material suitable for beach or nearshore bar placement or other uses. The inner bay channel reaches will yield silty fine-grained material. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites.

Table 5-47 - Niantic Bay and River FNP – Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Sand	9,500	2036-2040	Duck Island Roads CDF - Cap	$193
			Cornfield Shoals Disposal Site	$99
			New London Disposal Site	$96
			Twotree Island CDF – Cap	$183
			Clinton Harbor CDF – Cap	$193
			Groton Black Ledge CDF – Cap	$183
			Rocky Neck State Park - Nearshore	$123
			Bluff Point State Park - Nearshore	$136
			Falkner Island CDF – Cap	$217
			Cove Island Beach, CT – Nearshore	$220
			Calf Pasture Beach, CT – Nearshore	$220
			Sherwood Island Borrow Pit – Cap	$161

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	8,500	2036-2040	Duck Island Roads CDF – Fill	$205
			Twotree Island CDF – Fill	$190
			Clinton Harbor CDF – Fill	$205
			Groton Black Ledge CDF – Fill	$190
			Falkner Island CDF – Fill	$226
			New London Disposal Site	$103
			Cornfield Shoals Disposal Site	$106
			110 Sand Company Site, NY	$183
			Morris Cove Pit CAD – Fill	$152
			Manchester City Landfill, CT	$183
			Brookhaven Town Landfill, NY	$183
			Sandy Point LNB Marsh Creation	$167

The least cost placement alternative for the maintenance dredging of both sand and silty material from the Niantic Bay and Harbor FNP is open water placement at the New London site, with the Cornfield Shoals site slightly more expensive (3 percent). For sandy material, the next least expensive non-open water alternative is nearshore placement at Rocky Neck State Park, about 28 percent more expensive than open water placement, and the next nearshore placement at Bluff Point State Park comes at a 42 percent increase. Use as cap material at the Groton Black Ledge or Twotree Island CDF sites is about twice the cost of using the NLDS.

For fine-grained material the third least expensive non-open water alternative is placement as fill in the Morris Cove Borrow Pit CAD cell at New Haven (about 50 percent more expensive than placement at the NLDS). Beneficial use of the material as fill for a marsh creation project at Sandy Point in Little Narragansett Bay would be 1.6 times the cost of using the NLDS. Upland landfill placement of fine-grained material would be about 80 percent more costly than open water placement.

5.5.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for the one FNP in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-48 - Federal Navigation Project Base Plans Niantic Dredging Center Projects		
Project and Segment	Material Type	Federal Base Plan
Niantic Bay and Harbor FNP		
Entrance Channel	Sand	New London Disposal Site
Bay Channel	Suitable Fines	New London Disposal Site

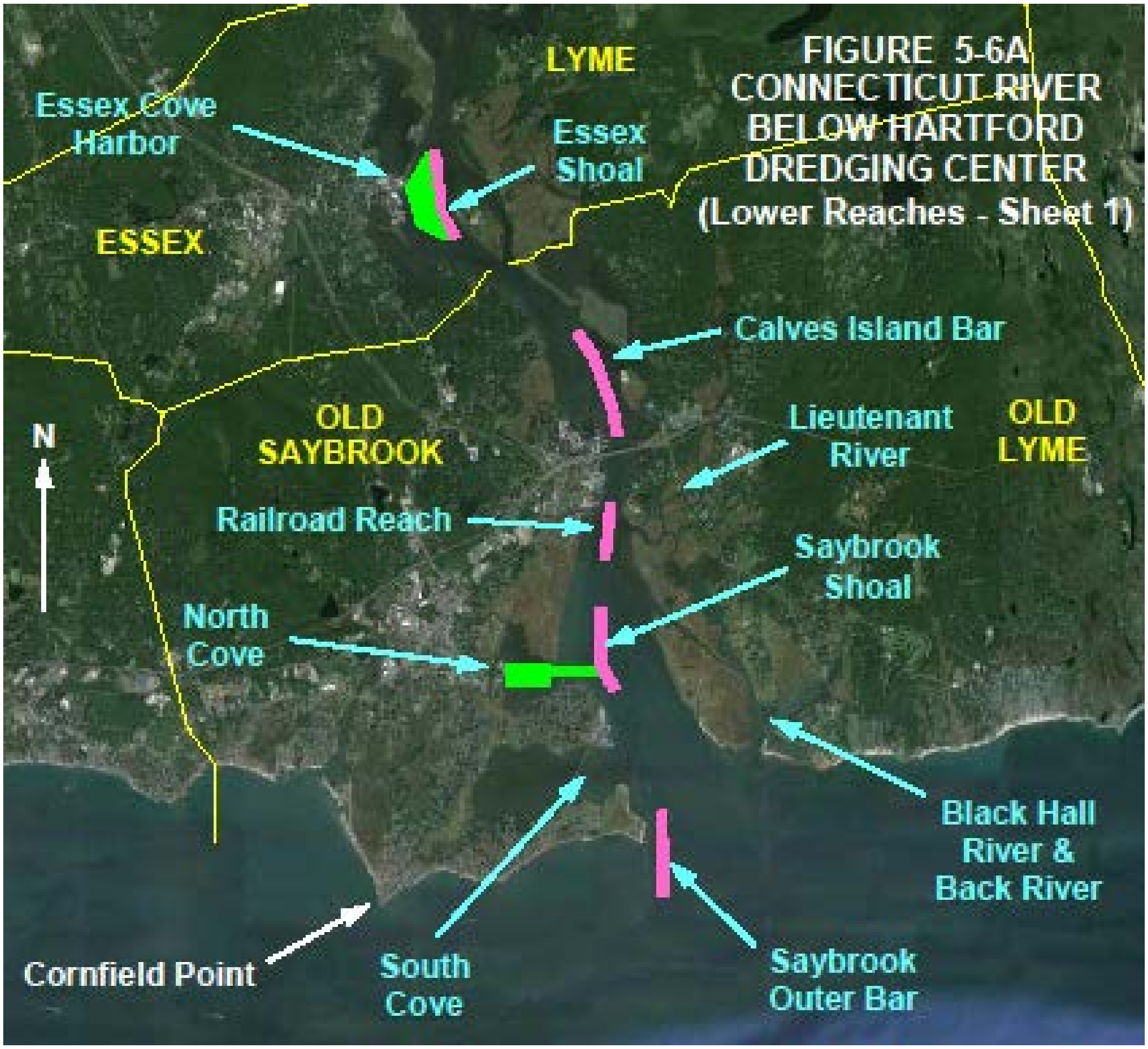
Alternatives to the Federal Base Plan: There are no lower cost alternatives to open water placement in LIS for the Niantic Bay FNP. For the sandy materials from the Niantic Bay entrance channel, the least costly alternatives to open water placement in LIS are nearshore nourishment off of nearby state beaches at about 30 to 40 percent above the cost of using the NLDS. However, there does not appear to be any near-term risk to infrastructure or other property at either of the two state beaches that would support Federal participation in funding the increased cost. For the suitable fine-grained materials from the inner channel reaches, the least costly non-open water alternative was use as cap material for a CAD cell, if one were available and needed cap material at the same time that the Niantic project was being dredged. Marsh creation/enhancement alternatives, at a 60 percent increase in cost, could not be implemented unless non-Federal funding was provided to pay for the additional cost.

5.6 Connecticut River Area Dredging Center

The Connecticut River Area Dredging Center consists of all the Connecticut towns and cities along the river from Long Island Sound up to Hartford, including; Old Saybrook, Old Lyme, Lyme, Essex, Deep River, Chester, East Haddam, Haddam, East Hampton, Middletown, Portland, Cromwell, Glastonbury, Rocky Hill, Wethersfield, East Hartford and Hartford. This dredging center includes the Federal Navigation Project for the Connecticut River Below Hartford, and its tributary sub-projects, including North Cove (Old Saybrook), Essex Cove Harbor (Essex), Eight Mile River and Hamburg Cove (Lyme), Salmon River Cove (Haddam and East Haddam), and Wethersfield Cove (Wethersfield). The dredging center also includes smaller tributary harbors at the river's mouth (South Cove, Lieutenant River, Black Hall and Back Rivers), and upstream along the River (Chester Creek). Limited Federal navigation features were constructed for the Connecticut River above Hartford, but these have not been maintained in over a century, and are not considered in this study. The principal waterways in this area are:

Connecticut River below Hartford – Includes FNP
South Cove
Black Hall and Back Rivers
North Cove – Includes FNP
Lieutenant River
Essex Cove Harbor – Includes FNP
Eight Mile River and Hamburg Cove – Includes FNP
Chester Creek
Salmon River Cove – Includes FNP (Channel Undefined)
Wethersfield Cove – Includes FNP

The Connecticut River basin drains much of southern and northwestern New England. The main 15-foot channel of the Connecticut River yields sandy dredged material, while the tributary channels yield siltier materials. The waterways in this dredging center yield a mix of material types. All materials have been found suitable for open water placement (generally from areas below Middletown), or in-river placement (areas above Middletown). While the lower main river sediments are typically sufficiently sandy for beneficial use as nearshore or beach placement material, they have not yet been used as such in the past.



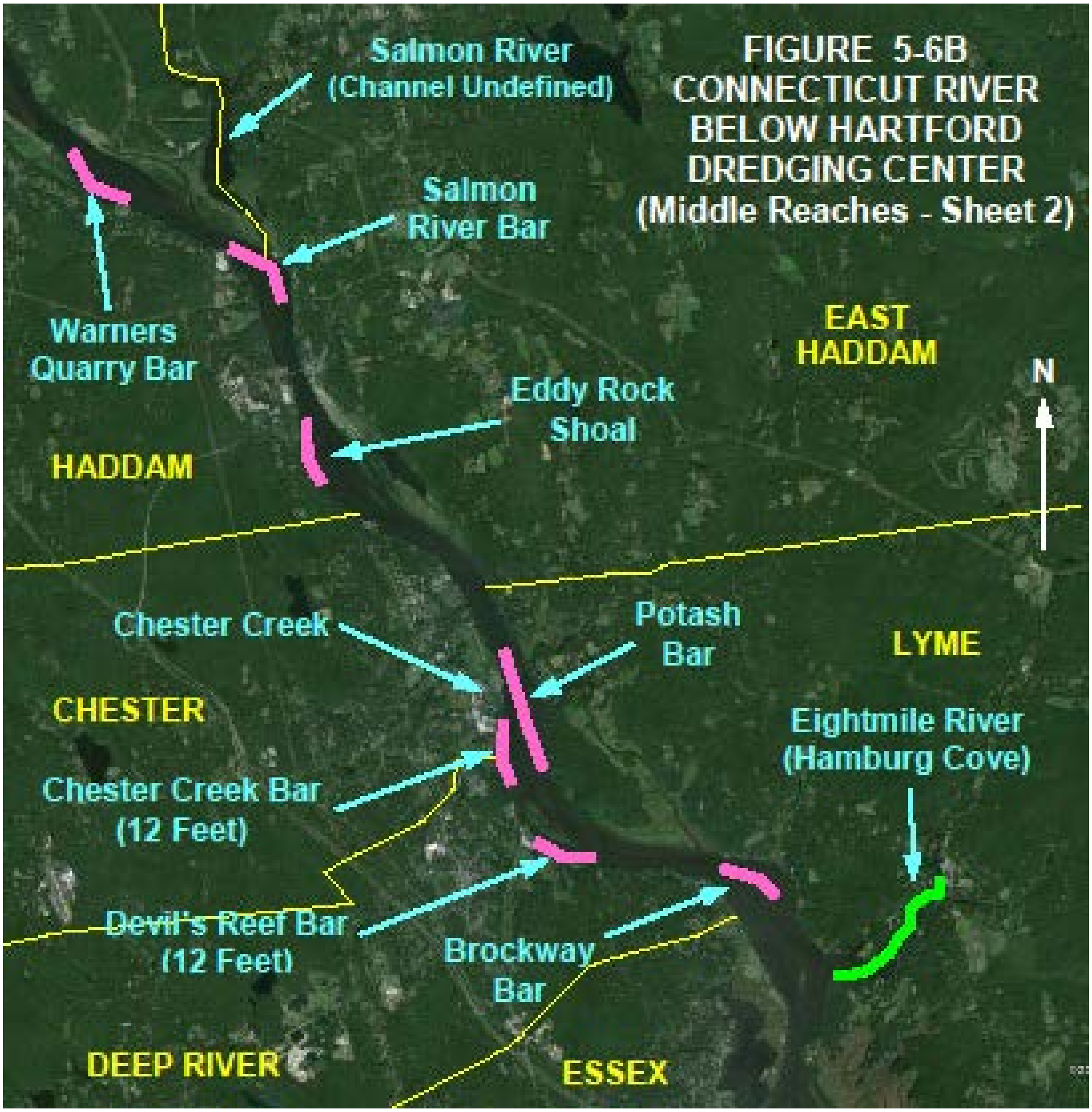


FIGURE 5-6B
CONNECTICUT RIVER
BELOW HARTFORD
DREDGING CENTER
(Middle Reaches - Sheet 2)
Salmon River
(Channel Undefined)
Salmon
River Bar
Warners
Quarry Bar
Eddy Rock
Shoal
EAST
HADDAM
N
HADDAM
Chester Creek
Potash
Bar
LYME
CHESTER
Eightmile River
(Hamburg Cove)
Chester Creek Bar
(12 Feet)
Devil's Reef Bar
(12 Feet)
Brockway
Bar
DEEP RIVER
ESSEX

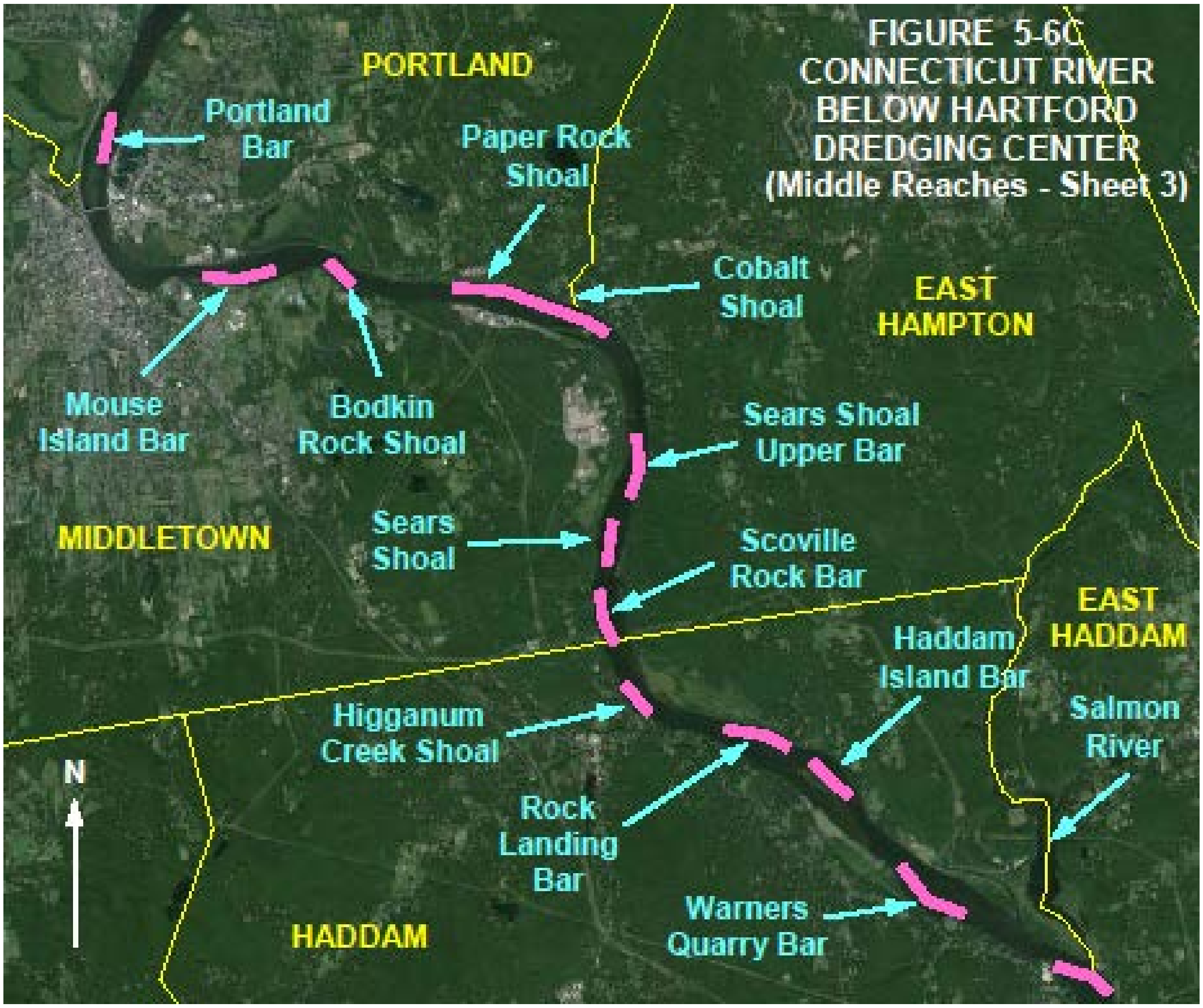


FIGURE 5-6C
CONNECTICUT RIVER
BELOW HARTFORD
DREDGING CENTER
(Middle Reaches - Sheet 3)
PORTLAND
Portland
Bar
Paper Rock
Shoal
Cobalt
Shoal
EAST
HAMPTON
Mouse
Island Bar
Bodkin
Rock Shoal
Sears Shoal
Upper Bar
MIDDLETOWN
Sears
Shoal
Scoville
Rock Bar
EAST
HADDAM
Haddam
Island Bar
Higganum
Creek Shoal
Salmon
River
N
Rock
Landing
Bar
Warners
Quarry Bar
HADDAM

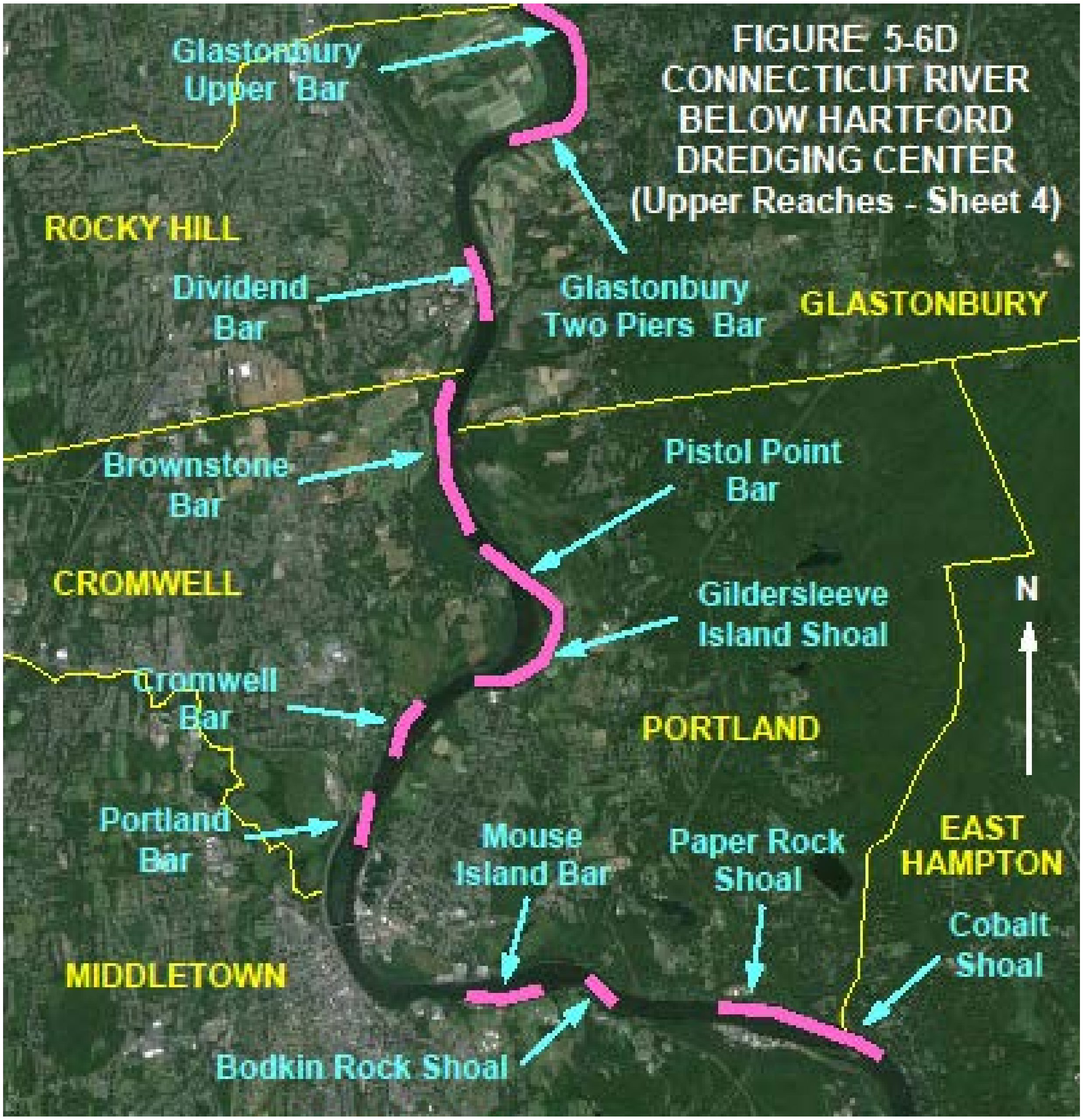
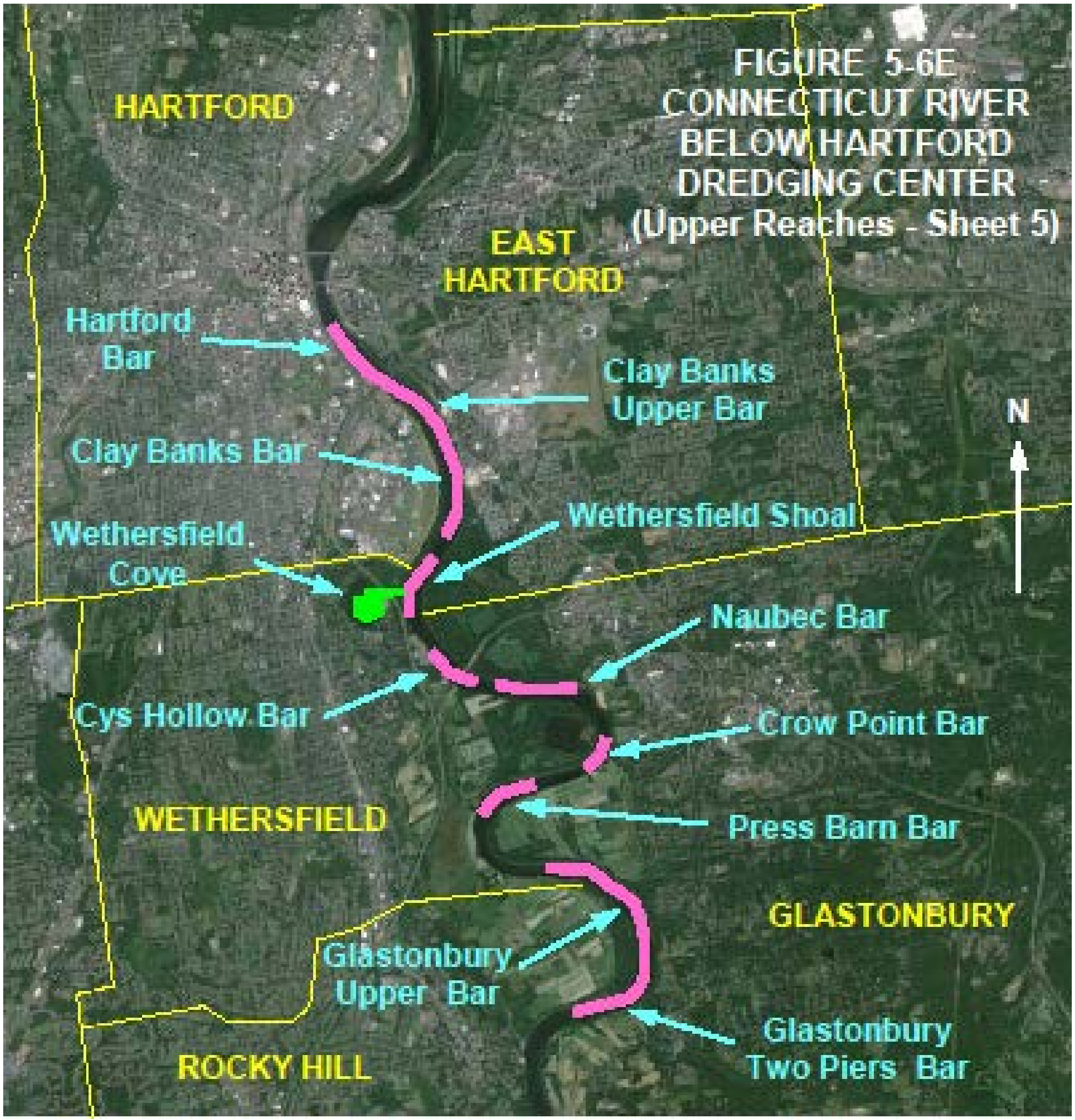


FIGURE 5-6D
CONNECTICUT RIVER
BELOW HARTFORD
DREDGING CENTER
(Upper Reaches - Sheet 4)
Glastonbury
Upper Bar
ROCKY HILL
Dividend
Bar
Glastonbury
Two Piers Bar
GLASTONBURY
Brownstone
Bar
Pistol Point
Bar
CROMWELL
Gildersleeve
Island Shoal
N
Cromwell
Bar
PORTLAND
Portland
Bar
Mouse
Island Bar
Paper Rock
Shoal
EAST
HAMPTON
Cobalt
Shoal
MIDDLETOWN
Bodkin Rock Shoal



5.6.1 Federal Navigation Projects - Maintenance

The dredged features of the Connecticut River below Hartford FNP, and its tributary sub-projects in this dredging center, have each been last maintained as shown below.

Table 5-49 - Federal Navigation Project Dredging History Connecticut River Dredging Center				
FNP Recent Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
North Cove	2008-2009	97,800	CSDS	Suitable Fine
		75,000	CLDS Cap	
	1991-92	152,300	CSDS	Suitable Fine
	1984	65,000	CSDS	Suitable Fine
Essex Cove Harbor	1976	36,500	Upland Nott Island	Suitable Mixed
Eight Mile River and Hamburg Cove	1911	54,500	Unknown	Suitable Fine
Salmon River Cove	1902	4,000	Unknown	Unknown
Connecticut River below Hartford – Main Channels	Connecticut River – Entrance Bar Channels			
Saybrook Outer Bar	1991	41,800	CSDS	Suitable Fine
Saybrook Shoal	1984	18,700	CSDS	Suitable Mixed
Saybrook Railroad Reach	1984	29,439	CSDS	Suitable Mixed
Connecticut River – Lower Bar Channels				
Calves Island Bar	1991	12,500	CSDS	Suitable Sand
Essex Shoal	1991	20,800	CSDS	Suitable Sand
Brockway Bar	1987	12,000	CSDS	Suitable Sand
Connecticut River – Middle Bar Channels				
Devils Reef Bar (12-Foot)	1913	7,300	Unknown	Suitable Sand
Chester Creek Bar (12-Foot)	1913	7,000	Unknown	Suitable Sand
Potash Shoal Bar (East Channel)	1984	32,200	In-River	Suitable Sand
Eddy Rock Shoal	1982	Unknown	Unknown	Suitable Sand
Warners Quarry Bar	1984	23,300	In-River	Suitable Sand
Salmon River Bar	1984	18,000	In-River	Suitable Sand
Haddam Island Bar	1983	Unknown	In-River	Suitable Sand
Rock Landing Bar	1984	23,200	In-River	Suitable Sand
Higganum Creek Bar	1994	36,500	In River	Suitable Sand
Scoville Rock Bar	1982	Unknown	In-River	Suitable Sand
Sears Shoal	1994	38,500	In River	Suitable Sand
Sears Upper Bar	1994	4,100	In-River	Suitable Sand
Cobalt Shoal	1984	2,500	In-River	Suitable Sand
Paper Rock Shoal	1984	34,200	In-River	Suitable Sand
Bodkin Rock	1982	Unknown	In-River	Suitable Sand
Mouse Island Bar	1984	1,600	In-River	Suitable Sand

Table 5-49 (Continued) - Connecticut River – Upper Bar Channels				
FNP Recent Activity	Year	Volume	Placement	Material Type
Portland Bar	1984	28,000	In-River	Suitable Sand
Cromwell Bar	1981	14,000	In-River	Suitable Sand
Gildersleeve Island Shoal	1958	13,000	In River	Suitable Sand
Pistol Point Bar	2002	49,600	In River	Suitable Sand
Brownstone Bar	1945	Unknown	In River	Suitable Sand
Dividend Bar	1984	44,600	In River	Suitable Sand
Glastonbury Two-Piers Bar	1987	12,100	In River	Suitable Sand
Glastonbury Upper Bar	1987	7,000	In River	Suitable Sand
Crow Point Bar	1889	Unknown	In River	Suitable Sand
Press Barn Bar	1982	Unknown	In River	Suitable Sand
Naubec Bar	1984	5,800	In River	Suitable Sand
Cys Hollow Bar	1982	Unknown	In River	Suitable Sand
Wethersfield Shoal	1955	5,000	In River	Suitable Sand
Clay Banks Bar	1984	2,700	In River	Suitable Sand
Clay Banks Upper Bar	1972	9,500	In River	Suitable Sand
Hartford Bar	1982	Unknown	In River	Suitable Sand
Wethersfield Cove	2014	10,407	In River	Suitable Fine

North Cove: The FNP for North Cove consists of an 11-foot deep (MLLW) entrance channel from the main channel of the Connecticut River at Saybrook Shoals westerly into North Cove to an anchorage 11 feet deep in its outer end and 6 feet deep at the inner end. Since its adoption and initial improvement in 1965, this project has been maintained four times (1976, 1984, 1992, and 2009), or about once every eleven years. In each of those four maintenance operations, the channel and lower anchorage were only dredged to a depth of 8 feet, instead of the authorized 11 feet, except for in 2009 when both anchorages were only maintained to 6 feet. For the initial improvement and the first three maintenance operations through 1992, all of the dredged material was placed at the Cornfield Shoals site in LIS. During the most recent maintenance operation completed in 2009, a total of 172,800 CY of silty shoal material was removed, of which 75,000 CY was hauled to the CLDS for use as capping material for the Norwalk Harbor maintenance materials, and the remaining 97,800 CY was placed at the CSDS.

The survey and shoal volume estimates from 1992 to 2009 yield an annual shoaling rate of about 11,300 CY. The 2009 maintenance dredging operation was to a shallower dredge template than the authorized dimensions; to a depth of 8 feet in the 11-foot channel, to 6 feet in the 11-foot outer anchorage, and to 6 feet in the inner 6-foot anchorage. The 2009 after-dredge survey (Survey CRB-988, 2009), showed about 18,700 CY of remaining pay overdepth material within the shallower dredge template at the depths maintained at the time. There was also 144,700 CY below the dredge template in the authorized 11-foot deep channel and lower anchorage. A condition survey was performed in December 2014 after the state of Connecticut indicated a willingness to fund the dredging of all project features to their full authorized depths. That survey (CRB-1027, 2014) showed a total of 266,500 CY would need to be removed for a full maintenance operation to restore authorized depths. The difference in shoal volume between the 2009 and 2014 surveys at the depths maintained in 2009 was 112,240 CY, giving an annual shoaling rate of 22,450 CY over that five-year period. Using that five-year rate and the 2014 shoal volume, if the state-funded work were to take place in 2017, then a total of 333,900 CY of total shoal material could be expected.

As with past dredging actions at North Cove, future dredged material is expected to be sandy silt and suitable for open water placement. This project would require further maintenance on about a twelve-year cycle during the DMMP planning horizon (2029 and 2041) with approximately 269,400 CY expected for each operation based on the 22,450 CY annual shoaling rate.

Essex Cove Harbor: The FNP for Essex Cove Harbor consists of a 10-foot deep (MLLW) channel branching off the main 15-foot deep Connecticut River Channel and running along the Essex waterfront before rejoining the main river channel. Between the two channels is an anchorage area, 10 feet deep in its lower portion, and 8 feet deep in its upper portion. The project was initially constructed in 1962-1963 when 64,400 CY was removed and placed upland on Notts Island located in the river to the east of the main channel. Since that time the project has been maintained once, in 1975-1976, when a total of 36,500 CY was dredged from the 10-foot deep channel and the adjacent Essex Shoal main channel segment. These materials were also deposited upland on Notts Island as part of a habitat enhancement project. The project currently has about 20,600 CY of shoal material accumulated in the 10-foot deep channel and anchorages (Survey CRB-1024, 2013). Survey and shoal volume estimates from the period of 1976 to 2013 yield an annual shoaling rate of 600 CY. If the project were maintained in 2021, concurrent with the next maintenance operation for North Cove, a total of about 25,000 CY could be expected at that time. This material is expected to be silty sand, suitable for open water placement or for upland placement as in the past. This project would not require maintenance again within the DMMP planning horizon.

Eightmile River and Hamburg Cove: The FNP for Eightmile River and Hamburg Cove, in Lyme, consists of an 8-foot channel branching off the main 15-foot Connecticut River channel and running upstream in the Eightmile River 1.5 miles to a turning basin at the landing at Hamburg. The project was initially constructed in 1910-1911, when 54,500 CY of material was removed. Further improvements authorized in 1950 were never constructed and later deauthorized. The channel has never been maintained as shoaling volumes and rates have proved low, about 400 CY per year between 1911 and 2009. The placement method used in 1911 is not reflected in the project records. There is currently about 40,300 CY of shoal material in the channel and basin (Survey CRB-994, 2009). If this project were maintained once during the planning horizon in 2021 concurrent with North Cove and Essex Cove Harbor, then a total of about 45,200 CY could be expected. Sediment sampling in 1977 showed the shoal material to be silty sand to sandy silt, averaging about 44 percent fines, but otherwise likely suitable for open water or upland placement.

Salmon River Cove: The FNP for Salmon River Cove consists of a channel 8-1/2 feet deep (MLLW) across the bar at the river's confluence with the main Connecticut River channel into the cove, and then upriver at a depth of 7 feet to the Moodus Wharves. The channel across the bar was initially constructed in 1878 (12,100 CY), extended upriver in 1883 (30,100 CY), and the entrance channel was deepened in 1902. The project has not been dredged since 1902, when about 4,000 CY was removed. There are no drawings in the record, though the annual reports indicate that the channel extended to a landing at the end of Cove Road at the former Scoville Landing where the Moodus River enters the northeast head of the cove. Re-establishing the channel into and up the cove to this location was considered in 1955, but not recommended at that time. In 2005, an ice control structure was constructed at Leesville Dam upriver from the cove under the USACE flood control continuing authority. There have been no recent surveys of this project feature. As the present public landing is now located at the mouth of the Salmon River close to its confluence with the Connecticut, there is likely no need to maintain this project feature in the foreseeable future, except perhaps at the bar at its mouth.

Wethersfield Cove: The FNP for Wethersfield Cove consists of a -6-foot MLLW channel from the main Connecticut River channel at Wethersfield Shoal, westerly into the cove to a 6-foot deep anchorage of 30 acres. The project was initially authorized in 1960 and constructed in 1962-1963, when approximately 32,200 CY was removed and deposited upland at Cove Park. A minor amount of maintenance was accomplished in 1986 when 200 CY was removed from a shoal in the entrance channel. Since that time the project has been maintained once, in 2014, when about 10,400 CY were removed from the channel and a small area of the anchorage and placed in-river in deep water downstream of Gildersleeve Island at a location used previously for Connecticut River main channel maintenance material. At that time about 2,900 CY of shoal remained in the dredge template (After-dredge Survey CRB-1026, 2014). Survey and volume estimates from 1968 to 2013 yield an annual shoaling rate of about 300 CY for the project. If maintenance was performed when the shoal volume next exceeded 10,000 CY it would be required in 2040, when the total shoal volume would be expected to reach 10,500 CY. As in the past, the material could be expected to be silty sand, suitable for in-river or upland placement.

Connecticut River Main Channels: The main channels portion of the FNP for the Connecticut River below Hartford, Connecticut consists of four types of features. First the 15-foot deep channel from LIS to Hartford, a distance of about 52 miles, consisting of channels across 36 shoals and bars. Second, the two stone jetties at the river's mouth at Old Saybrook. Third, the several revetments, training dikes and other bank protection measures, mostly along the upper river reaches, intended to prevent erosion of the river banks and deposition of material into the channel, and to train the river flow into the dredged channels to extend their maintenance frequency (the time between maintenance operations). And last, two remaining 12-foot deep channel segments at Deep River (Devil's Reef Bar) and Chester (Chester Creek Bar) that were not included in the 15-foot deepening when that channel was aligned to the east across Potash Bar but were retained for access to the steamer wharf at Chester.

In the past, during times of heavy barge shipping when the river was maintained every year or two after the spring floods, the river was divided into two reaches (above and below Middletown) for contracting purposes. For DMMP planning purposes the river can be divided into three sections. First, those bars within the coastal towns of Old Saybrook, Old Lyme, Essex and Lyme, which are close enough to the Sound to make the haul to an open water placement site or to a beach or nearshore site lower cost. These include the following 15-foot channel features which typically have been placed at the CSDS, or in the case of Essex Shoals, less often upland as habitat enhancement. This reach can be further divided into two sub-reaches, the entrance channel bars below I-95 which typically produce finer-grained materials and the lower river bars above that bridge which produce sand. The entrance bars were last dredged in 1991, and could be expected to require maintenance every 25 years and will therefore be maintained twice during the DMMP planning horizon, once in about 2017 in conjunction with the anticipated state-funded dredging of North Cove, and in about 2042.

Table 5-50 - Connecticut River – Shoal Volume Calculations – Entrance & Lower Bars

Channel Feature	Latest Survey	Soundings Date	Shoal Volume (CY)	Annual Shoal Rate	Next Dredge Year	Volume (CY)
Saybrook Outer Bars	CRB-1021	5/2013	170,600	7,800	2017	183,500
Saybrook Shoals	CRB-1022	6/2013	227,500	7,800	2017	246,700
Railroad Reach	CRB-1022	6/2013	131,200	4,500	2017	147,200
Entrance Bars at Saybrook – Total					2017	577,400
Entrance Bars at Saybrook – Future					2042	300,600
Calves Island Bar	CRB-1023	6/2013	51,100	2,300	2025	62,200
Essex Shoal	CRB-1024	8/2013	84,600	3,800	2025	134,100
Brockway Bar	CRB-993	9/2009	49,100	2,200	2025	84,700
Lower Bars (Above Saybrook to Essex) – Total					2025	281,000

Second are the seventeen channel features above the town of Essex to the city of Middletown that have been historically deposited in-river or upland along the river. Except for the two remaining 12-foot channels at Deep River and Chester, these are also 15-foot channel features. No recent surveys exist for the two 12-foot bar channels therefore no projections as to shoal volume in these channel features can be made. As of 2010 the Bodkin Rock Shoal had not accumulated any shoal material since its last maintenance, and is not expected to require maintenance in the foreseeable future.

Table 5-51 - Connecticut River – Shoal Volume Calculations – Middle Bars

Channel Feature	Latest Survey	Soundings Date	Shoal Volume (CY)	Annual Shoal Rate	Next Dredge Year	Volume (CY)
Potash Bar	CRB-997	3/2010	57,400	2,200	2025	90,600
Devil's Reef Bar	Unknown	- -	- -	- -	- -	0
Chester Bar	Unknown	- -	- -	- -	- -	0
Eddy Rock Shoal	CRB-998	6/2010	8,300	1,500	2025	63,400
Salmon River Bar	CRB-999	6/2010	50,200	300	2025	13,100
Warner's Quarry Bar	CRB-1000	6/2010	2,000	1,900	2025	79,200
Haddam Island Bar	CRB-1001	7/2010	82,500	100	2025	2,900
Rock Landing Bar	CRB-1002	7/2010	37,900	3,200	2025	130,100
Higganum Creek Shoal	CRB-1004	7/2010	37,900	2,400	2025	73,500

Channel Feature	Latest Survey	Soundings Date	Shoal Volume (CY)	Annual Shoal Rate	Next Dredge Year	Volume (CY)
Scoville Rock Bar	CRB-1005	7/2010	20,000	300	2025	24,700
Sears Shoal	CRB-1006	7/2010	92,400	5,800	2025	179,000
Sears Upper Bar	CRB-1006	7/2010	10,400	400	2025	16,300
Cobalt Shoal	CRB-1007	7/2010	2,700	100	2025	4,300
Paper Rock Shoal	CRB-1007	8/2010	38,000	1,500	2025	60,000
Bodkin Shoal	CRB-1008	8/2010	0	0	None	0
Mouse Island Bar	CRB-1009	8/2010	38,200	1,500	2025	60,200
				Middle Bars Total	2025	797,300

Last are the 16 channel bar features above Middletown to Hartford that have also been historically placed either in-river or upland along the river. The Crow Point Bar has not required dredging since the late 1800's as dikes and revetments have largely controlled that reach of the river and prevented shoal accumulation.

Table 5-52 - Connecticut River – Shoal Volume Calculations – Upper Bars

Channel Feature	Latest Survey	Sounding Date	Shoal Volume (CY)	Annual Shoal Rate	Next Dredge Year	Volume (CY)
Portland Bar	CRB-1010	8/2010	24,700	1,000	2035	48,500
Cromwell Bar	CRB-1011	8/2010	25,100	900	2035	46,700
Gildersleeve Isl. Shoal	CRB-1012	8/2010	15,100	300	2035	22,300
Pistol Point Bar	CRB-1012	8/2010	101,400	12,700	2035	418,100
Brownstone Bar	CRB-1012	8/2010	20,000	300	2035	27,600
Dividend Bar	CRB-1013	8/2010	100,400	3,900	2035	197,000
Glastonbury Two Piers	CRB-1014	9/2010	48,600	2,100	2035	101,400
Glastonbury Upper Bar	CRB-1014	9/2010	21,100	900	2035	44,100
Press Barn Bar	CRB-1015	9/2010	8,600	200	2035	14,200
Crow Point Bar	Unknown	- -	- -	- -	- -	0
Naubuc (Pratts Fy) Bar	CRB-1016	9/2010	16,100	600	2035	31,600
Cys Hollow Bar	CRB-1017	9/2010	7,600	300	2035	14,300
Wethersfield Bar	CRB-1018	9/2010	27,200	500	2035	39,500
Claybanks Bar	CRB-1018	9/2010	114,600	4,400	2035	224,800
Claybanks Upper Bar	CRB-1018	9/2010	45,400	1,200	2035	75,300
Hartford Bar	CRB-1018	9/2010	93,100	3,300	2035	176,300
				Upper Bars Total	2035	1,481,600

The dredging activity timeline over the planning horizon for the FNPs in the Connecticut River Dredging Center is shown below.

Table 5-53 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Connecticut River Area Dredging Center						
	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
North Cove	333,900		269,400			269,400
Essex Cove Harbor		25,000				
Eightmile River		45,200				
Salmon River	No Maintenance Necessary During DMMP Timeframe					
Wethersfield Cove					10,500	
Connecticut River Main Channels						
Entrance Bars	577,400					300,600
Lower Bars		281,000				
Middle Bars		797,300				
Upper Bars				1,481,600		
Total Sand		1,078,300		1,481,600	10,500	
Total Suitable Fine	911,300	70,200	269,400			570,000

5.6.2 Harbor Characterization for Federal Navigation Project Maintenance

North Cove: The original improvement of this project in 1965 and all four maintenance operations undertaken through 2009 used the CSDS, with some material in the last action placed at the CLDS as cap for other projects as required by the state of Connecticut. There have been five Environmental Assessments prepared for maintenance dredging of the project: May 1976, February 1984, July 1991, July 2003 and July 2008. Sediment sampling and testing in support of these NEPA documents was conducted in 1975, 1980 (one sample), 1983, 1988 and 1999. With the exception of the small bar that builds-up at the far outer end of the entrance channel to the cove which has tested between 1 and 34 percent fines, material from all other samples over these years has been silt and clay ranging from 76 to 100 percent fines. Bioassay (toxicity) testing was conducted in 2001 and 2008, with bioaccumulation testing also performed in 2001. All testing and evaluations found the material suitable for placement at the CSDS. In the future, the North Cove FNP is expected to yield suitable fine-grained material of a similar nature.

Essex Cove Harbor: As stated above, both in the initial improvement dredging of this FNP in 1962-1963, and its only maintenance operation since then in 1975-1976, dredged material was placed upland on Notts Island located east of the main river channel opposite Essex Cove. Sediment sampling was conducted in 1974 in support of the 1975-1976 maintenance operation.

Material from the 10-foot anchorage was found to be sand of about one percent fines, similar to the material from the adjacent 15-foot main river channel to the east. Material from the 10-foot Essex Cove waterfront channel ranged from 37 to 91 percent fines. No sediment sampling has been conducted since 1974 in the FNP. In the future, material dredged from the Essex Cove Harbor FNP is expected to be largely fine-grained along the waterfront becoming sandier to the eastward in the anchorage. These materials are all expected to remain suitable for unconfined open water placement or upland placement.

Eightmile River and Hamburg Cove: This FNP waterway segment has not been dredged since its improvement in 1911. Sediment sampling and testing was conducted in 1977 in preparation for proposed maintenance dredging which was ultimately not funded and no NEPA document was prepared. Those test results showed that the material in the river's entrance bar was sand of about 13 percent fines, while the material in the remaining project reaches up to Hamburg landing was silty sand to clay ranging from 29 to 78 percent fines. In any future maintenance dredging, the material from the Eightmile River FNP is expected to be fine-grained. Future testing of these materials is expected to show them suitable for unconfined open water placement or upland placement.

Salmon River: This FNP segment has not been dredged since its initial improvements in 1878-1883 and its one maintenance operation in 1902. There is no record of any sampling and testing performed or any NEPA document prepared. Though no dredging is projected for this project segment, for purposes of this DMMP it is assumed that similar to the Eightmile River, this project would yield silty materials suitable for unconfined open water placement or upland placement if it were to be dredged.

Wethersfield Cove: This FNP segment was initially improved in 1963 and maintained in 1986 and 2014. In 1963 and 1986, the dredged material was placed upland in areas adjacent to the cove channel. In 2014 the material was placed in a deep hole in the main river channel downstream of Gildersleeve Island at a location used previously for placement of main channel maintenance material. Environmental Assessments were prepared in 1986 and 2013 in support of these operations. Sediment sampling in support of the 1986 maintenance activity showed the material to be silty sand with 35 percent fines. Sediment sampling in 2011-2012 also showed the material to be silty sands ranging from 23 to 39 percent fines, with the exception of one sample taken beneath the I-91 Bridge which was sand with only 13 percent fines. It is assumed based on this history that future testing of these materials would show them suitable for unconfined in-river placement or upland placement.

Connecticut River Main Channels: Materials in the main river channels have largely been placed upland in areas adjacent to the river in the past, except for those channel reaches from Chester downstream to the river mouth which have on occasion been placed in open water in LIS. In general, main channel sediments below the lower-most bridges at Old Saybrook and Old Lyme are silty sands likely due to reduced current velocities as the river estuary opens-up before meeting the Sound. Upstream of the lower bridges, the river is largely confined to its channel and deposits more sandy materials in its bed. Harbor sediment characterization for the Connecticut River will be discussed in four sections: (1) the entrance reaches below the lower bridges at Old Saybrook, (2) the channel above Saybrook to Essex (up to Brockway Bar), (3) the channel above Essex to Chester and Middletown, and (4) the channel above Middletown to Hartford.

River Entrance Bars (at Old Saybrook) – Saybrook Outer Bar, Saybrook Shoals and Railroad Reach: Unlike the Connecticut River main channel segments above, the channel reaches at the River's mouth tend to be siltier materials, likely due to the widening of the river into a broad estuary as it enters Long Island Sound and begins to shed its sediment load. The most recent sediment sampling for the Saybrook Outer Bar channel reach in 2001 showed a range of 33 percent (east side of channel) to 66 percent (west side of channel) fines. While the grain size of the samples from the east side of the channel was within the range of materials generally acceptable for nearshore bar placement they were not sufficiently coarse to allow for direct beach placement. Samples from the west side of the channel were too silty for nearshore placement. Prior sediment sampling from the outer bar channel in 1973, 1977, and 1982 in support of maintenance operations through 1991 showed a similar overall range (39 to 86 percent fines).

Above the outer bar channel in the Saybrook Shoals and Railroad Reach channels, test results have been more variable with percent fines ranges of 2 to 63 percent in 1973, 51 to 69 percent in 1977 and less than one percent fines in 1982. Differences in the strength of spring freshets or watershed runoff from major storm events could play a role in this variability. The future availability of materials from these reaches for beach or nearshore bar placement will depend on the results of sampling for those activities. Since at least the 1970s, maintenance materials from these three reaches have been placed at the CSDS.

Lower River Bars (Above Saybrook to Essex) – Calves Island, Essex Shoal, and Brockway Bars: Sediment sampling at Calves Island Bar channel in 1974 and 1977 all showed clean sand of less than one percent fines. Material from Calves Island Bar has historically been placed at the CSDS. Materials from the maintenance of the Essex Shoal main channel were placed at CSDS in 1984 and 1991, and upland at Notts Island for habitat development in 1975. Brockway Bar's single record of sediment test results from 1974 shows clean sand of less than one percent fines. Maintenance dredging of the Brockway Bar main channel reach in 1968 and 1970-1971 placed the material at upland.sites along the river, while dredging in 1977, 1981-1982, 1984 and 1987 placed the material at the CSDS. All three of these lower river main channel reaches are expected to yield clean sand as found in the past. This material will likely continue to be found suitable for open water placement, for nearshore or beach nourishment, or for upland placement if other beneficial uses can be found.

Middle River Bars (Above Brockway Bar to Middletown): This section of the Connecticut River below Hartford project consists of main channel reaches at Devils Reef Bar, Chester Bar (West Channel), Potash Bar (East Channel), Eddy Rock Shoal, Salmon River Bar, Warners Quarry Bar, Haddam Island Bar, Rock Landing Bar, Higganum Creek Shoal, Scoville Rock Bar, Sears Shoal, Sears Shoal Upper Bar, Cobalt Shoal, Paper Rock Shoal, Bodkin Rock Shoal, Mouse Island Bar and Portland Bar. Maintenance at Higganum Creek and Sears Shoals was carried-out in the 1993-1994 period with placement in deeper areas of the river near each dredging site (June 1993 Plans and Specifications). There has been no dredging in the middle reach bar channels between Essex and Middletown since that time. The last major maintenance of the middle river bars was conducted in the 1982 to 1984 period when materials were placed at deep in-river locations (EA April 1981 and P&S April 1982). Periodic bar dredging in the late 1970s and earlier, typically placed materials at upland locations in the flood plain along the river (EA April 1977). These river bars typically yield sand and silty sands. Placement at deep in-river sites by hopper or mechanical bucket dredge as in recent decades will likely continue to be an acceptable low-cost placement method. Recent maintenance activities in the upper river (Pistol Point Bar and Wethersfield Cove) have successfully continued this method. The material may also be attractive to shorefront property owners wishing to increase the elevation of their floodplain properties in reaches of the river below Hartford which are subject to tidal flow. Using materials to buttress back slopes of river dikes that exist in many areas may also be a potential beneficial use of these materials. In any event, open water placement of dredged materials in Long Island Sound from river bars above the Towns of Essex and Lyme is likely to be more costly compared to the continued availability of in-river and potential upland placement alternatives in proximity to each bar channel.

<u>Upper River Bars (Above Middletown to Hartford)</u>: This section of the Connecticut River below Hartford project consists of main channel reaches at Portland Bar, Cromwell Bar, Gildersleeve Island Shoal, Pistol Point Bar, Brownstone Bar, Dividend Bar, Glastonbury Two Piers, Glastonbury Upper Bar, Press Barn Bar, Crow Point Bar, Naubuc (Pratts Ferry) Bar, Cys Hollow Bar, Wethersfield Bar, Claybanks Bar, Claybanks Upper Bar, and Hartford Bar. Maintenance of the Pistol Point Bar channel was carried-out in 2002 with placement in-river downstream. That material, based on 1999 sediment testing, was between 0.4 and 4.3 percent fines (2002 EA). Maintenance of the channels at Pistol Point and Dividend Bars was carried-out in the 1993-1994 period with placement in deeper areas of the river near each dredging site (June 1993 Plans and Specifications). As with the middle river bar channels, the upper river channels were maintained semi-annually through 1983-1984, with upland placement used through 1978, and in-river placement used in later years. These river bars also typically yield sand and silty sands. Placement at deep in-river sites by hopper or mechanical bucket dredge as in recent decades will likely continue to be an acceptable low-cost placement method. Placement upland to increase land elevations or supplement river dikes may also be practical beneficial alternatives. It is therefore unlikely that placement of upper river materials in LIS would be considered.

5.6.3 Historical and Potential FNP Placement Methods

Maintenance of the main channel of the Connecticut River below Hartford FNP and its tributary sub-projects has typically used a variety of placement options, including open water placement in Long Island Sound, at the CSDS for projects as far upriver as the towns of Essex and Lyme (Brockway Bar), or in-river and upland placement for projects from Essex up to Hartford. Suitable fine-grained material from the maintenance of North Cove has also been used beneficially as cap material at CLDS when required by the state of Connecticut to cover mounds of other suitable but less clean dredged material from other harbors. Historically, sediments in the lower tributary projects such as North Cove, Eightmile River, and Essex Cove Harbor have been silty materials, or in the case of Essex, more silty sand than is found in the main river channel.

The main river channel sediments from the lower bars and shoals are predominantly sand suitable for a wide range of placement options, including beach or nearshore bar nourishment. Haul distances from the lower river bars to a sample of public (state and municipal) beaches along the coast of eastern Connecticut are given below. Beaches within about two miles of a dredge site are typically cheaper to pump material to using a hydraulic pipeline cutterhead dredge (direct beach or nearshore placement) or small hopper dredge (nearshore placement).

Potentially the fine-grained materials in the lower tributary projects could be used to create saltmarsh in shallow tidelands to replace marsh lost in other areas to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. The material could also be placed upland along the river to raise land surfaces or create or expand dikes in response to flood potential. The lower river project feature materials could also be placed at an ocean site as at present, the closest being the CSDS.

The material could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary, this would require further investigation in the future. As always, testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

5.6.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Connecticut River Area Dredging Center that periodically generate dredged material. These include commercial barge wharves mainly located from Middletown up to Hartford. Large and small marina, yacht club and boat yard operations are located along the main river channel throughout its length, and in all of the tributary sub-projects. Private residential and public access facilities are also found throughout the project, and river ferries are active at two locations (Route 160 Rocky Hill/Glastonbury and Route 148 Chester/Lyme).

The 2009 Dredging Needs Update report projected, based on facility surveys, that 1,203,000 CY of maintenance dredging and 225,400 CY of improvement dredging would be needed by non-Federal facilities. If it is assumed that at least half of these materials are similar in distribution to the FNP materials from the adjacent channels, then about half will be nourishment-compatible sand, and half would be more silty material. These totals are shown in the table below.

Table 5-54 - Dredging Activity Timeline
Connecticut River Area Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	304,500	170,000	181,100	181,100	119,400	246,900
Improvement	35,000	144,400	11,300	11,200	11,800	11,700
Total Non-Federal	339,500	314,400	192,300	192,300	131,200	258,600
Sand Portion	169,800	157,200	96,100	96,100	65,600	129,300
Fine Portion	169,700	157,200	96,200	96,200	65,600	129,300

These activities typically generate suitable dredged material from silt, to silty sand, to sand. Ocean placement is an environmentally acceptable and cost effective alternative for non-Federal projects in the lower river reaches, when other uses are not practicable, with the CSDS being the closest approved site. In the middle to upper river reaches, upland placement or in-river placement may also be cost effective acceptable placement options. These activities could also take advantage of whatever practicable alternative placement methods are used for the Connecticut River FNP features if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water or in-river placement for otherwise smaller volumes.

5.6.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to large-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating up to 500,000 CY or more are anticipated.

Most dredged materials from this dredging center over at least the past century have been dredged from the middle and upper river bars and shoals of the main river channel and placed either in-river or upland along the river, including the most recent work in these areas. This would likely remain the placement method used in the future for these areas. A number of large and small marinas and boat yards are located in the river reaches from Middletown downstream to LIS. Several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-55 - Connecticut River Area Dredging Center Available/Potential Placement Alternatives

Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Cornfield Shoals Disposal Site (CSDS)		Open Water	200,000,000	All	All Suitable
New London Disposal Site (NLDS)		Open Water	7,796,500	All	All Suitable
Central Long Island Sound Disposal Site (CLDS)		Open Water	20,000,000	All	All Suitable
Western Long Island Sound Disposal Site (WLDS)		Open Water	20,000,000	All	All Suitable
New Haven Breakwaters	Fill	Island CDF	52,695,600	All Once Built	All
	Cap		5,554,400		All Suitable
Twotree Island CDF	- Fill	Island CDF	2,966,200	All Once Built	All
	- Cap		433,800		All Suitable
Stratford Point CDF	- Fill	Shore CDF	33,666,900	All Once Built	All
	- Cap		5,283,100		All Suitable

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Penfield Reef CDF - Fill	Shore CDF	33,539,300	All Once Built	All
- Cap		5,010,700		All Suitable
Duck Island Roads CDF Fill	Island CDF	1,376,100	All Once Built	All
Cap		233,900		All Suitable
Faulkner Island CDF - Fill	Island CDF	16,010,200	All Once Built	All
- Cap		1,169,800		All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
110 Sand Company Clean Fill Site (59)	Upland Sand Pit	1,000,000	All Until Filled	All Suitable
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Sandy Point Marsh Creation, RI	Marsh Creation	500,000	All Once Built	All Suitable
Generic In-River Placement	In-River	NA	All	All Suitable
Generic Onshore Placement	Upland	NA	All	All Suitable
Westbrook Town Beach, CT	Nearshore	57,000	Recurring	Sand
Middle Beach, Westbrook, CT	Nearshore	900	Recurring	Sand
Rocky Neck State Park, CT	Nearshore	48,600	Recurring	Sand
Hammonasset Beach State Park, Madison, CT	Nearshore	140,000	Recurring	Sand
Hither Hills State Park, East Hampton, NY	Nearshore	276,100	Recurring	Sand

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. For bar channels and other dredged features on the middle and upper areas of the Connecticut River, in-river and onshore upland placement alternatives are expected to remain as alternatives. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Beach and Nearshore Nourishment Sites: The LIS coastline of the Connecticut River dredging center is limited to the river's mouth and the immediate adjacent area and is a mix of beaches and rocky coast, with small coastal plain river inlets, and bays and small coves. There are no large public beaches, and only a few private beaches (Old Lyme Shores to the east of the river mouth, and Fenwick and Knollwood to the west). Beaches adjacent to the dredging center include state beaches such as Hammonasset State Beach in Madison, and Rock Neck State Park in East Lyme. Smaller public beaches (West and Middle Beaches in Westbrook) are located in the Clinton-Westbrook area. Hither Hills State Beach in East Hampton, New York, though more distant, was also indicated as an alternative by the screening process.

Table 5-56 - Scow Haul Distances to Beach and Nearshore Placement Sites

Project (Distances in Statute Miles)	Rocky Neck State Park	Harkness Beach State Park	Ocean Beach Park	Westbrook Town Beach	Hammonasset Beach State Park	Lighthouse Park Beach	Prospect Beach
Saybrook Shoals	8.9	14.8	16.2	9.0	14.6	34.4	35.7
Railroad Reach Shoals	9.8	15.7	17.1	9.9	15.5	35.3	36.6
Calves Island Bar	11.5	17.4	18.8	11.6	17.2	37.0	38.3
Essex Shoal	13.9	19.8	21.2	14.0	19.6	39.4	40.7
Brockway Bar	16.4	22.3	23.7	16.5	22.1	41.9	43.2
Devils Reef Bar	17.5	23.4	24.8	17.6	23.2	43.0	44.3
Potash Bar/Chester Bars	19.4	25.3	26.7	19.5	25.1	44.9	46.2

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the CSDS located offshore of the mouth of the Connecticut River. The NLDS, CLDS, and WLDS sites are more distant. These sites could receive any suitable material, either sandy or fine-grained.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material. Haul distances from the lower river bars and tributary projects and waterways, to various open water and CDF placement sites are shown below.

Table 5-57 - Scow Haul Distances to In-Water Placement Sites

Project (Distances in Statute Miles)	CLDS	Branford DS	Guilford DS	Falkner Is CDF	Clinton DS	CSDS	NBDS	NLDS	RIS DS
North Cove	32.2	27.2	23.2	19.9	12.5	6.4	11.9	17.0	53.7
Essex Cove Harbor	36.6	31.6	27.6	24.3	16.9	10.8	16.3	21.4	58.1
Eightmile River	40.0	35.0	31.0	27.7	20.3	14.2	19.7	24.8	61.5
Black Hall River	32.1	27.1	23.1	19.8	12.4	6.3	11.8	16.9	53.6
Saybrook Outer Bars	29.9	24.9	20.9	17.6	10.2	4.1	9.6	14.7	51.4
Saybrook Shoals	31.6	26.6	22.6	19.3	11.9	5.8	11.3	16.4	53.1
Railroad Reach Shoals	32.5	27.5	23.5	20.2	12.8	6.7	12.2	17.3	54.0
Calves Island Bar	34.2	29.2	25.2	21.9	14.5	8.4	13.9	19.0	55.7
Essex Shoal	36.6	31.6	27.6	24.3	16.9	10.8	16.3	21.4	58.1
Brockway Bar	39.1	34.1	30.1	26.8	19.4	13.3	18.8	23.9	60.6
Devils Reef Bar	40.2	35.2	31.2	27.9	20.5	14.4	19.9	25.0	61.7
Potash Bar/Chester Bars	42.1	37.1	33.1	29.8	22.4	16.3	21.8	26.9	63.6

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites located near this dredging center include New Haven Breakwaters, Falkner Island, Duck Island Roads, Twotree Island (Waterford), Stratford Point, and Penfield Reef.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. Two such marsh creation sites are located at Sandy Point in New Haven Harbor, and at Sandy Point in Little Narragansett Bay, RI.

5.6.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Connecticut River Area Dredging Center, analysis matched projects and placement alternatives as follows.

North Cove: Future maintenance dredging of the North Cove FNP will yield fine-grained material suitable for open water placement. Such suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites.

Table 5-58 - Connecticut River below Hartford – North Cove FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	333,900	2015-2020	Falkner Island CDF – Fill	$122
	269,400	2026-2030	Duck Island Roads CDF – Fill	$112
	269,400	2041-2045	New London Disposal Site	$30
			Cornfield Shoals Disposal Site	$23
			Two Tree Island CDF – Fill	$122
			Groton Black Ledge CDF – Fill	$122
			Central Long Island Sound DS	$37
			New Haven Breakwaters CDF Fill	$127
			Morris Cove CAD – Fill	$66
			110 Sand Company Site, NY	$128
			Manchester City Landfill	$128
			Western Long Island Sound DS	$93
			Sandy Point RI Marsh Fill	$62

The least cost placement alternative for the maintenance dredging of the North Cove FNP is open water placement at the Cornfield Shoals site. The second least costly is open water placement at the New London site which is about 30 percent more costly, followed by Central Long Island Sound at a 60 percent increase. The least costly non in-water alternative is placement at a marsh creation site at Sandy Point in Little Narragansett Bay at 2.7 times the cost of using the CSDS. Placement in a CDF constructed at Duck Island Roads is about five times the cost of placement at the CSDS. However, the Duck Island CDF site would need to be authorized and constructed and use allocated to multiple projects over a long term to make even that cost achievable, and the existing Duck Island Harbor of Refuge would also need to be first deauthorized by Congress. Such events are unlikely in the near term.

Essex Cove Harbor: Future maintenance dredging of the Essex Cove Harbor FNP will yield a mix of sandy and fine-grained material suitable for open water placement. Though some sandy material will be included, the volumes will be very small compared to the total volume and the deposits will be scattered through the dredge area, making separation by material type during dredging operations impractical. The entire volume is therefore evaluated as fine-grained material. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites.

Table 5-59 - Connecticut River below Hartford – Essex Cove Harbor FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	25,000	2021-2025	Falkner Island CDF – Fill	$149
			Duck Island Roads CDF - Fill	$127
			Two Tree Island CDF – Fill	$149
			Clinton Harbor CDF – Fill	$127
			Groton Black Ledge CDF – Fill	$149
			Morris Cove Pit CAD - Fill	$101
			New London Disposal Site	$51
			Cornfield Shoals Disposal Site	$48
			New Haven Breakwaters CDF – Fill	$149
			110 Sand Company Site, NY	$118
			Brookhaven Town Landfill	$118
			Manchester City Landfill	$118
			Yellow Mill Channel CDF - Fill	$181
			Generic Upland Onshore	$39
			Sandy Point RI Marsh Creation	$87

The least cost placement alternative for the maintenance dredging of the Essex Cove Harbor FNP would be upland placement onshore in the project vicinity, as was done in the 1970s with the filling of Nott Island for habitat development. Whether or not this site or any other is available for future use would need to be investigated prior to any future dredging. If an onshore site is not available, then the second least costly alternative is open water placement at the Cornfield Shoals site (a 23 percent increase over onshore placement). The next least costly is open water placement at the New London site which is about 31 percent more costly. The least costly non in-water alternative is placement as fill at a marsh creation project at Sandy Point in Little Narragansett Bay (2.2 times onshore placement). Placement in the Morris Cove Borrow Pit CAD cell site in New Haven Harbor would be about 2.6 times the cost of onshore placement. Somewhat more costly is transport and placement at landfills in either Connecticut or New York, which is about three times the cost of the least cost alternative. Use of a CDF constructed in the eastern Sound would be three to four times the cost of the least cost alternative.

Eightmile River and Hamburg Cove: Future maintenance dredging of the North Cove FNP would be accomplished once during the DMMP planning horizon and will yield fine-grained material suitable for open water placement. Such suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites.

Table 5-60 - Connecticut River below Hartford
Eightmile River and Hamburg Cove – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	45,200	2021-2025	Falkner Island CDF – Fill	$135
			Duck Island Roads CDF - Fill	$135
			Two Tree Island CDF – Fill	$135
			Clinton Harbor CDF – Fill	$135
			Groton Black Ledge CDF – Fill	$135
			Morris Cove Pit CAD - Fill	$85
			Cornfield Shoals Disposal Site	$44
			110 Sand Company Site, NY	$111
			Brookhaven Town Landfill	$111
			Manchester City Landfill	$111
			New London Disposal Site	$50
			Yellow Mill Channel CDF - Fill	$168
			Generic Upland Onshore	$37

The least cost placement alternative for the maintenance dredging of the Eightmile River FNP is upland placement onshore in the project vicinity. Whether any such site is available for future use would need to be investigated prior to any future dredging, as none was identified by this study. If an onshore site is not available then the second least costly alternative is open water placement at the Cornfield Shoals sites (a 19 percent increase over onshore placement). The next least costly is open water placement at the New London site which is about 50 percent more costly. The least costly non in-water alternative is placement in the Morris Cove Borrow Pit CAD cell site in New Haven Harbor, which would be about 2.3 times the cost of onshore placement. Somewhat more costly is transport and placement at landfills in either Connecticut or New York, which is about 3 times the cost of the least cost alternative. Use of a CDF constructed in the eastern Sound would be about 3.6 to 4.5 times the cost of the least cost alternative.

Salmon River Cove: This project segment is not expected to be dredged during the 30-year DMMP planning horizon and therefore no analysis of dredged material placement alternatives was conducted for Salmon River Cove during this study.

Wethersfield Cove: Future maintenance dredging of the Wethersfield Cove FNP will yield a mix of sandy and fine-grained material suitable for open water placement. Though some sandy material will be included, the volumes will be very small compared to the total volume and the deposits will be scattered through the dredge area, making separation by material type during dredging operations impractical. The entire volume is therefore evaluated as fine-grained material. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. For upriver project segments, such as Wethersfield the historic and recent placement practices have been limited to in-river and onshore (upland) placement. Due to the significant distance between these dredging sites and the waters of LIS, no additional alternatives were evaluated in this study.

Table 5-61 - Connecticut River below Hartford – Wethersfield Cove FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine and Sandy	10,500	2036-2040	In-River Placement	$78
			Upland On-Shore Placement	$86

The least cost alternative for Wethersfield Cove dredged material placement would be in-river placement in deep holes within the river channel, as has been done most recently with maintenance of this waterway segment. Placement onshore upland in the project vicinity would be 10 percent more costly than in-river placement.

Connecticut River Main Channels – Entrance Reaches: Future maintenance dredging of the three entrance reach segments of the 15-foot main river channel below the seaward-most bridges will yield a mix of sandy and fine-grained material suitable for open water placement. The material in these reaches becomes sandier upriver. Though some sandy material will be included, the volumes will be very small compared to the total volume and the deposits will be mixed and scattered through the dredge area, making separation by material type during dredging operations impractical. The entire volume is therefore evaluated as fine-grained material. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. Future testing may show some of these materials to be suitable for nearshore bar placement, but not likely for direct beach placement.

The least cost placement alternative for the maintenance dredging of the main channel entrance reaches of the Connecticut River FNP is open water placement at the Cornfield Shoals site. The next least costly is open water placement at the New London site which is about 93 percent more costly, or the CLDS at 2.7 times the cost of the CSDS. The least costly non in-water alternative is placement as fill at a marsh creation site at Sandy Point in Little Narragansett Bay at 4.3 times the cost of using the CSDS. Placement in a Duck Island Roads CDF would be about 7.9 times as costly as use of the CSDS. Transport and upland placement at landfills in either Connecticut or New York all would cost about 8.6 times the cost of placement at the CSDS. Other large CDFs, also yet to be authorized or constructed, would be from eight to more than ten times as costly as placement at the CSDS.

Table 5-62 - Connecticut River below Hartford – Main Channel Entrance Reaches FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	577,400	2015-2020	Falkner Island CDF – Fill	$120
	300,600	2041-2045	Duck Island Roads CDF – Fill	$111
			New London Disposal Site	$27
			Cornfield Shoals Disposal Site	$14
			Two Tree Island CDF – Fill	$111
			Groton Black Ledge CDF – Fill	$120
			Central Long Island Sound DS	$38
			Morris Cove CAD – Fill	$67
			110 Sand Company Site, NY	$120
			Manchester City Landfill	$120
			Western Long Island Sound DS	$80
			New Haven Breakwaters CDF – Fill	$145
			Sandy Point RI Marsh Fill	$60

Connecticut River Main Channels – Lower Bars: Future maintenance dredging of the three entrance reach segments of the 15-foot main river channel above the seaward-most bridges and up to Essex and Lyme will yield clean sand material suitable for open water placement. These channel segments include Calves Island Bar, Essex Shoals, and Brockway Bar.

Table 5-63 - Connecticut River below Hartford – Main Channel – Lower Bars FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Sand	281,000	2021-2025	Falkner Island CDF – Cap	$122
			New London Disposal Site	$30
			Cornfield Shoals Disposal Site	$19
			Twotree Island CDF – Cap	$112
			Clinton Harbor CDF – Cap	$112
			Groton Black Ledge CDF – Cap	$122
			Duck Island Roads CDF – Cap	$112
			Central Long Island Sound DS	$37
			Morris Cove CAD - Cap	$66
			Sherwood Island Pit COW – Cap	$55
			Hither Hills State Park – Nearshore	$60
			Western Long Island Sound DS	$94
			Hammonasset State Park – Nearshore	$51
			Lake Montauk Beach – Nearshore	$60
			Asharoken Beach NY – Nearshore	$60

The least cost placement alternative for the maintenance dredging of the main channel lower bars is open water placement at the Cornfield Shoals site. The second least costly is open water placement at the New London site at a 60 percent increase. Placement at the Central Long Island Sound site is twice the cost of using the CSDS. The least costly beneficial use alternative is nearshore placement off Hammonasset State Park beach, which is estimated at about 2.7 times the cost of using the CSDS. There are a number of small public beaches that are closer to the Connecticut River than Hammonasset Beach, but these have far less placement capacity than is required for one maintenance operation for the lower bars channels. There are other public beaches in New York that could receive this sandy material nearshore which are about 3.2 times the cost per CY of placement at the CSDS. There are significant areas of privately fronted beach closer to the Connecticut River mouth; however, significant public investment in nourishment of private beaches is unlikely absent a major storm event.

Connecticut River Main Channels – Middle Bars: Future maintenance dredging of the 16 bar and shoal segments of the 15-foot main river channel above Essex and up to Middletown will yield clean sand material suitable for open water placement. Historically, this material has been placed either in-river or upland onshore. Material has occasionally been used for bank stabilization and to raise the elevation of low-lying lands in the floodplain. Due to the significant distance between these dredging sites and the waters of LIS no additional alternatives were evaluated in this study.

Table 5-64 - Connecticut River below Hartford – Main Channel – Middle Bars FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Sand	797,300	2021-2025	In-River Placement	$9
			Upland On-Shore Placement	$19

The least cost alternative placement of dredged material from the Middle Bar segments of the Main Channel would be in-river placement in deep holes within the river channel, as has been done for past maintenance of this waterway segment. Placement onshore upland in the project vicinity would be twice as costly as in-river placement.

Connecticut River Main Channels – Upper Bars: Future maintenance dredging of the 16 bar and shoal segments of the 15-foot main river channel above Middletown and up to Hartford will yield clean sand material suitable for open water placement. Historically, this material has been placed either in-river or upland onshore. Material has occasionally been used for bank stabilization and to raise the elevation of low-lying lands in the floodplain. Due to the significant distance between these dredging sites and the waters of LIS, no additional alternatives were evaluated in this study.

The least cost alternative placement of dredged material from the Upper Bar segments of the Main Channel would be in-river placement in deep holes within the river channel, as has been done for past maintenance of this waterway segment. Placement onshore upland in the project vicinity would be three times as costly as in-river placement.

Table 5-65 - Connecticut River below Hartford – Main Channel – Upper Bars FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Sand	1,481,600	2031-2035	In-River Placement	$5
			Upland On-Shore Placement	$19

5.6.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-66 - Federal Navigation Project Base Plans Connecticut River Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
North Cove	Suitable Fines	Cornfield Shoals Disposal Site
Essex Cove Harbor	Suitable Fines	Onshore Placement or if Not Available then the Cornfield Shoals Disposal Site
Eightmile River and Hamburg Cove	Suitable Fines	Onshore Placement or if Not Available then the Cornfield Shoals Disposal Site
Wethersfield Cove	Suitable Fines	In-River Placement
Connecticut River Main Channel		
Entrance Reaches	Suitable Fines	Cornfield Shoals Disposal Site
Lower Bars	Sand	Cornfield Shoals Disposal Site
Middle Bars	Sand	In-River Placement
Upper Bars	Sand	In-River Placement

Alternatives to the Federal Base Plan: The middle and upper bar channels and Wethersfield Cove will most likely continue to be placed in-river or upland in on-shore locations on shore along the river. No further analysis of alternatives was conducted was conducted for these project segments.

For the sandy material produced by the Lower Bars channels above Old Saybrook to Essex, the only alternative to open water placement would be nearshore placement off area beaches.

Hammonasset State Park was evaluated as part of the screening which found the cost of that alternative to be 2.7 times that of placement at the CSDS. This increase would not be practicable without non-Federal funding of the additional cost. The USACE Section 204 continuing authority could assist the state if a receiving beach was identified that showed sufficient economic benefits from a nourishment project.

For the silty materials generated by the entrance bars and the North Cove, the least costly alternatives to open water placement would be use in a marsh creation/enhancement project at 2.7 to 4.3 times the cost of placement at the CSDS. This increase in cost would not be cost effective without non-Federal funding, or Federal and Sponsor partnership in developing a marsh or other habitat under the USACE Section 204 authority.

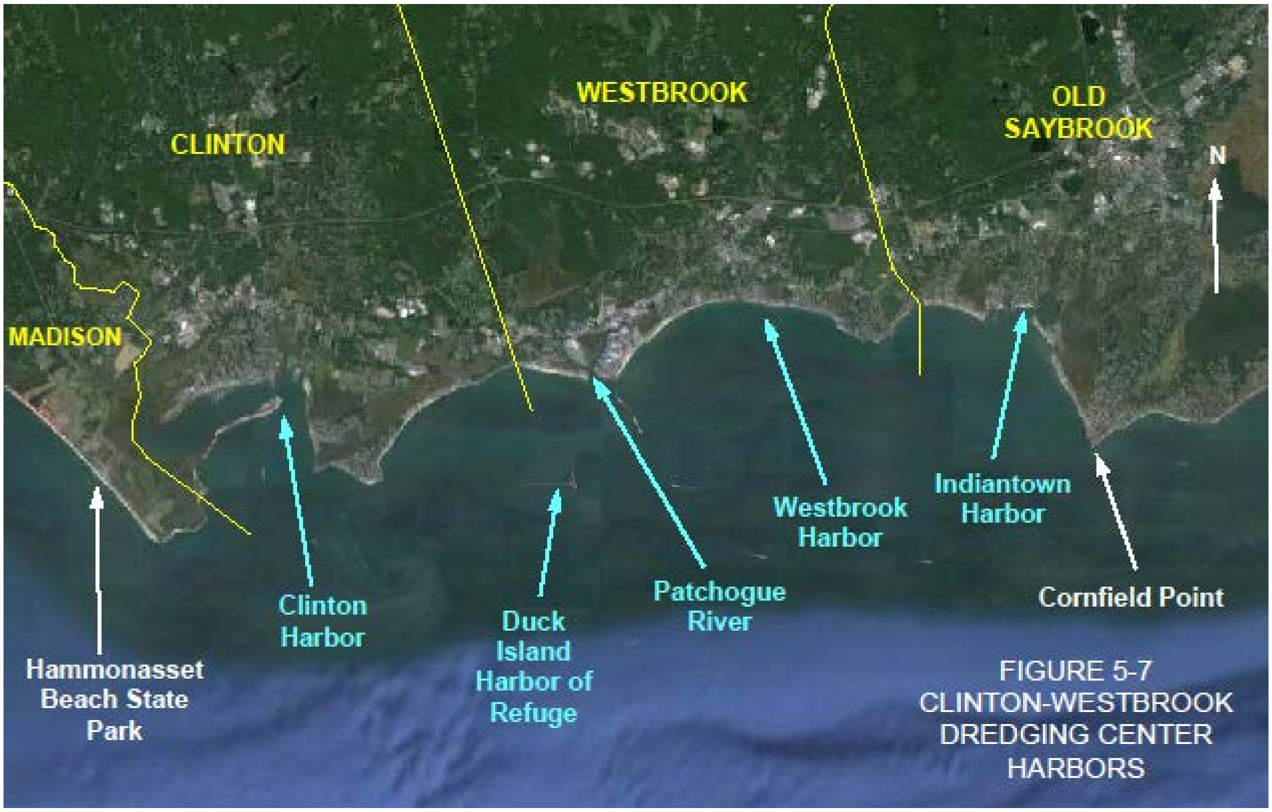
For the Eightmile River and Essex Cove project segments, the least cost alternative for fine grained sediments would be upland placement for habitat enhancement or other purposes. The next least costly alternatives for both these segments is open water placement. Other alternatives such as placement in the Morris Cove CAD cell (twice the cost of open water), or use in a marsh creation project (1.8 times the cost of the CSDS) would require non-Federal funding and or sponsorship for another project purpose.

5.7 Clinton-Westbrook Area Dredging Center

The Guilford-Branford Area Dredging Center consists of the towns of Westbrook and Clinton, and the western shore of the town of Old Saybrook, Connecticut and includes the Federal Navigation Projects (FNP) for Patchogue River, Duck Island Harbor of Refuge, and Clinton Harbor. The dredging center stretches from Cornfield Point in the east to Hammonasset Point in the west. The dredging center also includes a number of other small harbors, coves, and rivers which provide navigation access to Long Island Sound for commercial fishermen and boaters and small commercial cargo facilities. The principal waterways in this area are:

Indiantown Harbor and Oyster River
Westbrook Harbor (Seasonal Anchorage)
Patchogue River – Includes FNP
Duck Island Harbor of Refuge – Includes FNP
Clinton Harbor and the Hammonasset River – Includes FNP

The waterways in this dredging center yield a mix of material types, all found suitable for unconfined open water placement. Where larger coastal estuaries empty into these harbors material tends to fine-grained, at least inside those harbors. In waterways without riverine inputs, or in exposed entrance channels, material tends to be sandy, often sufficiently so to make it suitable for direct beach placement or nearshore bar nourishment.



5.7.1 Federal Navigation Projects - Maintenance

The dredged features of the three FNPs in this dredging center have been maintained and improved as shown below.

Table 5-67 - Federal Navigation Project Dredging History
Clinton-Westbrook Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Patchogue River	2012	34,100	CSDS	Mixed Fine & Sand
	2011	15,000	Hammonasset Bars	Suitable Sand
	2010	7,300	Hammonasset Bars	Suitable Sand
	1998	29,000	CSDS	Suitable Fine
Incl. Improvement	1983	20,000	Upland & Grove B.	Suitable Fine & Sand
	1977	36,500	Upland	Mixed Fine & Sand
	1976	10,900	Sidecast	Suitable Sand
	1972	42,600	Upland	Unknown
	1962	42,400	Clinton DS	Unknown
Improvement	1956	193,700	Upland Fill	Unknown

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Duck Island Harbor of Refuge	1949	132,500	Hopper Dredge Unknown	Mixed Fine & Sand
	1938	254,600	Unknown	Unknown
	1935	379,600	Unknown	Unknown
	1931	515,400	Unknown	Unknown
Clinton Harbor	2013	49,900	Hammonasset Beach	Suitable Sand
	2011	9,000	Hammonasset Nearshore	Suitable Sand
	2010	16,100	Hammonasset Nearshore	Suitable Sand
	2000	20,000	Hammonasset Nearshore	Suitable Sand
	1984	19,100	CSDS	Mixed Fine & Sand
	1981	27,000	CSDS	Mixed Fine & Sand
	1976	8,300	Sidecast	Suitable Sand
	1972	31,000	Town Beach and Upland Marsh Fill	Mixed Fine & Sand
	1965	27,600	Clinton DS	Unknown
	1957	75,000	Clinton DS	Unknown
	1950-51	123,500	Marsh Fill and Clinton DS	Mixed Fine & Sand

Patchogue River: The FNP for Patchogue River consists of an 8-foot entrance channel from deep water in LIS into the combined inlet of the Patchogue and Mennunketesuck Rivers. The 8-foot channel continues up the Patchogue River to a point just below the US Route 1 Bridge. An 8-foot anchorage is located along the east side of the channel in its upper reaches. Since the initial construction of the 8-foot project in 1956, the project has been maintained nine times, most recently in 2012 when about 34,100 CY was dredged and placed at the Cornfield Shoals site. The 1956 improvement project was placed upland as marsh-fill and maintenance dredging operations in 1972 and 1977 also placed material upland. Project maintenance has also been conducted by sidecast dredge (1976), with open water placement (1983, 1998 and 2012), and split placement on Grove Beach Point and at the CSDS (in 1983 when the entrance was also widened) as well. The entrance channel yields sandy material suitable for nearshore bar placement or direct beach placement. Nearshore placement off of Hammonasset State Beach was accomplished in 2010 and 2011 when the entrance channel was maintained by the USACE dredge *Currituck*. Over the 56 years since the 8-foot improvement, the project has been maintained an average of once every 5 years, with three operations confined to the entrance channel. When adjusted for recent after-dredge survey volumes (Survey PAT-324, 2012) and more recent condition survey volumes (PAT-325, 2014) and historic shoaling, it is estimated that the inner harbor shoals at a rate of about 1,140 CY annually while the entrance channel shoals at about 2,850 CY annually. This equates to about 11,400 CY of silty material from the inner harbor on a 10-year cycle and about 14,300 CY from the entrance channel on a five-year cycle.

Duck Island Harbor of Refuge: The FNP for the Duck Island Harbor of Refuge consists of a 16-foot anchorage protected by three rubblestone breakwaters, two extending out from Duck Island and one extending south from Kelsey Point to the west. The anchorage was initially dredged in 1917 when about 704,200 CY was removed, and was maintained five times between 1924 and 1949. No work has been done since. In the five maintenance operations, an average of 298,000 CY was removed. The last two maintenance operations (1938 and 1949) were accomplished by U.S. hopper dredge. The placement site(s) used are not recorded. The most recent condition survey of the anchorage (Survey DUC-316, 2008, Soundings 2004) shows about 1,245,800 CY in the anchorage. Over the 55 years since 1949, this yields an average annual shoaling rate of about 22,700 CY. The 1917 to 2004 and 1917 to 1949 periods yield annual rates of 31,400 CY and 46,600 CY, respectively. Using the lesser rate experienced for 1949 to 2004, gives an anticipated shoal volume of 1,472,300 CY in 2014, 1,834,800 CY for 2030, or 2,061,300 CY in 2040. It is estimated that this project, if maintained in about 2035, would require about 1,948,000 CY of dredging. No sediment testing has been conducted at this harbor. However, the entrance channels of nearby harbors all yield clean sand suitable at least for nearshore placement. It is therefore expected that Duck Island Harbor dredged materials would also be sandy materials suitable for nearshore placement.

Clinton Harbor: The Clinton Harbor FNP consists of an 8-foot channel from deep water in the Outer Harbor, through the inlet and into the Inner Harbor up to and along the Town Landing. Eight-foot anchorage areas are located alongside and south of the upper channel reach, and north of the channel east of the landing. Since the initial improvement of the 8-foot project in 1951, when about 129,300 CY were removed, the project has been maintained ten times. Three of those operations involved the entire project, while seven operations (including the last five from 1984 to 2013), dealt solely with the entrance channel. The last four entrance channel maintenance operations (2000, 2010, 2011 and 2013) placed material either nearshore at or directly on Hammonasset State Beach just west of the harbor. The average annual shoaling rate for the entrance channel seaward of the inlet over the period of 1981 to 2013 was about 3,600 CY. The rate for the entire harbor since the 1951 improvement, adjusted for the most recent condition surveys of the inner and outer harbor areas (Surveys CLI-237, 2011 and CLI-241, 2013, respectively) was about 4,800 CY over that 62-year period. This resulted in a 1,300 CY annual shoaling rate for the inner harbor alone.

If the entrance channel were next maintained in 2020, about 25,000 CY would require removal using the 3,600 CY annual rate. If a maintenance frequency of six years was then followed about 21,400 CY would be removed in each operation. This would likely be sandy material suitable for nearshore or direct beach placement. Using both the 2011 and 2013 surveys, there was 15,100 CY of shoal in the inner harbor in 2013. If the inner harbor were to be maintained in 2020 there would then be about 23,900 CY of silty material to be removed from that portion of the project. If the inner harbor were then maintained in conjunction with every other maintenance operation for the entrance channel, or every 12 years, then about 15,200 CY would be removed at those times, for a total of three times over the planning horizon.

The dredging activity timeline over the planning horizon for the three FNPs in the Clinton-Westbrook Dredging Center is shown below.

Table 5-68 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Clinton-Westbrook Area Dredging Center						
FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Patchogue River						
Entrance Channel	14,300	14,300	14,300	14,300	14,300	14,300
Inner Harbor		11,400		11,400		11,400
Duck Island Harbor of Refuge					1,948,000	
Clinton Harbor						
Entrance Channel	25,000		21,400	21,400	21,400	21,400
Inner Harbor	23,900			15,200		15,200
Total – Suitable Sand	39,300	14,300	35,700	35,700	1,983,700	35,700
Total – Suitable Fine	23,900	11,400		26,600		26,600

5.7.2 Harbor Characterization for Federal Projects

Patchogue River: The latest sampling and testing for the Patchogue River FNP was accomplished in 2004 and is presented in the April 2010 and May 2011 Environmental Assessments for maintenance dredging. These EAs supported the 2010 and 2011 maintenance dredging of the entrance channel by the U.S. Dredge *Currituck* with placement of the material off Hammonasset State Beach and the 2012 dredging of the entire project under contract by mechanical bucket dredge with placement of the material at the CSDS. The 2004 test results for samples from the entrance channel showed sands and silty sands ranging from zero to 38 percent fines (average 18%). These were the materials placed nearshore off Hammonasset Beach State Park. The samples from the inner harbor, with silts and clays ranging from 68 to 94 percent fines (average 86%), underwent chemical and biological testing and were found suitable for placement at the CSDS.

Sediment sampling and testing in 1991 from the entrance channel and 1995 from the inner harbor was presented in the June 1997 EA supporting the 1998 maintenance dredging of the entire project. The entrance channel materials ranged from 40 to 65 percent fines (average 53%), while the inner harbor ranged from 94 to 96 percent fines. All materials also underwent chemical and biological testing and were found suitable for placement at the CSDS.

In 1983, the entire project was maintained concurrent with improvement dredging to widen the entrance channel. The improvement materials were found to be sand ranging from 1 to 9 percent fines, except for one sample that was fine sand to sandy silt as shown in the December 1982 EA. The August 1983 plans and specifications for this work showed that the maintenance and improvement material from the entrance channel would be placed on Grove Point Beach, while inner harbor maintenance material would be placed at a previously used upland waterfront site. Sediment sampling in 1975 for the 1977 maintenance operation (December 1976 EA) showed ranges of 11 to 73 percent fines in the entrance channel and 2 to 4 percent fines in the inner harbor. Those materials were placed upland in a diked area behind the Pilots Point/Duck Island Marina.

Other placement sites used in prior dredging events include side-casting east of the entrance channel, upland as marsh-fill for marina development, upland in Town-owned diked areas, and the CLDS. While the inner harbor has yielded consistently silty materials (except for 1975) suitable for open water placement, the entrance channel materials have proved variable in grain size, though also suitable. When sandy entrance channel materials are encountered they are typically placed directly on the adjacent Grove Point Beach or nearshore off the nearby Hammonasset State Beach. Suitable fine materials from both the entrance and inner harbor have either been placed at the CSDS or at upland sites along the waterfront.

Duck Island Harbor of Refuge: There are no current sediment test results for the shoal material at the Duck Island anchorage. The refuge anchorage was last maintained in 1949 using a hopper dredge, the fifth maintenance operation since its 1917 improvement. The 1938 annual report describes the maintenance dredging done that year as being "mud and sand". Local interests report that the shoal material in the refuge anchorage is principally sand. As the entrance channels of nearby harbors yield sandy material suitable at least for nearshore placement, it is expected that Duck Island Harbor dredged materials would be similar.

Clinton Harbor: The May 2010 EA relied on sediment sampling and testing from 2001 and 2003 (including biological testing) in support of entrance channel dredging by the U.S. hopper dredge *Currituck* in 2010 and 2011. Sandy material of 12 to 16 percent fines was dredged from the entrance channel was placed nearshore off Hammonasset State Beach. These same test results were also used to support amended NEPA documentation for the maintenance dredging of the main channel at and seaward of Cedar Point, which was completed in early 2013. That latest effort involved hydraulic cutterhead pipeline dredging with placement of the sandy material directly on Hammonasset State Beach. State sampling and testing of inner channel shoal materials in 2012 showed a range of 23 to 33 percent fines.

A June 2000 Environmental Assessment looked to maintain the entrance channel with nearshore bar placement. Sampling of the entrance channel in 1999 showed a range of 1 to 39 percent fines, with an average of 8 percent. The material was dredged later that year by the *Currituck* and placed nearshore off Hammock Point east of the harbor. The April 1981 and September 1984 EAs relied on 1975 sediment test results in concluding that materials to be removed in maintenance dredging of the entrance channel in 1981 and 1984 were suitable for mechanical bucket dredging with placement at the CSDS. Those tests showed that the entrance shoals were fine sand averaging about 6 percent fines. The 1975 tests of the inner harbor shoal materials not removed in those operations ranged from 43 to 97 percent fines.

In summary, maintenance materials dredged from the Clinton Harbor channel at and seaward of Cedar Point are clean sands suitable for direct beach or nearshore bar placement or other uses. Materials from inner channel reaches are finer sandy material potentially suitable for nearshore bar placement. Materials from the anchorage are predominantly silt and clay, but suitable for open water placement in LIS.

5.7.3 Historic and Potential Federal Navigation Project Placement Options

Maintenance of the three FNPs has typically used open water placement in LIS, at the CSDS, nearshore or beach placement, principally at Hammonasset, or upland placement in the case of Patchogue River. Maintenance of all three projects is expected to generate mainly sandy material suitable for nearshore placement, if not for direct beach placement, as nourishment material. The inner harbors at Patchogue River and Clinton Harbor are expected to generate fine-grained materials suitable for unconfined open water placement. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

Potentially the fine-grained material could be used to create salt marsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise.

The material could also be placed at an ocean site as at present, the closest being the CSDS. The material could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary this would require further investigation in the future.

5.7.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Clinton-Westbrook Dredging Center that periodically generate dredged material. These are all shallow draft public and private small craft facilities (large and small marina, yacht club and boat yard operations) at the Patchogue River, Clinton Harbor, and Indiantown Harbor and their tributaries. Private residential access facilities are found at many other locations throughout the dredging center.

The 2009 Dredging Needs Report projected, based on facility surveys, that 612,300 CY of maintenance dredging and 202,000 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in Table 5-69 below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CSDS being the closest approved site. Materials with higher silt content may need to be hauled to a more distant placement site, as the CSDS is primarily a dispersal site reserved for materials that are generally no more than 50 percent fines. These smaller permit activities could also take advantage of whatever alternative placement methods are used for silty material removed from the FNPs in this dredging center, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-69 - Dredging Activity Timeline – Clinton-Westbrook Dredging Center Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	83,300	83,000	187,700	187,800	32,700	32,800
Improvement	83,000	18,000	1,500	1,500	49,000	49,000
Total Non-Federal	166,300	101,000	189,200	189,300	81,700	81,800

5.7.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to large-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities and large private permit activities generating up to 1,950,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at the CSDS, or on or near beaches when consisting of sandy material. Port fill for marina development has been used as well. Several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-70 - Clinton-Westbrook Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Cornfield Shoals Disposal Site (CSDS)	Open Water	200,000,000	All	All Suitable
New London Disposal Site (NLDS)	Open Water	7,796,500	All	All Suitable
Central Long Island Disposal Site (CLDS)	Open Water	20,000,000	All	All Suitable
Duck Island Road CDF - Fill	Island CDF	1,376,100	Once Built	All
- Cap		233,900		All Suitable
Clinton Harbor CDF - Cap	Shoreline CDF	59,800	Once Built	All
- Fill		640,200		All Suitable
Faulkner Island CDF - Fill	Island CDF	16,010,200	Once Built	All
- Cap		1,169,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Twotree Island CDF, CT - Fill	Island CDF	2,966,200	Once Built	All
- Cap		433,800		All Suitable

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
110 Sand Co., Melville, NY	Upland Sand Pit	1,000,000	Until Filled	All Suitable
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Hammonasset State Park Beach	Beachfill	562,700	Recurring	Suitable Sand
	Nearshore	140,000		
Grove Beach Point, CT	Beach	26,000	Recurring	Suitable Sand
	Nearshore	62,800		
Westbrook Town (West) Beach	Beachfill	57,000	Recurring	Suitable Sand
Sandy Point Beach, RI	Nearshore	80,000	Recurring	Suitable Sand
Sandy Point Marsh Site, CT	Marsh	1,100,000	Once Built	All Suitable

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

<u>Beach and Nearshore Nourishment Sites</u>: The coastline of the Clinton-Westbrook dredging center is a mix of beaches and rocky coast, with small coastal plain river inlets, small bays and coves, and rocky headlands. There is one large public beach (Hammonasset State Beach in Madison) and a few small municipal beaches, such as West Beach in Westbrook. Other more distant dredging centers include additional beaches that could receive sandy material from the Clinton-Westbrook area. Haul distances from this dredging center’s projects and waterways, to various public beaches are shown below.

Table 5-71 - Haul Distances to Beach and Nearshore Placement Sites							
Project (Distances in Statute Miles)	Hammonasset Beach State Park	Rocky Neck State Park	Harkness Beach State Pk	Ocean Beach Park	Westbrook Town Beach	Lighthouse Park Beach	Prospect Beach
Indiantown Harbor	9.7	10.9	16.5	18.0	3.2	27.6	30.9
Patchogue River	6.4	14.3	20.0	21.3	2.6	24.5	27.8
Duck Island Harbor	5.6	14.1	19.8	21.2	2.4	23.0	26.3
Clinton Harbor	3.6	17.8	23.2	24.7	6.2	21.6	24.9

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Cornfield Shoals site located offshore of New Haven Harbor. The NLDS and CLDS are more distant. These sites could receive any suitable material, either sandy or fine-grained. Haul distances from this dredging center's projects and waterways, to various open water placement sites are shown below.

Table 5-72 - Scow Haul Distances to In-Water Placement Sites									
Project (Distances in Statute Miles)	CLDS	Branford DS	Guilford DS	Falkner Is CDF	Clinton DS	CSDS	NBDS	NLDS	RIS DS
Indiantown Harbor	27.2	22.2	18.2	15.2	7.5	5.3	12.9	18.4	55.5
Patchogue River	24.6	19.6	15.6	12.5	5.0	7.9	16.7	22.3	59.2
Duck Island Harbor	22.6	17.6	13.7	10.5	3.7	7.6	16.4	21.9	58.8
Clinton Harbor	21.1	16.2	12.3	8.6	3.6	10.4	19.4	25.0	62.0

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: Potential CAD cells and COW sites could be developed for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites located near this dredging center include New Haven Breakwaters, Falkner Island, Duck Island Roads, Twotree Island (Waterford), and Clinton Harbor.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. Two such potential marsh creation sites are located at Sandy Point in New Haven Harbor, and at Sandy Point in Little Narragansett Bay, RI.

5.7.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Clinton-Westbrook Area Dredging Center the analysis matched projects and placement alternatives as follows.

Patchogue River: Future maintenance dredging of the Patchogue River FNP will yield both sand from the entrance channel and fine-grained material from the inner harbor, all suitable for open water placement. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, of for other upland applications. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Patchogue River are shown below.

The least cost placement alternative for the maintenance dredging of sand from the Patchogue River entrance channel is either nearshore or direct placement at Grove Beach, or direct placement on Westbrook Town (West) Beach. Open water placement at the Cornfield Shoals site is about 18 percent more expensive. Nearshore placement at Hammonasset State Park is about 1.5 times the cost of the closer Grove Beach. Placement at the New London or Central LIS sites is slightly more than 1.5 times the cost of placement at Grove Beach. Use of the sand as cap for the Morris Cove borrow pit CAD cell in New Haven Harbor is about twice the cost of placement at Grove Beach.

For the Patchogue River’s inner harbor fine-grained materials, open water placement at the Cornfield Shoals site is the least cost alternative. The next least costly is open water placement at the New London or Central LIS sites which are about 30 percent more costly. The least costly non in-water alternatives are use in a potential marsh creation project at Sandy Point in West Haven, or placement as cap material at the Morris Cove Borrow Pit CAD cell site in New Haven Harbor, which are both about 1.6 to 1.7 times the cost for the CSDS. Transport and upland placement at landfills in Connecticut or New York is about 1.8 times the cost of open water placement at the CSDS.

Table 5-73 - Patchogue River – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand Entrance Channel	14,300	2015-2020	Westbrook Town (West) Beach	$60
	14,300	2021-2025	Falkner Island CDF – Cap	$169
	14,300	2026-2030	Duck Island Roads CDF – Cap	$154
	14,300	2031-2035	Cornfield Shoals Disposal Site	$71
	14,300	2036-2040	Twotree Island CDF – Cap	$169
	14,300	2041-2045	Clinton Harbor CDF – Cap	$154
			Grove Beach – Nearshore	$60
			Morris Cove Pit CAD – Cap	$121
			Hammonasset Beach - Nearshore	$90
			Central Long Island Sound DS	$92
			New London Disposal Site	$92
			Sherwood Island COW – Cap	$122
			Shadmoor State Park NY – Nearshore	$161
			Sandy Point Beach, RI – Nearshore	$161
			Grove Beach – On-Beach	$60
Suitable Fine Inner Harbor	11,400	2021-2025	Falkner Island CDF – Fill	$180
	11,400	2031-2035	Duck Island Roads CDF – Fill	$170
	11,400	2041-2045	Cornfield Shoals Disposal Site	$84
			Twotree Island CDF – Fill	$180
			Clinton Harbor CDF – Fill	$170
			Morris Cove Pit CAD – Fill	$133
			Central Long Island Sound DS	$109
			New London Disposal Site	$109
			New Haven Breakwaters CDF – Fill	$201
			Groton Black Ledge CDF – Fill	$201
			Sherwood Island COW – Cap	$142
			Sherwood Island COW – Fill	$142
			110 Sand Company Site, NY	$153
			Manchester City Landfill	$153
			Brookhaven Town Landfill	$153
			Sandy Point West Haven Marsh	$142

Duck Island Harbor of Refuge: The single maintenance dredging action that may occur at the Duck Island Harbor of Refuge during the DMMP planning horizon is expected to yield fine sand, suitable for open water placement. Sand can also be used beneficially for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, of for other upland applications. The top-scoring alternatives from the site screening process for Duck Island Harbor of Refuge are shown below.

Table 5-74 - Duck Island Harbor of Refuge – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	1,948,000	2036-2040	Cornfield Shoals Disposal Site	$15
			Falkner Island CDF – Cap	$101
			Central Long Island Sound DS	$34
			New London Disposal Site	$34
			New Haven Breakwaters CDF – Cap	$121
			Clinton Harbor CDF – Cap	$101
			Twotree Island CDF – Cap	$116
			Grove Beach – Nearshore	$4
			Westbrook Town (West) Beach	$5
			Western Long Island Sound DS	$41
			Stratford Point CDF – Cap	$133
			Penfield Reef CDF – Cap	$133
			Hammonasset Beach – Nearshore	$7
			Sandy Point West Haven Marsh	$58

The least cost placement alternative for the maintenance dredging of sand from the Duck Island Harbor of Refuge is nearshore placement off of Grove Beach, Westbrook Town Beach or Hammonasset State Park Beach. The unit costs for these placement sites are very low due to both proximity and the large volume of sand that would be dredged from the project. However, none of these sites have sufficient capacity to handle more than a small percentage of the anticipated dredge material volume, and these estimated costs would only be valid if the work was accomplished in combination with additional placement sites. Open water placement at the Cornfield Shoals site is relatively low cost compared to other harbor projects in the area, but is two to four times the cost of the nearshore alternatives. More distant open water sites or CDF alternatives are eight to 30 times the nearshore cost, respectively.

<u>Clinton Harbor</u>: Future maintenance dredging of the Clinton Harbor FNP will yield both sand from the entrance channel and fine-grained material from the inner harbor channel and anchorage, all suitable for open water placement. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, or for other upland applications. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Clinton Harbor are shown below.

Table 5-75 - Clinton Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand Entrance Channel	25,000	2015-2020	Morris Cove Pit CAD – Cap	$105
	21,400	2026-2030	Hammonasset Beach – Nearshore	$50
	21,400	2031-2035	Hammonasset State Park – On-Beach	$50
	21,400	2036-2040	Falkner Island CDF – Cap	$133
	21,400	2041-2045	Duck Island Roads CDF – Cap	$123
			Cornfield Shoals Disposal Site	$53
			Twotree Island CDF – Cap	$154
			Clinton Harbor CDF – Cap	$123
			Central Long Island Sound DS	$70
			Westbrook Town (West) Beach NS	$68
			Sherwood Island Pit COW – Cap	$96
			Sandy Point RI – Nearshore	$121
			Grove Beach – Nearshore	$68
			Clinton Town Beach – On-Beach	$43
Suitable Fine	23,900	2015-2020	Morris Cove Pit CAD – Fill	$109
	15,200	2031-2035	Falkner Island CDF – Fill	$138
	15,200	2041-2045	Duck Island Roads CDF – Fill	$129
			Two Tree Island CDF – Fill	$157
			Clinton Harbor CDF – Fill	$129
			Cornfield Shoals Disposal Site	$58
			New Haven Breakwaters – Fill	$163
			Milford Harbor CDF – Fill	$163
			Groton Black Ledge CDF – Fill	$163
			110 Sand Company Site, NY	$127
			Manchester City Landfill	$127
			Brookhaven Town Landfill	$127
			Central Long Island Sound DS	$76
			Sandy Point West Haven Marsh	$102

The least cost placement alternative for the maintenance dredging of sand from the Clinton Harbor entrance channel is placement on Clinton Town Beach. This beach only has capacity to receive about 1,900 CY, less than 10 percent of the amount to be dredged in any one maintenance operation, and so cannot be the sole least cost alternative. The second least costly alternative, which can accept the entire dredging volume, is either direct or nearshore placement at Hammonasset State Beach, at an increase in cost of 16 percent. Open water placement at the Cornfield Shoals site in LIS is the next least costly alternative at a 6 percent increase over Hammonasset. Nearshore placement off Westbrook Town (West) Beach or Grove Beach are the next least costly alternatives at a 36 percent increase over placement at Hammonasset. Open water placement at the CLDS is a 40 percent increase over placement at Hammonasset.

For Clinton's inner harbor fine-grained materials, open water placement at the Cornfield Shoals site is the least cost alternative. The next least costly is open water placement at the Central Long Island Sound site which is about 30 percent more costly. The least costly non in-water alternatives are use in a potential marsh creation project at Sandy Point in West Haven, or placement as cap material at the existing Morris Cove Borrow Pit CAD cell site in New Haven Harbor, which are both about 1.8 times the cost for the CSDS. Transport and placement upland at landfills in Connecticut or New York is about 2.2 times the cost of open water placement at the CSDS. Placement in a potential CDF is about 2.2 to 2.8 times the cost of open water placement at the CSDS.

5.7.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-76 - Federal Navigation Project Base Plans
Clinton-Westbrook Area Dredging Center Projects

FNP Project and Segment	Material Type	Federal Base Plan
Patchogue River		
Entrance Channel	Sand	Grove Beach or Westbrook Town (West) Beach – Nearshore
Inner Harbor	Suitable Fines	Cornfield Shoals Disposal Site
Duck Island Harbor of Refuge	Sand	Nearshore at Grove Beach, Westbrook Town Beach or Hammonasset State Park and other Area Beaches
Clinton Harbor		
Entrance Reaches	Sand	Clinton Town Beach and Hammonasset State Beach – Direct Placement
Inner Harbor	Suitable Fines	Cornfield Shoals Disposal Site

Alternatives to the Federal Base Plan: For the sandy material produced by the Patchogue and Clinton entrance channels, the Federal base plans are beneficial use options for beach or nearshore placement. For Duck Island Harbor, nourishment is also the base plan; however, several beaches will need to be used for that one project to distribute the large volume of material.

For the silty materials generated by the inner harbor areas at Patchogue and Clinton, the least costly non-open water alternatives are use in a potential marsh creation project at Sandy Point in West Haven or placement in the Morris Cove CAD cell at 1.7 to 1.9 times the cost of open water placement at the CSDS. Non-Federal funding would be required for the additional cost to implement alternatives to placement at CSDS. For the marsh creation alternative, the Section 204 continuing authority may provide a means for the USACE to assist the state in implementation, if that program's requirements for feasibility and cost-sharing are met.

5.8 Guilford-Branford Area Dredging Center

The Guilford-Branford Area Dredging Center consists of the towns of Madison, Guilford and Branford, Connecticut, and includes the Federal Navigation Projects (FNP) for Guilford Harbor, Stony Creek, and Branford Harbor. The dredging center stretches from Hammonasset Point west to the Farm River on the border between Branford and East Haven. The dredging center also includes a number of other small harbors, coves and rivers which provide navigation access to Long Island Sound for commercial fishermen and boaters and small commercial cargo facilities. The principal waterways in this area are:

Madison Harbor
Guilford Harbor – Includes FNP
West River (Guilford)
Sachem Head Harbor
Stony Creek Harbor – Includes FNP
Pine Orchard Harbor
Indian Neck Harbor and Maltby Cove
Branford Harbor – Includes FNP
Short Beach Cove
Farm River (East Haven River)

This dredging center also includes a number of offshore islands which require navigation access including the Thimble Islands and Faulkner's Island. The waterways in this dredging center yield a mix of material types, all found suitable for unconfined open-water placement. Where larger coastal estuaries empty into these harbors, material tends to fine-grained, at least inside those harbors. In waterways without riverine inputs, or in exposed entrance channels, material tends to be sandy, often sufficiently so to make it suitable for direct beach placement or nearshore bar nourishment.

The riverine tributaries contribute silty shoal material to the harbor, resulting in harbor maintenance materials which are predominantly fine-grained. Outer harbor materials are somewhat sandier, though not sufficiently so to present beach nourishment opportunities or other non-treated beneficial uses other than marsh creation.

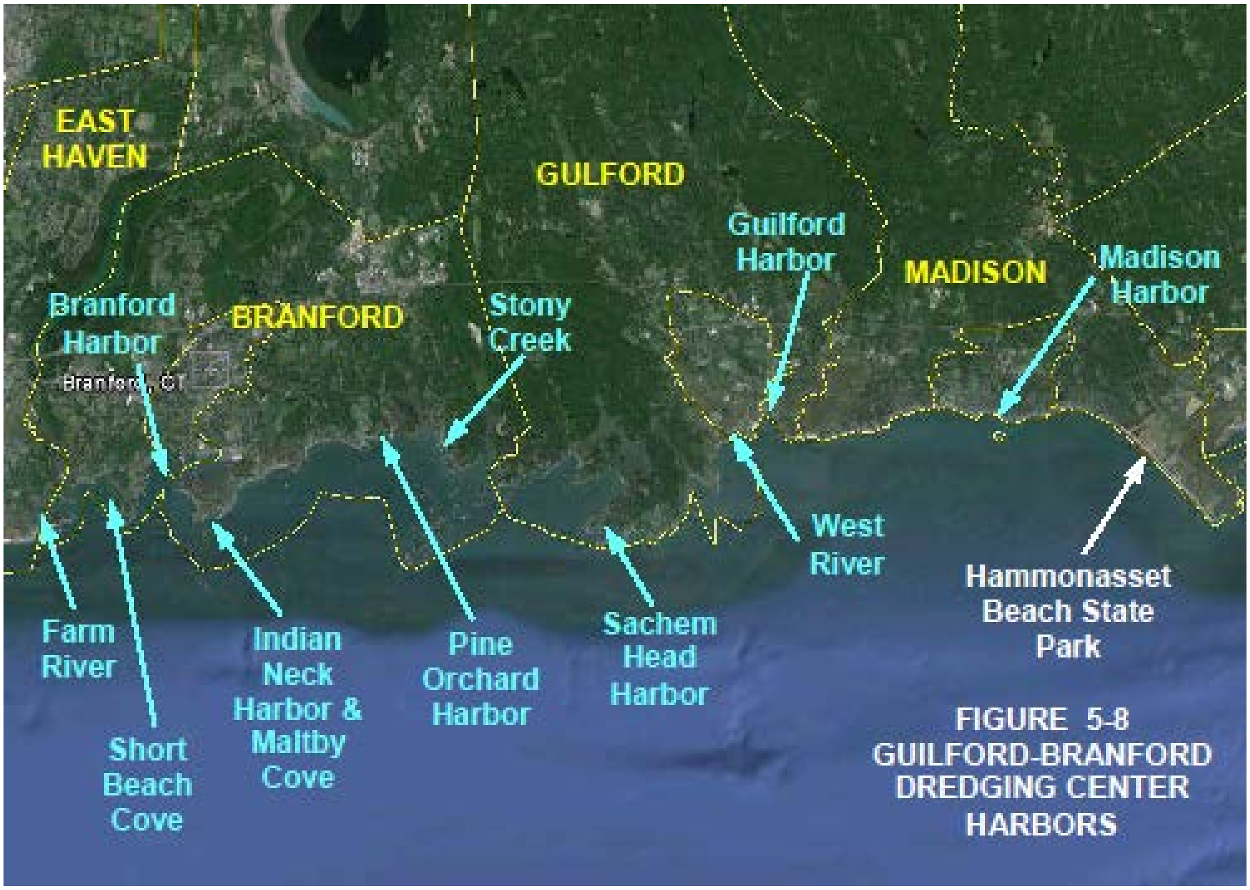


FIGURE 5-8
GUILFORD-BRANFORD DREDGING CENTER HARBORS

5.8.1 Federal Navigation Projects - Maintenance

The dredged features of the three FNPs in this dredging center have each been maintained within the last several decades as shown below.

Table 5-77 - Federal Navigation Project Dredging History
Guilford-Branford Dredging Center

FNP Recent Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Guilford Harbor	2014-15	52,500	CLDS and Nearshore	Suitable Fine and Sand
	1992-94	41,900	CLDS	Suitable Fine
	1982	72,000	Upland GYC	Fines
	1974	71,800	CLDS	Suitable Fine
	1964	73,000	Guilford DS	Unknown
Improvement	1957	109,700	Beach & Upland Marsh Fill	Mixed Sand and Fines

FNP Recent Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Stony Creek Harbor	1995	45,800	CLDS	Suitable Fine
	1977	36,000	CLDS	Suitable Fine
Improvement	1969-70	76,000	Branford DS	Suitable Fine
Branford Harbor	1989-90	76,300	CLDS	Suitable Fine
	1976	60,000	Upland Fill	Fines
	1965	93,200	Branford DS	Unknown
	1956	102,200	Branford DS and Upland	Unknown
	1946	71,100	Unknown	Unknown
	1938	88,100	Unknown	Unknown
	1933	46,200	Unknown	Unknown
	1929-30	80,800	Unknown	Unknown

Guilford Harbor: The FNP for Guilford Harbor consists of a 6-foot deep entrance channel from deep water in LIS, two 6-foot branch channels to Sluice Creek and the East River, and a 6-foot anchorage in the East River. The project was initially constructed in 1957-1958 when sandy material was placed on the town beach and silty material was placed in two upland marsh fill areas. Since its initial construction, the project has been maintained four times, including in 1992-1994 when about 41,900 CY was dredged and placed at CLDS. Earlier dredging placed material at the historic Guilford (Falkner Island) Disposal Site just south of the harbor in LIS (1964), at the CLDS (1974), or at an upland site provided at the Guilford Yacht Club (1982). Maintenance dredging is currently underway during the 2014-2015 dredging season, partly in response to shoaling from Hurricane Sandy, with an estimated 52,500 CY requiring removal, including allowable overdepth (Survey GUI-296, 2013). The state of Connecticut has requested that the sandy material (about 4,400 CY) from the project areas at the mouth of the East River be placed in the nearshore bar system off Hammonasset Beach State Park in Madison, about 9 miles east of the harbor. The Pre-dredge Survey (GUI-297) for this action increased the FNP total available contract volume to 55,000 CY. The remaining materials, which are more fine-grained, are to be placed at the CLDS. The Federal contract also included maintenance of the public marina which was funded by the state, and that material was also placed at the CLDS.

Over the 35-year period between 1958 and 1993 when the project was maintained four times (on average every 9 years), the average shoaling rate was about 7,390 CY annually. Adding the 2014 survey volume to that record gives a reduced annual shoaling rate of about 5,660 CY over a 56-year period. Adding the 21-year interval between the 1993-1994 and 2014-2015 maintenance operations increases the average maintenance frequency to over 11 years. Using the lower rate, this project is estimated to generate about 67,900 CY of maintenance material on a 12-year cycle, a volume similar to that of the current maintenance activity. Beyond the

2014-2015 operation, the project would require maintenance two additional times during the DMMP planning horizon. In the 2014-2015 maintenance operation about ten percent of the dredged material from the middle reach of the channel at the northeast end of Grass Island was sand which was placed nearshore off Hammonasset State Beach at the state's request. A similar opportunity is expected with future maintenance dredging (estimated at 61,100 CY fine-grained and 6,800 CY sand).

Stony Creek Harbor: The FNP for Stony Creek Harbor consists of a 6-foot deep entrance channel from deep water in LIS to a 6-foot anchorage basin. The project was initially constructed in 1969-1970 when the dredged material was placed at the Branford Disposal Site in LIS, about 5.5 miles south of the harbor (May 1969 Plans and Specifications). Since that time the project has been maintained twice with placement at the CLDS, in 1977 (February 1977 EA), and most recently in 1995 (August 1993 EA), when about 45,800 CY were dredged with the material placed at the CLDS both times. Based on this dredging record, shoaling in the 1970 to 1995 period averaged 3,270 CY annually. The project currently has about 41,200 CY of shoal material accumulated (Survey SCB-19, 2013). For the longer 43-year period of 1970 to 2013, the average annual shoaling rate is reduced to 2,860 CY.

It is estimated that at a 25-year maintenance interval, this project will require maintenance dredging twice during the 30-year DMMP planning horizon, in 2020 and 2045. Using the 41,200 CY accumulated through 2013, and the annual shoaling rate of 2,860 CY, would yield an anticipated volume of about 61,200 CY in 2020. Subsequently, by 2045 a further 71,500 CY in shoal volume could be expected (2,860 CY x 25 years).

Branford Harbor: The Branford Harbor FNP consists of an 8.5-foot deep channel from deep water in the Outer Harbor, through the Inner Harbor and up the Branford River to just below the first bridge. The project was last maintained in 1989-1990, with placement of about 76,300 CY of silty material at the CLDS. Since its initial improvement in 1904-1907 through its last maintenance in 1989-90, this project was maintained a total of eleven times, with an average annual shoaling rate of about 8,090 CY over that 83-year period. The entire Branford Harbor project currently has about 65,400 CY in shoal material, including allowable overdepth (Survey BRN-93, 2009), of which 48,000 CY is in the river channel above Branford Point, and the remainder in the outer and inner harbor channel reaches. When this amount is added-in the historical record, the annual shoaling rate drops to 7,220 CY over that 102-year period.

This harbor has typically been maintained about once every 8 years, when total shoal volume is in the range of 60,000 to 100,000 CY. Using the 2009 shoal volume and the lesser annual shoaling rate, if the harbor were maintained in 2020 then the total shoal volume that could be expected at that time would be about 144,800 CY. If subsequent maintenance were to follow at a 20-year frequency, then in 2040 an available shoal volume of about 144,400 CY could be expected.

The dredging activity timeline over the planning horizon for the three FNPs in the Guilford-Branford Dredging Center is shown below.

Table 5-78 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Guilford-Branford Area Dredging Center						
Project	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Guilford Harbor						
Inner & Outer Harbor	0	0	61,100	0	61,100	0
Middle Reach	0	0	6,800	0	6,800	0
Stony Creek Harbor	61,200	0	0	0	0	71,500
Branford Harbor	144,800	0	0	0	144,400	0
Total Sand	0	0	6,800	0	6,800	0
Total Fines	206,000	0	61,100	0	205,500	71,500

5.8.2 Harbor Characterization for Federal Navigation Project Maintenance

Guilford Harbor: Sediment sampling and testing for shoal materials in the Guilford Harbor FNP has been undertaken four times, in 1972, 1975, 1988, and 2013. Dredged materials from the initial improvement project in 1956-1958 (June 1956 Plans and Specifications) were placed on the Town Beach and upland as fill at Jacobs Park west of the harbor, and upland as fill on Grass Island south of the anchorage. The 1963 maintenance materials were placed in open water at the Guilford (Falkners Island) Disposal Site in LIS. The 1974 maintenance materials were determined suitable for placement at the CLDS based on the 1972 test results. The 1982 maintenance (February 1981 EA) relied on the 1975 test results in choosing to place materials by hydraulic pipeline dredge upland as marsh fill in an area of phragmites located north of the Guilford Yacht Club on the east bank of the West River. The 1992-1994 maintenance work (September 1992 EA) relied on the 1988 test results in its determination that the material was suitable for placement at the CLDS, as did the August 2014 EA in determining that material was suitable for CLDS placement based on the 2013 test results. .

The test results have shown similar results for grain size and chemistry. Entrance channel sediments range from 42 to 63 percent fines, spur channel 48 to 99 percent, channel bend area 1 to 7 percent, and the anchorage 21 to 95 percent. All materials other than those at the channel bend area northeast of Grass Island are considered fine-grained and suitable for open-water placement. The channel bend area materials are typically sand suitable for beach or nearshore bar placement.

Stony Creek: Sediment sampling and testing for shoal materials in the Stony Creek FNP has been undertaken two times, in 1975 and 1992. The 1975 test results showed a range of 86 to 99 percent fines (February 1977 EA), while the 1992 results showed a range of 87 to 97 percent fines (August 1993 EA). In both cases, open-water placement at the CLDS in LIS was the selected method. All testing has shown Stony Creek shoal materials to be largely silt and clay, not suitable for beach or bar placement due to its fine-grained nature.

Branford Harbor: During the 1956 maintenance operation, dredged material placement was originally to have all been at the Branford DS located about 7 miles south of the harbor in LIS.

However, slow construction progress resulted in a change in placement areas to include three upland areas on the east shore of the upper river. Sediment sampling and testing for shoal materials in the Branford Harbor FNP has been undertaken three times, in 1972, 1974 and 1986. The 1972 and 1974 test results supported the March 1976 EA and showed a range of 84 to 99 percent fines. The 1976 maintenance dredging was by hydraulic pipeline dredge with placement as fill in upland diked areas along the east shore of the upper river south of Hickory Road and north of Quarry Dock Road. The 1987 sediment sampling and testing supported the November 1987 EA and the August 1989 Plans and Specifications which found the material to be 87 to 97 percent fine-grained silt and suitable for open-water placement at the CLDS in LIS.

5.8.3 Historical and Potential Federal Navigation Project Placement Options

Maintenance of the three FNPs in the Guilford-Branford dredging center has typically used open-water placement in LIS, at the CLDS or historically at the Branford and Guilford Disposal Sites. Both the Branford and Guilford projects have also used upland placement as marsh fill for marina development in earlier times. Maintenance of all three projects is expected to generate mainly fine-grained materials suitable for unconfined open-water placement. However, materials outside the inner project reaches at both Branford and Guilford may be shown to be sandy material suitable for nearshore placement, if not for direct beach placement, as nourishment material. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement. Potentially, the fine-grained material could be used to create salt marsh in shallow tidelands to replace marsh lost in other areas to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise.

The material could also be placed at an ocean site, the closest being the CLDS. The material could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary this would require further investigation in the future.

5.8.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Guilford-Branford Dredging Center that periodically generate dredged material. These include the deep draft Tilcon commercial quarry wharf at Pine Orchard Harbor in Branford, large and small marina, yacht club and boat yard operations in all of the waterways listed above, private residential and public access facilities at many other locations throughout the dredging center, and offshore island access points.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 387,600 CY of maintenance dredging and 150,800 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in Table 5-79 below. These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CLDS being the closest approved site. These activities could also take advantage of whatever alternative placement methods are used for the three FNPs in this dredging center, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open-water placement for otherwise smaller volumes.

Table 5-79 - Dredging Activity Timeline – Guilford-Branford Dredging Center Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	188.500	45,500	51,500		45,500	
Improvement	800	150,000				
Total Non-Federal	188,800	195,500	51,500		45,500	

5.8.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities and large private permit activities generating up to 150,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at the CLDS. However, port fill and upland fill for specific purposes have been used as well. Several investigations of alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-80 - Guilford Branford Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Central Long Island Disposal Site (CLDS)	Open Water	20,000,000	All	All Suitable
Cornfield Shoals Disposal Site (CSDS)	Open Water	200,000,000	All	All Suitable
Western Long Island Disposal Site (WLDS)	Open Water	20,000,000	All	All Suitable
Faulkner Island CDF - Fill	Island CDF	16,010,200	Once Built	All
- Cap		1,169,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Duck Island Roads CDF - Fill	Island CDF	1,376,100	Once Built	All
- Cap		233,900		All Suitable
Clinton Harbor CDF - Cap	Shoreline CDF	59,800	Once Built	All
- Fill		640,200		All Suitable

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
110 Sand Company Clean Fill Site, NY (59)	Upland Sand Pit	1,000,000	All	All Suitable
Manchester Landfill, Manchester, CT (251)	Upland Landfill	1,200,000	All	All Suitable
Town of Brookhaven Landfill, NY (61)	Upland Landfill	700,000	All	All Suitable
Sandy Point Marsh Site, CT	Marsh	1,100,000	Once Built	All Suitable
Hammonasset State Beach	Nearshore	140,000	Recurring	Suitable Sand
Sandy Point Beach, RI	Nearshore	80,000	Recurring	Suitable Sand
Jacobs Beach, Guilford, CT	Beachfill	8,600	Recurring	Suitable Sand
Lighthouse Beach Park	Nearshore	55,600	Recurring	Suitable Sand

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for potential CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Beach and Nearshore Nourishment Sites: The coastline of the Guilford-Branford dredging center is largely rocky coast, with small coastal plain river inlets, small bay and coves, and rocky islands and headlands. There are no large public beaches and only a few small municipal beaches, such as Jacob's Beach in Guilford. The adjacent Clinton-Westbrook and New Haven dredging centers include additional beaches that could receive sandy material from the Guilford-Branford area, including sites such as Hammonasset State Beach in Madison, East Haven Town Beach, and Lighthouse Point Park in New Haven. Haul distances from this dredging center's projects and waterways, to various public beaches are shown below.

Table 5-81 - Haul Distances to Beach and Nearshore Placement Sites										
Project or Harbor (Distances in Statute Miles)	Stratford Point Beach	Silver Sands Beach	Woodmont Beach	New Haven Breakwaters CDF	Savin Rock Beach	Prospect Beach	Lighthouse Beach Park	Hammonasset State Beach	Westbrook Town Beach	Rocky Neck State Park
Guilford Harbor	25.8	23.1	19.2	17.3	18.1	18.4	15.1	6.0	13.2	24.4
Sachem Head Harbor	21.8	19.1	15.2	13.3	14.1	14.4	11.1	8.5	15.6	26.8
Stony Creek	21.5	18.8	14.9	13.0	13.8	14.1	10.8	11.4	18.1	29.3
Pine Orchard Harbor	20.0	17.3	13.4	11.5	12.3	12.6	9.3	13.0	19.5	30.8
Branford Harbor	17.6	13.9	10.0	8.1	8.9	9.2	5.9	15.6	22.5	34.1
Farm River	15.2	11.5	7.6	5.7	6.5	6.8	3.5	16.6	23.1	34.5

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Central Long Island Sound site located offshore of New Haven Harbor. The CSDS and WLDS sites are more distant. These sites could receive any suitable material, either sandy or fine-grained. Haul distances from this dredging center's projects and waterways, to various open-water placement sites are shown below.

Table 5-82 - Scow Haul Distances to In-Water Placement Sites									
Project (Distances in Statute Miles)	CLDS	Branford DS	Guilford DS	Falkner Is CDF	Clinton DS	CSDS	NBDS	NLDS	RIS DS
Guilford Harbor	14.9	10.1	6.9	4.2	9.1	17.0	26.2	31.8	68.7
Sachem Head Harbor	11.3	6.8	4.5	4.1	11.1	19.3	28.4	34.0	70.9
Stony Creek	11.3	7.2	6.0	6.6	13.7	21.8	31.1	36.6	73.5
Pine Orchard Harbor	10.2	6.7	6.6	7.9	15.1	23.3	32.6	38.1	75.0
Branford Harbor	9.0	7.4	9.2	11.3	18.6	26.7	36.0	41.8	78.8
Farm River	7.3	6.9	9.3	11.5	18.8	26.9	36.2	42.0	78.7

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such an alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are potentially available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development since the 1970s. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites located near this dredging center include New Haven Breakwaters, Falkner Island, Duck Island Roads, and Clinton Harbor.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such potential site, a marsh creation site is located at Sandy Point in New Haven Harbor, close to this dredging center.

5.8.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Guilford-Branford Area Dredging Center, the analysis matched projects and placement alternatives as follows.

Guilford Harbor: Future maintenance dredging of the Guilford Harbor FNP will yield both sand from the middle channel reach and fine-grained material from the outer harbor entrance channel and the inner harbor channel and anchorage, all suitable for open water placement. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, of for other upland applications. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Guilford Harbor are shown below.

The least cost placement alternative for the maintenance dredging of sand from the middle channel reach is Jacob's Beach in Guilford. The next least costly alternatives for sand are open water placement at either the CLDS or Cornfield Shoals site (both a 52 percent increase). Nearshore placement at Hammonasset State Park is twice the cost of placement at Jacob's Beach. Use of the material as cap for the Sherwood Island offshore borrow pit would be about 2.5 times the cost of the least cost alternative. Nearshore placement off either Misquamicut or Sandy Point, Rhode Island beaches is about three times the least cost alternative.

For the fine-grained material (90 percent of the total project volume), the least cost placement alternative is open water placement at the Central Long Island Sound or Cornfield Shoals sites. The least costly non-open water alternative would be placement as fill in the Morris Cove Borrow Pit CAD cell site at a 40 percent increase over the least cost alternative. The next least costly is placement in a potential Sandy Point marsh creation project at West Haven at 1.5

times the cost of open water placement. Use of the material as fill or cap at the Sherwood Island offshore borrow pit would be about 1.7 times the cost of the least cost alternative.

Table 5-83 - Guilford Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand Middle Channel Reach	6,800 6,800	2026-2030 2036-2040	Morris Cove Pit CAD – Cap	$82
			Central Long Island Sound DS	$41
			Falkner Island CDF – Cap	$119
			Duck Island Roads CDF – Cap	$119
			Cornfield Shoals Disposal Site	$41
			New Haven Breakwaters CDF – Cap	$129
			Clinton Harbor CDF – Cap	$119
			Hammonasset Beach – Nearshore	$57
			Twotree Island CDF – Cap	$136
			Stratford Point CDF – Cap	$136
			Jacob's Beach, Guilford – Beach	$27
			Sherwood Island COW – Cap	$67
			Misquamicut Beach - Nearshore	$80
			Sandy Point Beach, RI Nearshore	$80
Suitable Fine Inner Harbor	61,100 61,100	2026-2030 2036-2040	Morris Cove Pit CAD – Fill	$170
			Central Long Island Sound DS	$122
			Falkner Island CDF – Fill	$206
			Duck Island Roads CDF – Fill	$206
			Cornfield Shoals Disposal Site	$122
			New Haven Breakwaters CDF – Fill	$233
			Clinton Harbor CDF – Fill	$206
			Twotree Island CDF – Fill	$246
			Yellow Mill Channel CDF – Fill	$246
			Milford Harbor CDF – Fill	$246
			Sherwood Island COW – Fill	$195
			Sherwood Island COW – Cap	$195
			110 Sand Company Site, NY	$219
			Brookhaven Town Landfill	$219
			Manchester City Landfill	$219
			Sandy Point West Haven Marsh	$186

Stony Creek Harbor: The two maintenance dredging actions that may occur at Stony Creek Harbor during the DMMP planning horizon are expected to yield fine-grained material, suitable for open water placement. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Stony Creek Harbor are shown below.

Table 5-84 - Stony Creek Harbor – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	61,200	2015-2020	Morris Cove Pit CAD – Fill	$81
	71,500	2041-2045	Central Long Island Sound DS	$40
			Falkner Island CDF – Fill	$118
			Duck Island Roads CDF – Fill	$127
			New Haven Breakwaters CDF – Fill	$118
			Milford Harbor CDF – Fill	$127
			Stratford Point CDF – Fill	$127
			Cornfield Shoals Disposal Site	$45
			Yellow Mill Channel CDF – Fill	$135
			Clinton Harbor CDF – Fill	$127
			Sherwood Island COW – Fill	$66
			Sherwood Island COW – Cap	$66
			110 Sand Company Site, NY	$106
			Manchester City Landfill	$106
			Brookhaven Town Landfill	$106
			Sandy Point West Haven Marsh	$73

The least cost placement alternative for the maintenance dredging of fine-grained material from Stony Creek Harbor is open water placement at the Central Long Island Sound site. The second least costly alternative is open water placement at the Cornfield Shoals site at a 13 percent increase. Placement at the Sherwood Island confined open water site as either fill or cap material would be about 1.7 times the least cost alternative. The least costly non-open water alternative is use as part of a potential marsh creation project at Sandy Point in West Haven at 1.8 times the cost of using the CLDS. Next least costly would be placement in the Morris Cove Borrow Pit CAD cell site at about twice the least cost alternative. Transport and placement at a landfill in either Connecticut or New York would each be about 2.7 times the cost of open water placement.

Branford Harbor: Future maintenance dredging of the Branford Harbor FNP will yield mainly fine-grained material, suitable for open water placement. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Branford Harbor are shown below.

Table 5-85 - Branford Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	144,800	2015-2020	Morris Cove Pit CAD – Fill	$71
	144,400	2036-2040	Central Long Island Sound DS	$27
			Falkner Island CDF – Fill	$114
			Duck Island Roads CDF – Fill	$125
			New Haven Breakwaters – Fill	$114
			Stratford Point CDF – Fill	$125
			Milford Harbor CDF – Fill	$125
			Yellow Mill Channel CDF – Fill	$125
			Sherwood Island COW – Cap	$39
			Sherwood Island COW – Fill	$39
			110 Sand Company Site, NY	$117
			Manchester City Landfill	$117
			Brookhaven Town Landfill	$117
			Western Long Island Sound DS	$58
			Sandy Point West Haven Marsh	$66

The least cost placement alternative for the maintenance dredging of fine-grained material from Branford Harbor is open water placement at the Central Long Island Sound site. Placement at the Sherwood Island confined open water site as either fill or cap material would be a 44 percent increase over the least cost alternative. The next least costly alternative would be open water placement at the Western Long Island Sound site at 2.2 times the least cost alternative. The least costly non-open water alternative is use as part of a marsh creation project at Sandy Point in West Haven at 2.4 times the cost of using the CLDS. Next least costly would be placement in the Morris Cove Borrow Pit CAD cell site at about 2.6 times the least cost alternative.

5.8.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-86 - Federal Navigation Project Base Plans Guilford-Branford Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
Guilford Harbor		
Middle Channel	Sand	Jacob's Beach, Guilford - Beach
Outer & Inner Harbor	Suitable Fines	Central Long Island Sound DS
Stony Creek Harbor	Suitable Fines	Central Long Island Sound DS
Branford Harbor	Suitable Fines	Central Long Island Sound DS

Alternatives to the Federal Base Plan: For the sandy material produced by the middle channel reaches at Guilford Harbor, the Federal base plan is beneficial use as nourishment at town beaches adjacent to the harbor. An alternative for nearshore placement at Hammonasset State Park would be twice as costly.

For the silty materials generated by all three FNPs in this dredging center, the base plan is open water placement at the CLDS. CAD or COW placement would be about 40 percent more expensive (or 1.7 times for Stony Creek). The least costly non in water alternative for each is use in a marsh creation project at Sandy Point in West Haven at 1.5 to 2.4 times the cost of open water placement at the CSDS. At such increases in cost, these non-open water alternatives would require non-Federal funding for the difference in cost. For the potential marsh creation alternative, the Section 204 continuing authority may provide a means for the USACE to assist the state in implementation and funding, provided program requirements were met.

5.9 New Haven Dredging Center

The New Haven Dredging Center consists of the city of New Haven and the Towns of East Haven and West Haven, Connecticut, and encompasses a single Federal Navigation Project; New Haven Harbor. New Haven is Connecticut's largest port, with a full mix of navigation and marine trades from commercial/industrial shipping to fishing and recreational boating. The harbor also includes the U.S. Coast Guard Station New Haven (Sector Long Island Sound).

A number of small rivers empty into New Haven Harbor, including the Mill, Quinnipiac, and West Rivers, and Morris Creek. All but Morris Creek include tributary FNPs which are part of the larger New Haven Harbor project. New Haven Harbor also includes the three rubblestone breakwaters in the outer harbor which were constructed as a harbor of refuge, and a stone dike at Sandy Point which provides some protection to the inner harbor.

The riverine tributaries contribute silty shoal material to the harbor, resulting in harbor maintenance materials which are predominantly fine-grained. Outer harbor materials are somewhat sandier, though not sufficiently so to present beach nourishment opportunities or other non-treated beneficial uses other than marsh creation.

5.9.1 New Haven Harbor Federal Navigation Project - Maintenance

The dredged features of the New Haven Harbor FNP can be divided into four sub-projects: the main deep draft channels and upper harbor anchorage and maneuvering area, and the Mill River, Quinnipiac River and West River tributaries. The recent dredging history for the project and its sub-features is shown below.

Table 5-87 - Federal Navigation Project Dredging History New Haven Dredging Center				
New Haven Harbor FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Main Channels	2013-14	831,000	CLDS	Suitable Fine
	2003-04	630,900	CLDS	Suitable Fine
	1993-94	837,500	CLDS	Suitable Fine
	1983	229,200	CLDS-FVP	Suitable Fine
	1983	465,000	CLDS	Suitable Fine
	1979	284,000	CLDS	Suitable Fine
	1973-74	945,000	CLDS	Suitable Fine
	1964	262,000	CLDS	Unknown Fine
	1957	1,033,900	CLDS & East Park	Unknown Fine
Mill River	1982	51,300	CLDS	Unsuitable
	1966-67	93,400	CLDS	Unknown Fine
	1960	29,000	CLDS	Unknown Fine
	1950	47,500	CLDS	Unknown Fine
Quinnipiac River	1982	141,100	CLDS	Unsuitable
	1966	54,500	CLDS	Unknown Fine
	1955-56	153,600	CLDS	Unknown Fine
West River	1989	107,100	CLDS	Suitable Fine
	1977	88,200	Upland	Suitable Fine
	1963	83,300	CLDS	Unknown Fine
	1957	66,100	CLDS	Unknown Fine
	1950	133,400	CLDS	Unknown Fine

Main Channels: The main channels deep draft segment of the New Haven Harbor project consists of a 35-foot deep entrance and main ship channel from deep water in LIS up-harbor to below the highway and railway bridges, with a 35-foot maneuvering area/turning basin in the upper harbor, and a 16-foot anchorage west of the maneuvering area. A 15-foot waterfront anchorage and Brewery Street Channel have been deauthorized. The main channel and maneuvering area were last maintained in 2013-2014 with about 831,000 CY removed (Survey NHH-924, 2014). The 35-foot main channels were initially completed in 1949-1950 when about 5,116,000 CY was dredged, with much of that material being placed upland in the shorefront towns surrounding the harbor, including East Shore Park in New Haven, as fill at the airport in East Haven, and with sandy material placed on Savin Rock Beach and other areas in West Haven. Maintenance of those deep-draft project features since 1950 has occurred nine times with smaller additional actions over the years to remove unclassified hard materials.

Most dredged material placement from maintenance activities has been at the Central Long Island Sound site, except for in 1957 when some additional material was placed upland at East Shore Park. Over the 63 years between 1950 and 2013 the records indicates a shoaling rate of about 88,000 CY annually. The main channels are expected to generate about 880,000 CY of suitable fine-grained maintenance material on a 10-year cycle.

Quinnipiac River Channel: This project segment consists of 18-foot, 16-foot and 12-foot deep channels in the Quinnipiac River above the upper end of the 35-foot main channel, as last improved in 1932. In the 50 years between that improvement and its last maintenance operation in 1982 the project shoaled about 9,420 CY annually, and was dredge every 13 years on average. The 1982 maintenance dredging was carried out as part of the Stamford-New Haven capping demonstration at the CLDS. The Quinnipiac River channel segments currently have about 112,300 CY in shoal material, including allowable overdepth (Survey NHH-920, 2012). The 80-year record from 1932 to 1982 yields an annual shoaling rate of 7,290 CY. If just the 1982-2012 period is used the annual rate is reduced further to 3,740 CY. It is assumed for this DMMP that this segment of the FNP would be maintained towards the latter half of the 30-year planning horizon, say in 2040. If this project segment had been actively maintained since 1982, then use of one of the higher annual shoaling rates may have been appropriate. However, in its currently shoaled condition, the lower 3,740 CY annual shoaling rate would likely yield a more accurate result, and this project segment could be expected to have accumulated a total of about 217,100 CY by 2040.

Mill River Channels: This project segment consists of 12-foot main and branch channels in the Mill River above the 18-foot Quinnipiac River Channel. The Mill River was also the LIS terminus of the historic 85-mile long Hampshire, Hampden, and Farmington Canal which connected the Connecticut River at Northampton, Massachusetts with LIS at New Haven, via Farmington, Connecticut. As with the Quinnipiac River, this segment was last maintained in 1982 as part of the Stamford-New Haven capping demonstration at the CLDS. Since its last improvement in 1913 when the main channel was widened concurrent with maintenance dredging, the Mill River channels have been maintained 11 times. This yields a shoaling rate of about 10,030 CY annually over that 69-year period. The Mill River channel segments currently have about 104,200 CY in shoal material, including allowable overdepth (Survey NHH-919, 2012). When the current survey date and volumes are added to the record (now 99 years), the annual shoaling rate is reduced to about 8,050 CY. If just the 1982-2012 period is used, then the annual rate is reduced further to 3,470 CY. It is assumed for this DMMP that this segment of the FNP would be maintained towards the latter half of the 30-year planning horizon, possibly around 2040 in conjunction with the Quinnipiac River maintenance. Using the lowest 3,470 CY annual shoaling rate, this project segment could be expected to have accumulated a total of about 201,500 CY by 2040.

West River Channel and Anchorage: The project segment for the West River consists of a 12-foot entrance channel from New Haven Harbor to just below Kimberly Avenue, with an 8-foot channel above, and a 6-foot anchorage adjacent to the channel in its outer entrance from New Haven Harbor. This project segment was last maintained in 1989, with placement of about 107,100 CY at the CLDS. Since its last improvement in 1913 through its most recent maintenance in 1989 this project segment was maintained a total of eleven times, about once every seven years on average, with an average annual shoaling rate of about 14,970 CY over that 76-year period. The West River channel segments currently have about 108,900 CY in shoal material, including allowable overdepth (Survey NHH-918, 2013). When the current survey date and volumes are added to the record (now 99 years), the annual shoaling rate is reduced to about 12,590 CY. If just the 1982-2012 period is used the annual rate is reduced further to 4,740 CY. It is assumed for this DMMP that this segment of the FNP would be maintained by 2022 by which time, using the lowest annual shoaling rate (4,740 CY), this project segment could be expected to have accumulated a total of about 156,300 CY. If the project were to be maintained every fifteen years after that, then a shoal volume of 71,000 CY could be expected.

The dredging activity timeline over the DMMP planning horizon for the New Haven Harbor FNP and its several separable segments is shown below.

Table 5-88 - Dredging Activity Timeline – New Haven Harbor FNP – Maintenance

Project/Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Main Channels	0	880,000	0	880,000	0	880,000
Mill River	0	0	0	0	201,500	0
Quinnipiac River	0	0	0	0	217,100	0
West River	0	156,300	0	0	71,000	0
Total Suitable	0	1,036,300	0	880,000	71,000	880,000
Total Unsuitable	0	0	0	0	418,600	0

5.9.2 New Haven Harbor Federal Navigation Project - Improvement

Deepening of the main channel segments of the New Haven Harbor FNP to -40 feet MLLW was authorized by WRDA 1986, though construction was not funded before the authorization sun-setted in 2002. Congressional resolutions in 2007 called for a restudy of the port deepening project and the state is actively pursuing funding to initiate that effort with its delegation. Deepening the main ship channel and maneuvering area to bring deeper draft bulk carriers to the harbor's terminals would generate about 5.1 million CY of largely parent glacial clays and sands and about 27,000 CY of rock. This material would be predominantly fine-grained suitable material, all of which could be beneficially used. The rock could be used for a variety of shore stabilization projects, or more likely for artificial reef creation. The sandy material, till and clay could be used to cap older placement mounds at the active or historic open water sites in the Sound, for port fill, or upland fill. Alternatively, open water placement would be a cost-effective means of dredged material management if beneficial uses are found impractical. For DMMP purposes it has been assumed that construction of this improvement project would likely not occur before 2022. It is also assumed that port deepening would not increase the current maintenance dredging frequency or volume.

Table 5-89 - Dredging Activity Timeline – New Haven Harbor Projected Federal Improvement Dredging						
	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
New Haven Harbor FNP Deepening	0	5,100,000	0	0	0	0

5.9.3 Harbor Characterization for the Federal Navigation Project

New Haven Harbor – Main Deep-Draft Channel, Maneuvering Area and Turing Basin: From the 1964 main channel maintenance operation to the most recent 2014 maintenance dredging, all materials removed from the New Haven Harbor FNP have been placed at the CLDS, located about eleven miles south of the head of the 35-foot channel. In those eight maintenance actions over a 50-year period nearly 4.5 million CY have been dredged and placed in open water. In 2013-2014, approximately 830,000 CY of material was removed from the -35-foot MLLW main entrance channel and maneuvering/turning basin at the New Haven Harbor FNP and disposed at the CLDS.

New Haven is one of the most extensively tested harbors in New England, with sediment sampling and testing undertaken as follows:

- In 1970, 1971, and 1973 in support of the June 1973 Final Environmental Statement for placement of material at the CLDS;
- In 1977 and 1978 (98 percent fines on average) in support of the October 1978 EA and February 1979 Clean Water Act Section 404(b)(1) Evaluation for the 1979 maintenance operation for both Stamford and New Haven Harbors;
- In 1980 in support of the December 1982 EA covering the two 1983 maintenance actions – the materials were found to be 83 percent fines on average except for the area of the outer entrance channel bend at the breakwaters where the material was 1 to 2 percent fines (December 1982 Plans and Specifications);
- In 1984 (91 percent fines on average) in support of the February 1988 EA, and in 1990 (95 percent fines), and 1991 (94 percent fines) in support of the August 1993 EA, both of which covered the 1993-1994 maintenance operation;
- In August 2000 in support of the September 2002 EA which covered the 2003-2004 maintenance operation; and
- In 2010 (52 percent fines on average) in support of the June 2013 EA which covered the 2013-2014 maintenance operation

The main channel and the turning basin were tested for sediment quality in 2010 for the 2013-2014 maintenance operation. Samples were composited for chemical and biological analysis. Grain size data from the composites indicated that the material consisted primarily of silt and fine sand in the range of 60-78% silt, 19-24% clay, and 1-11% very fine sand. Polychlorinated biphenyls (PCBs) were detected in most of the sediment composites at levels greater than the target detection limits. Polycyclic aromatic hydrocarbons (PAHs) and metals were detected above the target detection limits in all sediment composites and a general trend of increasing concentrations occurred from outer to inner harbor locations for all eight of the metals tested (June 2013 EA).

Biological testing of the project samples showed that the material was not acutely toxic. In the bioaccumulation tests, one species showed significant accumulation of two contaminants in two composites at levels greater than in the reference animals. Because of the presence of significant bioaccumulation, the EPA ran a risk-assessment model of the bioaccumulation results to evaluate toxicological significance. It was determined that the placement of the material as proposed would not cause any significant undesirable effects. The 10-day bioassay test showed no negative impacts of the dredged material. Based on these findings, the project material was found suitable by the USACE and EPA for unconfined aquatic placement at CLDS (June 2013 EA). However, the Connecticut Department of Energy and Environmental Protection specified that sequential dredging from the inner harbor to the mouth of the navigation channel take place so as to cover the inner harbor sediments with the cleaner outer harbor material.

Sediment quality for the -35-foot MLLW main channel and turning basin was tested in 2000 as well. Grain size results of the composites were generally in the range of 40 – 50% silt, 40–50% clay, and 1-3% fine sand (September 2002 EA). Bulk chemistry results were similar to those reported in 2010. PCBs were detected in most of the sediment composites at levels greater than the target detection limits. PAHs and metals were detected above the target detection limits in all sediment composites. The dredged material was mechanically dredged and disposed at CLDS (USACE, 2002b). The -35-foot MLLW main entrance channel was also dredged in 1993-1994. Testing indicated the same grain size and bulk chemistry results as those presented above with placement at CLDS (August 1993 EA).

Overall, dredged materials from the maintenance of the main deep-draft project features of the New Haven Harbor FNP are fine-grained (silty) materials, suitable for open water placement at the CLDS. In recent years the materials shoaling the entrance channel at the outer bend near the breakwaters have been sand. Future improvement dredging, should the port ever be deepened beyond the current 35-foot project depth, may also encounter sandy materials at this or other locations within the project limits. Whether that material can be placed beneficially will depend on its suitability, its separation from other material types, and its volume relative to the remainder of the project volume.

<u>Quinnipiac River Channel</u>: The Quinnipiac River segment of the New Haven Harbor FNP was last maintained in 1982 when about 141,100 CY of material was removed in conjunction with the joint maintenance of the Mill and Quinnipiac Rivers. At that time the dredged material was determined suitable for placement at the CLDS. Grain size analysis from 1980 showed that the material in the Quinnipiac River FNP was mostly organic sandy silt (84 percent fines on average – January 1982 Plans and Specifications and December 1981 EA). A biological evaluation of the sediments in the Quinnipiac River FNP was prepared by the Energy Resources Company, Inc (ERCO) in 1980 to test for toxicity to marine organisms. Results showed that dredged material was ecologically acceptable to be placed at CLDS due to the fact that survival rates of all organisms met or exceeded reference site values. Bulk chemistry testing from 1986 of sediment samples taken from areas in the Quinnipiac River adjacent to the Federal channels showed the material to be about 63 percent fines and exhibited low values for all parameters tested except for copper which was abnormally high in comparison to reference

site material (February 1988 EA). No maintenance work was funded subsequent to the 1986 testing. No sediment sampling has been undertaken in the Quinnipiac River since the 1986 testing. Any future dredging of the Quinnipiac River Federal project features would likely encounter silty material similar to the 1980 and 1986 test results. Further chemical and biological testing would need to be conducted at that time to determine suitability for various placement alternatives. For DMMP planning purposes the 1980 biological results may be problematic in view of today's test evaluation procedures. There is some risk that Quinnipiac River shoal materials, if subjected to today's testing protocols and evaluation procedures, would be found unsuitable for unconfined open water placement. These materials will therefore be treated as unsuitable fine-grained materials for DMMP purposes.

<u>Mill River Channels</u>: Sediment testing of the Mill River segment of the New Haven Harbor FNP was undertaken in 1969 and 1980. The 1969 testing was limited to only a few parameters. The 1980 testing was done in support of the joint dredging of the Mill and Quinnipiac Rivers in 1982 when approximately 51,300 CY of material was removed from the Mill River Channels. The 1980 grain size analysis indicated the sediments were primarily organic sandy silt (87 percent fines on average – January 1982 Plans and Specifications and December 1981 EA). A biological evaluation of the sediments in the Mill River FNP was prepared in November 1980, and a chemistry and bioaccumulation analysis was undertaken in 1981-1982 (ERCO June 1981). That testing revealed that the Mill River sediments contained relatively high concentrations of heavy metals and PCBs, but the sediments did not cause significant biological effects to the test species. Bulk chemistry testing from 1986 of sediment samples taken from areas in the Mill River showed the material to be about 52 percent fines and exhibited low values for all parameters tested except for copper which was abnormally high in comparison to reference site material (February 1988 EA). No maintenance work was funded subsequent to the 1986 testing. No sediment sampling has been undertaken in the Mill River since the 1986 testing. Any future dredging of the Mill River Federal project features would likely encounter silty material similar to the 1980 test results. Further chemical and biological testing would need to be conducted at that time to determine suitability for various placement alternatives. There is some risk that Mill River shoal materials, if subjected to today's testing protocols and evaluation procedures, would be found unsuitable for unconfined open water placement. These materials will therefore be treated as unsuitable fine-grained materials for DMMP purposes.

<u>West River Channel and Anchorage</u>: Sediment testing of the West River segment of the New Haven Harbor FNP was undertaken in 1969, 1972, 1974 and 1986. The earlier 1969 and 1974 testing was limited to only a few parameters. The 1972 testing found the shoal material to average about 94 percent fines. Those testing efforts supported the August 1975 EA for maintenance dredging which placed material at a previously used diked upland site west of the river between the railway grade and I-95. The latest 1986 testing for proposed maintenance dredging showed that the shoal material consisted of predominantly silt and clay, averaging 89 percent fines (February 1988 EA). Chemical testing revealed that the sediments had higher levels of lead and copper, but did not have any other significantly high values for parameters. This material was deemed suitable for placement at the CLDS.

5.9.4 Historic and Potential Federal Navigation Project Placement Options

Maintenance of the project is expected to generate only fine-grained materials. Maintenance materials from the main channels and West River are expected to be suitable for unconfined open water placement. Materials removed from maintenance of the Mill and Quinnipiac River channels are expected to be fine-grained, and for the purposes of this DMMP; unsuitable for unconfined open water placement. The material removed from these segments in 1982 was placed at CLDS, but was capped by cleaner Stamford Harbor material. Under EPA's suitability and site management processes today, capping is not permitted and placement of those same materials would not likely be found suitable for placement in open water. Whether today's shoal material in the Mill and Quinnipiac River would be found suitable is speculative without sediment testing.

Historically, the predominantly silty material dredged from this harbor has been dredged by mechanical bucket dredge, placed in scows and towed for open water placement at the CLDS. In the 19th century, material was also used for port fill, and at least twice in the 20th century, for upland fill for the Tweed-New Haven Airport and at East Shore/Fort Hale Park. Material from the West River has also been placed at an upland site between the railroad and I-95 at least twice (in 1977 and earlier). Coarse material from the 1940s 35-foot deepening of the main entrance channel has been placed on beaches in West Haven as nourishment. If coarse material were encountered in future maintenance or deepening of the entrance channel, that material could also be placed as beach or bar nourishment.

Potentially, the fine-grained material could be used to create saltmarsh in shallow tidelands, or pumped onto existing marsh areas as adaptive management in response to sea level rise. Its silty nature makes it unsuitable for upland or shoreline structural fill.

The material could also be placed at an ocean site as at present, the closest being the CLDS. The material could also be placed upland, with dewatering and re-handling, and perhaps treatment, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. There are several public parks and parking lots in the vicinity of the harbor that could be used temporarily if necessary for dewatering. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary, this would require further investigation in the future.

5.9.5 Other Federal (Non-USACE) Projects (Permit Activities)

The U.S. Coast Guard (USCG) Station New Haven, part of Coast Guard Sector Long Island Sound, is located adjacent to Fort Hale Park in New Haven on the east side of the harbor. This Federal facility has dredged its access channel and boat basin area in the past, with placement most recently (about 12,800 CY in 1999-2000) in the Morris Cove borrow pit in the lower harbor. Sediment sampling and testing in 1998 showed the materials to be sand to sandy silts ranging from 5 to 62 percent fines (40 percent on average). Previously, the facility was maintained in October 1993 when about 27,700 CY was dredged and placed at CLIS. The latest maintenance event volume represents an annual shoaling rate of about 1,800 CY. The material dredged has been fine-grained material, largely suitable for the same potential placement and uses as material from the New Haven Harbor FNP. Maintenance of this facility is anticipated to be required about once every 15 years at about 20,000 CY each operation.

Table 5-90 - Dredging Activity Timeline – New Haven Harbor – Other Federal Activities						
	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
USCG Station New Haven	20,000	0	20,000	0	0	20,000

5.9.6 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the New Haven Dredging Center that periodically generate dredged material. These include the deep draft commercial industrial users and terminals along the upper-most reaches of the main channels, and the Mill and Quinnipiac Rivers. Recreational and public marinas and boat yards, and private residential docks and floats are located on the Quinnipiac and West Rivers, along the downtown New Haven waterfront west of the Federal anchorage, along Lighthouse Point, in Morris Creek, and in the Farm River (East Haven River). The 2009 Dredging Needs Update report projected, based on facility surveys, that 866,000 CY of maintenance dredging and 1,045,000 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the table below, with that improvement volume spread over a 15-year period. In addition, terminal berth deepening associated with the New Haven Harbor FNP port deepening project are expected to generate about 500,000 CY in the same period as the Federal improvement.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CLDS being the closest approved site. These activities could also take advantage of whatever alternative placement methods are used for the New Haven Harbor FNP, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-91 - Dredging Activity Timeline – New Haven Dredging Center Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	209,600	197,500	113,300	113,200	116,300	116,200
Improvement	348,000	848,000	348,000			
Total Non-Federal	557,600	1,045,500	461,300	113,200	116,300	116,200

5.9.7 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce the largest range of dredging project sizes in the region over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards to major port deepening generating several million cubic yards are anticipated. Most of the materials from this dredging center over the past 60 years have been placed at the CLDS. However, port fill and upland fill for specific purposes have been used as well. The Morris Cove borrow pit in the outer harbor has also been used by the USCG for dredging at its New Haven facility. Several investigations of placement alternatives identified the following opportunities for projects from this dredging center.

Table 5-92 - New Haven Dredging Center Available/Potential Placement Alternatives

Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Central Long Island Disposal Site (CLDS)		Open Water	20,000,000	All	All Suitable
Western Long Island Sound Disposal Site (WLDS)		Open Water	20,000,000	All	All Suitable
Cornfield Shoals Disposal Site (CSDS)		Open Water	200,000,000	All	All Suitable
New London Disposal Site (NLDS)		Open Water	7,796,500	All	All Suitable
Faulkner Island CDF	- Fill	Island CDF	16,010,200	Once Built	All
	- Cap		1,169,800		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Milford Harbor CDF	- Fill	Shore CDF	219,100	All Until Filled	All
	- Cap		50,900		All Suitable
Stratford Point CDF	- Fill	Shore CDF	33,666,900	All Once Built	All
	- Cap		5,283,100		All Suitable
Penfield Reef CDF	- Fill	Shore CDF	33,539,300	All Once Built	All
	- Cap		5,010,700		All Suitable
Groton Black Ledge CDF	- Fill	Island CDF	6,930,000	All Once Built	All
	- Cap		570,000		All Suitable
Duck Island Road CDF	- Fill	Island CDF	1,376,100	All Once Built	All
	- Cap		233,900		All Suitable
Twotree Island CDF, CT	- Fill	Island CDF	2,966,200	All Once Built	All
	- Cap		433,800		All Suitable

Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable
Greenwich Captain Harbor CDF	- Fill	Island CDF	498,200	All Until Filled	All
	- Cap		331,800		All Suitable
Norwalk Outer Harbor Islands Marsh Creation	- Fill	Island CDF	554,000	All Until Filled	All
	- Cap		376,000		All Suitable
Hempstead Harbor CDF	- Fill	Shore CDF	2,787,700	All Once Built	All
	- Cap		712,300		All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT		CAD Fill	466,100	All Until Filled	All
		CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit		COW Fill	266,000	All Until Filled	All Suitable
		COW Cap	484,000		
110 Sand Co., Melville, NY		Upland Sand Pit	1,000,000	Until Filled	All Suitable
Manchester City Landfill, CT		Upland	1,200,000	All	All
Brookhaven Town Landfill		Upland	700,000	All	All
New Haven CAD cells - Fill		CAD	As Built	As Built	Unsuitable
Marsh Creation – Sandy Point New Haven Harbor		Marsh Fill	1,100,000	All Once Built	All Suitable

Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement of unsuitable materials projected to be dredged from the Mill and Quinnipiac River segments of the New Haven Harbor project would require containment, either in CDFs, CAD cells, or upland at approved landfills.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Beach and Nearshore Placement Sites: Projects in this dredging center are expected to yield only fine-grained materials. However, past improvement projects have yielded some sandy materials that have been used in shore stabilization efforts and upland fill. Haul distances to public beaches in the area are shown below, in the event that coarse materials are encountered in future dredging actions, particularly in improvement projects that dredge into parent materials.

Table 5-93 - Haul Distances to Public Beaches and Nearshore Bar Sites									
New Haven Harbor Project (Distances in Statute Miles)	Jennings Beach	Seaside Park	Stratford Point Beaches	Silver Sands Beach Milford	Woodmont Beach	Prospect Beach	Savin Rock Beach	Lighthouse Park Beach	Hammonasset State Beach
Main Channel	22.7	21.1	15.3	12.4	5.1	3.2	2.8	1.8	24.3
West River	25.2	23.6	17.8	14.9	8.1	6.3	5.5	4.4	24.8

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Central Long Island Sound site located offshore of New Haven Harbor. The CSDS, CLDS, and WLDS sites are more distant. These sites could receive any suitable material, either sandy or fine-grained. Haul distances from this dredging center's projects and waterways, to various open water placement sites are shown in the table below.

Table 5-94 - Scow Haul Distances to In-Water Placement Sites									
New Haven Harbor Project (Distances in Statute Miles)	Branford DS	Guilford DS	Falkner Island CDF	Clinton DS	CSDS	NBDS	Orient DS	NLDS	RIS DS
Head of Main Channel	12.6	15.9	18.8	26.3	34.1	43.5	40.8	49.0	85.9
Quinnipiac River	13.5	16.8	19.7	27.2	35.0	44.4	41.7	50.3	87.0
Mill River Channels	13.2	16.5	19.4	26.9	34.7	44.3	41.4	49.8	86.6
West River	13.0	16.4	19.3	26.6	34.8	44.1	41.4	49.7	86.5
New Haven Harbor Project	Stamford DS	Norwalk Islands CDF	WLIS DS	Eatons Neck East DS	Southport DS	Bridgeport East	Milford DS	New Haven Breakwaters CDF	CLDS
Head of Main Channel	41.3	35.8	39.8	36.6	28.3	22.8	15.3	5.2	10.6
Quinnipiac River	42.2	36.8	40.7	37.5	29.2	23.7	16.2	6.1	11.5
Mill River Channels	41.9	36.5	40.4	37.2	28.9	23.4	15.9	5.8	11.2
West River	41.8	36.4	40.3	37.1	28.8	23.0	15.5	5.7	11.1

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive suitable materials from this and other dredging centers, as either fill or cap material. Additionally, the Morris Cove borrow pit could receive unsuitable materials as fill, since this site is located inside the harbor and not in the waters of LIS. CAD cells designed specifically for placement of Mill and Quinnipiac Rivers could also be constructed in New Haven Harbor.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. Potential CDF sites located near this dredging center include New Haven Breakwaters, Falkner Island, Duck Island Roads, Twotree Island (Waterford), Milford Outer Harbor, Stratford Point, Penfield Reef, Captain Harbor, Norwalk Outer Harbor Islands, and Hempstead Harbor.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such potential marsh creation sites are located at Sandy Point in New Haven Harbor.

5.9.8 Alternatives Screening for Federal Project

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the New Haven Harbor Dredging Center the analysis matched projects with placement alternatives as follows.

New Haven Harbor Main Channels Maintenance: Future maintenance dredging of the New Haven Harbor FNP Main Channels will yield a large volume of fine-grained material every ten years. This suitable fine-grained material may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for New Haven Main Channels maintenance are shown below.

The least cost placement alternative for the maintenance dredging of fine-grained material from the New Haven Harbor Main Channels is open water placement at the Central Long Island Sound site. The second least costly alternative is open water placement at either the Cornfield Shoals site at about twice the cost of using the CLDS. The next least costly alternative is open water placement at either the WLDS or NLDS at about 2.7 times the least cost alternative. The least costly non-open water alternative is to use the material as part of a potential marsh creation project at Sandy Point in West Haven, at 3.5 times the cost of placement at the CLDS. Placement in the Morris Cove Borrow Pit CAD cell is about 3.8 times the cost of CLDS, though the borrow pit can only accommodate about half of one maintenance operation from the main channels. Placement in a potential New Haven Breakwaters CDF would cost more than five times the least cost alternative. Other CDFs would be five to six times as costly.

Table 5-95 - New Haven Harbor – Main Channels Maintenance FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	880,000	2021-2025	Central Long Island Sound DS	$17
	880,000	2031-2035	Falkner Island CDF – Fill	$117
	880,000	2041-2045	New Haven Breakwaters CDF – Fill	$88
			Stratford Point CDF – Fill	$117
			Penfield Reef CDF – Fill	$117
			Cornfield Shoals Disposal Site	$35
			Morris Cove Pit CAD – Fill	$64
			Yellow Mill Channel CDF – Fill	$117
			Milford Harbor CDF – Fill	$106
			Western Long Island Sound DS	$45
			New London Disposal Site	$45
			Twotree Island CDF – Fill	$138
			Hempstead Harbor CDF – Fill	$138
			Groton Black Ledge CDF – Fill	$138
			Sandy Point West Haven Marsh	$59

New Haven Harbor – West River Maintenance: Future maintenance dredging of the New Haven Harbor FNP – West River segment will yield fine-grained material. These suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for New Haven West River maintenance are shown below.

The least cost placement alternative for the maintenance dredging of fine-grained material from the New Haven Harbor West River is open water placement at the Central Long Island Sound site. The second least costly alternative is placement at the Sherwood Island borrow pit as either fill or cap, at a 43 percent increase in cost. Next least costly is placement in open water at the Western Long Island Sound site, at about twice the cost of using the CLDS. The least costly non open water alternative is to use the material as part of a potential marsh creation project at Sandy Point in West Haven, at 2.4 times the cost of placement at the CLDS. Upland placement would be about 3.9 times the least cost alternative. Placement in the Morris Cove Borrow Pit CAD cell would be about 2.7 times the cost of CLDS. Placement in a New Haven Breakwaters CDF would cost more than four times the least cost alternative. Other CDFs would be five to six times as costly.

Table 5-96 - New Haven Harbor – West River Maintenance
FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	156,300	2021-2025	Morris Cove Pit CAD – Fill	$75
	71,000	2036-2040	Central Long Island Sound DS	$28
			Falkner Island CDF – Fill	$126
			New Haven Breakwaters CDF Fill	$115
			Stratford Point CDF – Fill	$126
			Milford Outer Harbor CDF – Fill	$115
			Penfield Reef CDF – Fill	$126
			Sherwood Island COW – Cap	$40
			Sherwood Island COW – Fill	$40
			110 Sand Company Site, NY	$108
			Manchester City Landfill	$108
			Brookhaven Town Landfill	$108
			Western Long Island Sound DS	$60
			Sandy Point West Haven Marsh	$67

<u>New Haven Harbor – Mill River and Quinnipiac River Maintenance</u>: Future maintenance dredging of the New Haven Harbor FNP – Mill and Quinnipiac River segments will yield fine-grained material unsuitable for unconfined open water placement. This unsuitable material will require containment to isolate it from the environment, either in CAD cells, CDFs or upland. The top-scoring alternatives from the site screening process for New Haven West River maintenance are shown below.

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained materials from the New Haven Harbor – Mill and Quinnipiac Rivers is placement in the Morris Cove Borrow Pit CAD cell in the outer harbor. The next least costly alternatives are placement in a CDF that would need to be constructed at either the New Haven Breakwaters or at Milford Outer Harbor, both at a 66 percent increase over the least cost alternative. The next least costly alternatives are placement in a CDF constructed at Falkner Island, Stratford Point, or Clinton Harbor, or transported and placed upland in a landfill at Manchester, Connecticut, all at an 80 percent increase over the least cost alternative. The cost of placement in the other considered

CDF sites is at least 1.8 times that of placement at Morris Cove. Use of Morris Cove for these project segments would consume that site's entire fill capacity.

Table 5-97 - New Haven Harbor – Mill River and Quinnipiac River Maintenance FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Unsuitable	201,500	2036-2040	Morris Cove Pit CAD – Fill	$67
	217,100	2036-2040	Falkner Island CDF – Fill	$120
			New Haven Breakwaters CDF Fill	$111
			Yellow Mill Channel CDF – Fill	$120
			Milford Harbor CDF – Fill	$111
			Stratford Point CDF – Fill	$120
			Duck Island Roads CDF – Fill	$126
			Penfield Reef CDF – Fill	$126
			Clinton Harbor CDF – Fill	$120
			Twotree Islands CDF – Fill	$146
			Norwalk Islands CDF – Fill	$146
			Captain Harbor CDF – Fill	$146
			Hempstead Harbor CDF – Fill	$146
			Groton Black Ledge CDF – Fill	$146
			Manchester City Landfill	$120

New Haven Harbor Main Channels Improvement: Study of future improvement dredging to deepen the New Haven Harbor Main Channels will begin in 2015. If a deepening project is recommended, it is expected to yield a large volume of suitable fine-grained material. These materials may have beneficial uses, such as for marsh creation or enhancement, and can also be placed in CDFs, upland landfills, or open water sites. The top-scoring alternatives from the site screening process for improvement dredging of New Haven Harbor are shown below.

The least cost placement alternative for the improvement dredging of fine-grained material from the deepening of the New Haven Harbor Main Channels is open water placement at the Central Long Island Sound site. The next least costly alternatives is placement as either fill or cap material at the Sherwood island offshore borrow pit site, or open water placement at the Cornfield Shoals site, all at about 2.5 times the cost of using the CLDS. The next least costly alternatives are open water placement at either the Western LIS or New London sites at 2.9 times the least cost alternative. The least costly non-open water alternative is to use the material as part of a potential marsh creation project at Sandy Point in West Haven, at 3.9 times the cost of placement at the CLDS. Placement in the Morris Cove Borrow Pit CAD cell at about 4.5 times the cost of CLDS, though the borrow pit could only accommodate about ten percent of the improvement material.

Table 5-98 - New Haven Harbor – Main Channels Improvement FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	5,100,000	2021-2025	Central Long Island Sound DS	$11
			Falkner Island CDF – Fill	$91
			New Haven Breakwaters CDF – Fill	$66
			Stratford Point CDF – Fill	$91
			Penfield Reef CDF – Fill	$91
			Cornfield Shoals Disposal Site	$27
			Morris Cove Pit CAD – Fill	$49
			Western Long Island Sound DS	$32
			Yellow Mill Channel CDF – Fill	$91
			New London Disposal Site	$32
			Sherwood Island COW – Fill	$27
			Sherwood Island COW – Cap	$27
			Morris Cove Pit CAD – Cap	$49
			Sandy Point West Haven Marsh	$43

However, none of the CAD, COW or smaller-scale CDFs have the capacity to fully accommodate a five million CY improvement project. Only the open water sites or the larger-scale CDFs like the New Haven Breakwaters, Falkner Island, Penfield Reef or Stratford Point sites could fully accommodate a project of that size. Placement in a New Haven Breakwaters CDF would cost six times the least cost alternative. The other CDFs would all be even more costly. Therefore there are no cost-effective options to placement in open water. But even open water placement can, with a very large project such as this, be managed to a beneficial use. Though dredged material management records in LIS only go back to the late 1940s, older records indicate that the CLDS has been in use for perhaps longer than a century. Significant amounts of material were placed at the site for many decades before the advent of the Water Pollution Control Act and Clean Water Act and the resulting requirements for sediment testing and analysis. A large volume of clean parent material could be sued to cap areas of the CLDS or other open water sites where materials with chemical analysis concerns may be found. If a New Haven Harbor port deepening project does progress to the feasibility study phase, then such an option would need to be examined.

U.S. Coast Guard –Station New Haven: Future maintenance dredging of the U.S. Coast Guard's Station at New Haven Harbor (USCG Sector Long Island Sound) is expected to yield fine-grained material. This suitable fine-grained material may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for the New Haven Station maintenance are shown below.

Table 5-99 - U.S. Coast Guard – Station New Haven – Maintenance Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	20,000	2015-2020	Morris Cove Pit CAD – Fill	$108
	20,000	2026-2030	Falkner Island CDF – Fill	$156
	20,000	2041-2045	Yellow Mill Channel CDF – Fill	$156
			New Haven Breakwaters CDF – Fill	$136
			Clinton Harbor CDF – Fill	$156
			Milford Outer Harbor CDF – Fill	$136
			Stratford Point CDF – Fill	$156
			Penfield Reef CDF – Fill	$156
			Central Long Island Sound DS	$56
			Duck Island Roads CDF – Fill	$160
			Sherwood Island COW – Cap	$73
			Sherwood Island COW – Fill	$73
			Cornfield Shoals DS	$73
			Manchester City Landfill	$125
			Western Long Island Sound DS	$99
			Sandy Point West Haven Marsh	$95

The least cost placement alternative for the maintenance dredging of fine-grained material from the New Haven Harbor West River is open water placement at the Central Long Island Sound site. The second least costly alternatives are placement at the Sherwood Island borrow pit as either fill or cap, or open water placement at the Cornfield Shoals site, all at a 30 percent increase in cost. Next least costly is use in a marsh creation project at Sandy Point in West Haven at a 70 percent increase in cost. Next least costly is placement in open water at the Western Long Island Sound site, at about a 77 percent increase over the cost of using the CLDS. Placement in the Morris Cove Borrow Pit CAD cell would be about 1.9 times the cost of using the CLDS. All other alternatives would be more than twice the cost of placement at the CLDS.

5.9.9 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-100 - Federal Navigation Project Base Plans New Haven Harbor Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
New Haven Harbor	Maintenance	
Main Channels	Suitable Fines	Central Long Island Sound DS
West River	Suitable Fines	Central Long Island Sound DS
Mill River	Unsuitable	Morris Cove Borrow Pit CAD Cell - Fill
Quinnipiac River	Unsuitable	Morris Cove Borrow Pit CAD Cell - Fill
New Haven Harbor	Improvement	
Main Channels	Suitable Fines	Central Long Island Sound DS
U.S. Coast Guard LIS Station	Suitable Fines	Central Long Island Sound DS

Alternatives to the Federal Base Plan: For the unsuitable materials produced by the maintenance of the Mill and Quinnipiac Rivers, the only available alternatives are containment, most likely in-harbor either at Morris Cove or a specifically constructed CAD cell or CDF. There are no beneficial uses for this type of material without costly and inefficient treatment.

For the silty materials generated by all the remaining segments of the FNP, and its potential future improvement, and by the U.S. Coast Guard, the base plan is open water placement at the CLDS. For the Main Channels and West River maintenance actions, a single maintenance cycle for both would completely fill a Sandy Point marsh creation project, at a cost 2.4 to 3.5 times the base plan. Alternatives more expensive than the base plan would require non-Federal funding of the increased cost to allow for implementation. The USACE might be able to participate with the state in the implementation of a marsh creation project, if it could be pursued under the Section 204 continuing authority.

5.10 Housatonic-Milford Area Dredging Center

The Housatonic/Milford Area Dredging Center consists of the town of Milford, a portion of the town of Stratford and the Housatonic River from Long Island Sound through the towns of Orange and Shelton to the head of navigation at Derby, Connecticut. The dredging center includes the Federal Navigation Projects for Milford Harbor in the town of Milford, and the Housatonic River. The dredging center stretches from Pond Point in Milford in the east to Stratford Point in the west. The two projects provide navigation access to LIS for commercial fishermen and boaters, and small-scale barge cargo operations in the lower Housatonic River. The principal waterways in this area are:

Milford Harbor – Includes FNP
Housatonic River – Includes FNP

The waterways in this dredging center yield a mix of material types. Materials from the two FNPs have always been found suitable for unconfined open water placement. At Milford Harbor the inflowing rivers contribute silty shoal material to the inner harbor, resulting in harbor maintenance materials which are predominantly fine-grained, and not recommended for beach nourishment or nearshore placement. The entrance channel shoal materials are typically sand and have occasionally been placed on adjacent city beaches. In the lower Housatonic River (18-foot channel) the material is sand which has most recently been placed nearshore. The upper Housatonic River (7-foot channel) has not been dredged in some time, due partly to its use as a borrow site for coarse material used in construction and as shellfish bed substrate elsewhere.

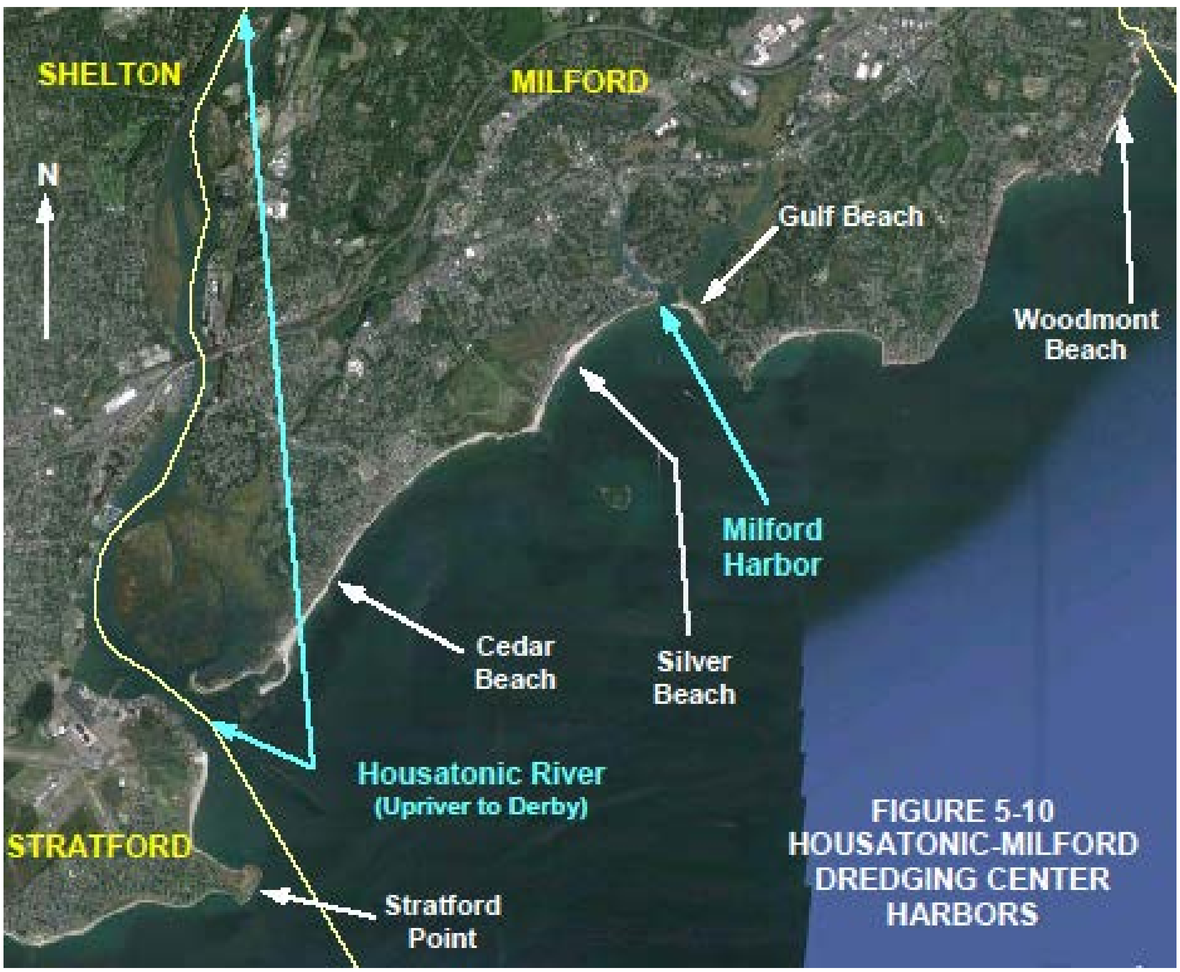


FIGURE 5-10
HOUSATONIC-MILFORD
DREDGING CENTER
HARBORS

5.10.1 Federal Navigation Projects - Maintenance

The dredged features of the two FNPs in this dredging center have each been most recently dredged as shown in the following table.

Table 5-101 - Federal Navigation Project Dredging History Housatonic-Milford Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Milford Harbor				
Entire Project	1988	88,400	CLDS	Suitable Mixed
10-Foot Entrance Channel	1981	16,800	Gulf Beach	Suitable Sand
Entire Project	1967	40,000	Milford DS	Suitable Mixed
Entire Project	1956	52,800	Milford DS	Suitable Mixed
Entire Project	1948	38,700	Milford DS	Unknown
Entire Project	1941	42,900	Unknown	Unknown
Entire Project - Improvement	1939	168,300	Unknown	Unknown
Housatonic River				
Lower 18-Foot Channel (14-Ft)	2013	59,000	Nearshore off Point-No-Point	Suitable Sand
Lower 18-Foot Channel (Full)	1976	215,000	Upland	Suitable Mixed
Lower 18-Foot Channel (Full)	1960	132,300	Milford DS	Suitable Mixed
Lower 18-Foot Channel (Full)	1955	1,975,500	Marshfill and Beaches	Suitable Mixed
Upper 7-Foot Channel	1944-45	48,700	Unknown	Unknown
Upper 7-Foot Channel	1940	74,000	Unknown	Unknown

Milford Harbor: The FNP for Milford Harbor consists of a 10-foot deep (MLLW) entrance and lower channel with adjoining 10-foot deep lower anchorage, and an 8-foot deep upper channel and anchorage. A second 10-foot deep anchorage located between the channel and the east jetty was authorized in 1902 and only partially constructed, with the uncompleted portion later deauthorized (1986). The project also includes two stone jetties at the mouth of the harbor. In 1988, in settlement of numerous encroachments by local marinas, the City of Milford agreed to dredge areas required to realign the channel and anchorage areas in the inner harbor, while retaining the authorized channel dimensions and the area available for anchorage.

The project was last improved in 1939, when the inner harbor channel and anchorage dimensions were modified to their present depths and areas. Since that time the project's dredged features have been maintained six times, the last in 1988 as mentioned above, when about 88,400 CY was removed and placed at the Central Long Island Sound site. Maintenance of the entrance channel alone was accomplished in 1981 with the sand material placed on Gulf Beach to the east of the inlet. The three maintenance operations conducted for the entire project previous to that in 1967, 1956 and 1948 all placed the material at the Milford Disposal Site in LIS south of the harbor. The most recent condition survey (MIL-420, 2013) indicates that about 56,600 CY of shoal material has accumulated in the project features since 1988, of which about 33 percent (or about 18,800 CY) is sand shoal in the 10-foot entrance channel. This, together with the prior maintenance events, yields an annual shoaling rate of about 4,600 CY for the entire project.

Prior to 1988 the FNP was maintained on average every eight years, but has not been dredged since that time. If the Milford Harbor FNP were maintained in the early half of the DMMP planning horizon (say in 2023) then a total of about 107,300 CY could be expected. Split 33 percent sand and 67 percent fine-grained material, this would yield 35,700 CY of sand available for beach or nearshore placement, and about 71,600 CY of suitable fine-grained material. If after that the FNP were maintained on a 10-year frequency (2033 and 2043) then about 15,300 CY of sand and 30,800 CY of fine-grained material would be expected.

It will be assumed for this analysis that entrance channel materials are suitable coarse-grained material available for beneficial use as nourishment, and that the inner harbor materials are suitable fine-grained materials.

<u>Housatonic River</u>: The FNP for the Housatonic River consists of two segments; an -18-foot MLLW lower channel from LIS upriver to a point just below Popes Island in Stratford, and a -7-foot MLLW channel from that point up to Derby just below the Connecticut Route 8 Bridge. The total length of the channels from the river mouth to Derby is about 14 miles. The project also includes a rubblestone breakwater on the north side of the inlet and two stone training dikes at Stratford. The 7-foot deep channel was authorized and initially constructed in 1871, and further authorized with advanced maintenance in 1986. The 18-foot lower channel deepening was authorized in 1930 and constructed between 1944 and 1957.

The 18-foot entrance and lower channel up to Popes Island was improved to that depth in 1955-1957. About 1,979,500 CY was removed for the improvement, of which about 18 percent was sandy material placed on beaches in Milford and Stratford Point. The remainder was placed upland to fill three marsh areas along the riverfront for development purposes. The sediment type and specific management method of the upland-placed material is not recorded but it may have been used for highway construction. From available records between 1948 and the 1957 improvement, maintenance of the lower channel at its previous 7-foot depth during that period included placement at open water sites.

Since the 18-foot improvement action the lower channel has been maintained three times: in 1960 when material was placed at the Milford DS, in 1976 when material was placed upland, and in November 2013 when the channel was dredged by the *Currituck* to a reduced depth of 14 feet with placement of the material nearshore off Point-No-Point in Stratford. State funds were provided for part of the cost of the 2013 work. The after-dredge survey from the 2013 maintenance action showed about 732,500 CY remaining shoal material to the 18-foot design depth including allowable overdepth. When added to the maintenance record since the 1957 improvement, this shows an average annual shoaling rate of about 20,200 CY for the 18-foot channel over that 56-year period. The State of Connecticut has indicated a near-term need to maintain the channel to its full 18-foot depth and expressed a willingness to provide funding for its placement at Hammonasset Beach. If such work were to be accomplished within the first five years of the DMMP planning horizon (for example 2018), then a total of about 833,400 CY could be expected. In the future, if the lower channel were dredged on a 10-year cycle, then about 201,800 CY could be expected to be removed for each operation (2028 and 2038).

In the past, the lower channel has yielded a mix of suitable materials with sands predominating. Sampling and testing of core samples in 2000 showed that in all but one core, the material was suitable for beach or nearshore placement, and that one sample had 27 percent fines in only its lower 2 feet of the 12-foot core. This indicates that all the material may be suitable for nearshore placement, with a small portion perhaps not available for direct beach placement. For the purposes of this DMMP all the lower channel materials are classified as clean sands.

The 7-foot upper channel was maintained thirteen times between 1910 and 1945 during which time shoal volumes dredged averaged about 8,600 CY annually. The most current condition survey for the upper channel, with soundings made in September 2005 (Survey HOU-512, 2006), shows about 59,600 CY of shoal material. With this volume added to the prior maintenance record, an annual shoaling rate of about 3,800 CY results. If this segment of the project were not maintained until near the end of the DMMP planning horizon (in say 2043) then a total shoal accumulation of about 203,900 CY could be expected. The upper channel has in the past produced both coarse and fine-grained sediments, and the river bed has been extensively mined for coarse material in the past. No actual sediment test results from the upper channel were located. It will be assumed for this analysis that half of the upper channel materials are suitable coarse-grained material, and half are suitable fine-grained materials.

The dredging activity timeline over the planning horizon for the two FNPs in the Housatonic/Milford Area Dredging Center is shown below.

Table 5-102 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Housatonic/Milford Area Dredging Center

Project/Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Milford Harbor						
10-Ft Entrance Channel		35,700		15,300		15,300
Inner Harbor Areas		71,600		30,800		30,800
Housatonic River						
18-Foot Lower Channel	833,400		201,800		201,800	
7-Foot Channel – Sands						102,000
7-Foot Channel - Fines						101,900
Total – Suitable Sand	833,400	35,700	201,800	15,300	201,800	117,300
Total – Suitable Fine		71,600		30,800		132,700

5.10.2 Harbor Characterization for Federal Navigation Projects

Milford Harbor: Sediment sampling and testing for the Milford Harbor FNP has occurred five times, in 1972, 1975, 1980, 1985, and 2003. In 2003, it was proposed that 20,000 CY of material be dredged for maintenance of the -10-foot MLLW entrance channel of the Milford Harbor FNP. Project material was found suitable for placement in the sub-tidal area off of Gulf Beach, but the project did not take place. Grain size analysis showed that the sediments in the 10-foot entrance channel of Milford Harbor consist of primarily fine (65%) and medium sand (18%) with some silt/clay (12%) (WHG September 2003 Final Report). Sediment chemistry data were not obtained.

Previously, Milford Harbor was sampled for sediment quality in March 1985 in support of a September 1987 EA covering combined Federal maintenance dredging and municipal anchorage expansion for project realignment. Grain size analysis indicated that dredged material from the 10-foot entrance channel contained primarily medium to fine sand, however, the inner harbor's sediments were predominantly sandy to silty clay. Chemical testing of those sediments showed that the entrance channel and outer harbor sediments presented relatively low concentrations for all parameters. Grain size and bulk chemistry for the entrance channel sediments indicated that they could be beneficially used for beach nourishment. The inner harbor sediments were found to have relatively high concentrations of cadmium and total percent fines as well as moderate to low levels of other contaminants, making them unsuitable for beach nourishment projects. Placement occurred at the CLDS for dredging operations in 1988.

In December 1980, only the 10-foot entrance channel at Milford Harbor was maintained. Bulk chemistry testing showed lower levels of all potential contaminants and grain size analysis determined the material to be primarily sand, averaging 5 percent fines (August 1980 EA). Accordingly, this material was placed on Gulf Beach by a hydraulic pipeline dredge as a means of beneficial use for beach nourishment. Sediment testing also occurred at Milford Harbor FNP in 1972, when the entrance channel and inner harbor showed 10 and 88 percent fines, respectively, and again in 1975 when it showed 5 and 82 percent fines, respectively. The anchorage area and the 8-foot channel exhibited relatively high values for multiple contaminant parameters, but the entrance channel showed no significantly higher values. Overall analysis for grain size in those years indicated that the sediments were primarily fine grained (88-97% fines) in the 8-foot inner channel and anchorage area, but coarser in the 10-foot entrance channel (0-16% fines). It can be expected in the future that these results will be repeated. Sand suitable for beach or nearshore bar placement will be found in the entrance channel, and more silty material in the inner harbor.

Housatonic River – Lower (18-Foot) Channel Reaches below Pope's Island: The lower Housatonic River was last dredged in 2013, when about 59,000 CY of sand was removed and placed nearshore off Point-No-Point Beach in Stratford. Sediment sampling and testing for this work was begun in 1999 when shoal areas throughout the 18-foot channel were sampled in support of the October 2012 EA. The only areas actually dredged using the USACE hopper dredge, *Currituck* were located below the U.S. Route 1 Bridge. Material from throughout the 18-foot channel was found to be sand ranging from <1 to 21 percent fines. When all but the uppermost sample at Pope's Island is included, the average percent fines drops to 2.6 percent. Downstream of U.S. Route 1 the range was <1 to 11 percent fines. The total organic carbon (TOC) was quite low, ranging from 0.1% to 1.5%. The concentrations of PAHs ranged from below detection limits to 890 ppb. This material was deemed acceptable for placement in a nearshore environment for the purpose of beach nourishment.

Before 1999 the only sediment sampling and testing was conducted in 1971 in support of a January 1975 Final Environmental Statement covering the 1975-1976 maintenance dredging that used upland placement. Grain size analysis from that 1971 effort indicated that the main channel sediments were primarily sand with an average of 20.5% total fines. Approximately 215,000 CY of material was removed in the 1975-1976 operation. The material was placed at three sites; within the Short Beach Park area in the Town of Stratford; upland on a 6-acre tract of land owned by Conine and Troland also in Stratford; and on a second upland tract owned by Beard Sand and Gravel Company next to the river in the Milford (see 1975 EA). Material was shown to contain average levels of contaminants except in the vicinity of the Interstate 95 Bridge where zinc and copper values were abnormally high. Grain size indicated that material ranged from gray sand with shell fragments at the mouth of the river to organic, silty sand at Carting Island marsh.

It can be expected in the future that these results will be repeated. Sand suitable for beach or nearshore bar placement will be found in the entire 18-foot lower channel, with perhaps all but the uppermost reach materials along lower Pope's Island suitable for direct beach placement.

<u>Housatonic River – Upper (7-Foot) Channel Reaches above Pope's Island to Derby</u>: There are no sediment test results on file for the 7-foot Federal channel above Pope's Island. Maintenance dredging of the 7-foot channel last occurred in 1944 to 1945 when 48,700 CY of material was removed and in 1940 when 74,000 CY was removed. Where this material was placed is not stated in the available record. Sections of the river between Pope's Island and Naugatuck/ Shelton have been mined in the past for sand and gravel. It is expected that shoal material in the upper river bars will be mixed sand and silty sand, similar to the material found at the head of the 18-foot channel at Pope's Island and may vary by bar.

5.10.3 Historical and Potential Federal Navigation Project Placement Options

Maintenance of these two FNPs has used a variety of dredging and dredged material placement methods. There are beaches in close proximity to both projects which could benefit from and accommodate direct placement of sand materials from each project's lower channels. A hopper dredge has been used at Housatonic in the past to enable placement of sand nearshore off more distant beaches. Material from both projects has been dredged mechanically and by hydraulic pipeline dredge in the past, with placement at open water sites and upland.

All materials from both waterways are expected to be suitable for unconfined open water placement, as in the past. Potentially the fine-grained material in the inner harbor and Upper River areas could be used to create salt marsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. Testing prior to each dredging operation will be needed to confirm suitability for any alternative placement.

The fine materials could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary, this would require further investigation in the future.

Should creation of a confined placement facility (CDF) at the New Haven breakwaters, Falkner Island, Stratford Shoals or elsewhere in the vicinity be pursued, then material from these two harbors or other sources in the dredging center could potentially provide material towards that purpose. These materials could also be placed at an ocean site as at present, the closest being the CLDS.

5.10.4 Other Federal (Non-USACE) Dredging Activities

There is one non-USACE Federal facility in the dredging center; the National Marine Fisheries Service (NMFS) Long Island Sound laboratory located at Milford Harbor. The basin and berth at this facility was last maintained to a depth of -9 feet MLLW in conjunction with the USACE 1967 maintenance operation. While this facility does have vessel access, NMFS did not indicate a need for dredging within the DMMP planning horizon.

5.10.5 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Housatonic/Milford Dredging Center that periodically generate dredged material. These include the deep draft commercial facilities along the lower 18-foot Housatonic River channel, and large and small marina, yacht club and boat yard operations in both waterways, and private residential and public access facilities at other locations throughout the dredging center. In addition, the state of Connecticut has a fisheries science facility at Milford Harbor with vessel access.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 220,400 CY of maintenance dredging would be needed by non-Federal facilities. No improvement dredging was reported as needed. These totals are shown in the Table 5-103 below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CLDS being a regularly-used approved site for this area. The former Milford DS is also located within this area, and the former Bridgeport DS is a short distance to the west. These activities could also take advantage of whatever alternative placement methods are used for the four FNPs in this dredging center, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-103 - Dredging Activity Timeline – Housatonic/Milford Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	80,500	43,300	27,700	27,600	20,700	20,600
Improvement	None Reported as Needed					
Total Suitable Fine	80,500	43,300	27,700	27,600	20,700	20,600

5.10.6 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to large-sized range of dredging project sizes over the DMMP planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to large private permit activities, and FNP maintenance activities and generating up to the 800,000 CY range are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at open water sites in LIS. Several investigations of alternatives identified the following as opportunities for management of dredged material for projects from this dredging center.

Table 5-104 - Housatonic/Milford Area Dredging Center Available/Potential Placement Alternatives					
Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Central Long Island DS		Open Water	20,000,000	All	All Suitable
Western Long Island DS		Open Water	20,000,000	All	All Suitable
Falkner Island CDF	- Fill	Island CDF	16,010,200	Once Built	All
	- Cap		1,169,800		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Milford Harbor CDF	- Fill	Shore CDF	219,100	All Until Filled	All
	- Cap		50,900		All Suitable
Stratford Point CDF	- Fill	Shore CDF	33,666,900	All Once Built	All
	- Cap		5,283,100		All Suitable
Penfield Reef CDF	- Fill	Shore CDF	33,539,300	All Once Built	All
	- Cap		5,010,700		All Suitable
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Duck Island Road CDF - Fill	Island CDF	1,376,100	All Once Built	All
- Cap		233,900		All Suitable
Twotree Island CDF, CT - Fill	Island CDF	2,966,200	All Once Built	All
- Cap		433,800		All Suitable
Clinton Harbor CDF, CT - Fill	Shoreline CDF	59,800	All Once Built	All
- Cap		640,200		All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
110 Sand Co., Melville, NY	Upland	1,000,000	Until Filled	All Suitable
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Sandy Point Beach, RI	Nearshore	80,000	Recurring	Suitable Sand
Prospect Beach, West Haven	Nearshore	55,000	Recurring	Suitable Sand
Gulf Beach, Milford	Beach	7,100	Recurring	Suitable Sand
Cedar Beach, Milford	Nearshore		Recurring	Suitable Sand
Silver Sands Beach, Milford	Beach	25,400	Recurring	Suitable Sand
Short Beach, Stratford, CT	Beach	73,500	Recurring	Suitable Sand
Woodmont Beach, CT	Nearshore	8,200	Recurring	Suitable Sand
Bradley Point Park, Savin Rock & Oak Street Beach	Nearshore	214,700	Recurring	Suitable Sand
Hammonasset State Beach	Nearshore	140,000	Recurring	Suitable Sand
Point-No-Point Bar System, CT	Nearshore		Recurring	Suitable Sand
Asharoken Beach	Nearshore	248,300	Recurring	Suitable Sand
Theodore Roosevelt Cty Park	Nearshore	202,400	Recurring	Suitable Sand
Hither Hills State Park	Nearshore	276,100	Recurring	Suitable Sand
Marsh Creation – Sandy Point New Haven Harbor	Marsh Fill	1,100,000	Once Built	Suitable Fines

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Beach and Nearshore Nourishment Sites: The coastline of the Housatonic-Milford dredging center is a mix of large and small beaches and rocky coast, with small coastal plain river inlets, one large river estuary (Housatonic), small bays and coves, and rocky headlands. There are many small public beaches and a few large private beach fronts. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from the Housatonic-Milford area. Fourteen beaches listed above were identified by the screening process, or are beaches in the vicinity that were constructed with Federal assistance. Haul distances to various beach and nearshore placement sites are shown below.

Table 5-105 - Haul Distances to Beach and Nearshore Placement Sites

Project or Harbor (Distances in Statute Miles)	Jennings Beach	Seaside Beach	Stratford Point Beach	Silver Sands Beach	Woodmont Beach	New Haven Breakwaters CDF	Prospect Beach	Savin Rock Beach	Lighthouse Beach Park	Hammonasset State Beach
Milford Harbor	13.2	11.6	5.6	1.3	5.2	7.8	7.0	8.1	9.5	27.0
Housatonic River 18-Foot Channel below Pope’s Island	13.4	11.4	4.2	7.0	11.8	13.4	13.3	14.4	16.1	33.5
Housatonic River 7-Foot Channel above Pope’s Island	23.0	21.0	13.8	16.6	21.4	23.0	22.9	24.0	25.7	43.1

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Central Long Island Sound site located offshore of New Haven Harbor. The Western Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Haul distances to various open water and CDF sites are shown below.

Table 5-106 - Scow Haul Distances to In-Water Placement Sites											
Project (Distances in Statute Miles)	WLIS DS	Eatons Neck East DS	Southport DS	Bridgeport East	Milford DS	CLDS	Branford DS	Guilford DS	Falkner Is CDF	Clinton DS	CSDS
Milford Harbor	28.6	25.5	17.2	12.2	6.6	10.4	14.6	18.4	21.5	28.8	36.8
Housatonic River 18-Foot Channel below Poe's Island	28.0	24.8	16.6	11.7	8.1	14.8	19.7	23.7	27.0	34.3	42.4
Housatonic River 7-Foot Channel above Pope's Island	37.6	34.4	26.2	21.3	17.7	24.4	29.3	33.3	36.6	43.9	52.0

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The nine potential CDF sites located near this dredging center or identified in the screening process include Milford Outer Harbor, Penfield Reef, Bridgeport Yellow Mill Channel, Stratford Point, New Haven Breakwaters, Falkner Island, Duck Island Roads, Clinton Harbor, and Twotree Island (Waterford).

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in New Haven Harbor.

5.10.7 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Housatonic-Milford Dredging Center, the analysis matched projects with placement alternatives as follows.

Milford Harbor: Future maintenance dredging of the Milford Harbor FNP will yield both sand from the entrance channel and fine-grained material from the inner harbor, all suitable for open water placement. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, or for other upland applications. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Milford Harbor are shown below.

Table 5-107 - Milford Harbor – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	35,700	2021-2025	Sherwood Island Borrow Pit – Cap	$55
Entrance	15,300	2031-2035	Morris Cove Pit CAD Cell – Cap	$104
Channel	15,300	2041-2045	Central Long Island Sound DS	$52
			Silver Sands State Park – Beach	$49
			Falkner Island CDF – Cap	$153
			Yellow Mill Channel CDF – Cap	$132
			New Haven Breakwaters CDF Cap	$132
			Stratford Point CDF – Cap	$132
			Penfield Reef CDF – Cap	$153
			Milford Harbor CDF – Cap	$122
			Bradley Point, Savin Rock – Berm	$79
			Prospect Beach – Nearshore	$67
			Gulf Beach – On-Beach	$42
Suitable Fine	71,600	2021-2025	Sherwood Island COW – Fill	$44
Inner Harbor	30,800	2031-2035	Sherwood Island COW – Cap	$44
	30,800	2041-2045	Morris Cove Pit CAD Cell – Fill	$85
			Central Long Island Sound DS	$37
			Falkner Island CDF – Fill	$136
			Yellow Mill Channel CDF – Fill	$121
			New Haven Breakwaters CDF – Fill	$121
			Milford Harbor CDF – Fill	$107
			Stratford Point CDF – Fill	$121
			Penfield Reef CDF – Fill	$136
			110 Sand Company Site, NY	$111
			Manchester City Landfill	$111
			Brookhaven Town Landfill	$111
			Sandy Point West Haven Marsh	$77

The least cost placement alternative for the maintenance dredging of sand from the Milford Harbor entrance channel is direct placement on Gulf Beach to the east of the inlet. The second least costly alternative, at an increase of 17 percent over Gulf Beach, is direct beach placement at Silver Sands State Park southwest of the harbor inlet and beyond the Charles Island tombolo. The third least costly alternative is open water placement at the CLDS at a 24 percent increase over Gulf Beach. The next least costly alternative is placement as cap material at the Sherwood Island offshore borrow pit, at an increase of about 31 percent. Nearshore placement off Prospect or Savin Rock Beaches in West Haven are the next least costly alternatives at an increase of 60 or 88 percent, respectively, over the least cost alternative. Use of the sand for cap material at Morris Cove or another nearby CDF site is between 2.5 and 3.7 times the cost of placement at Gulf Beach.

For the Milford's inner harbor fine-grained materials, open water placement at the Central Long Island Sound site is the least cost alternative. The second least costly is placement as both fill and cap material at the Sherwood Island offshore borrow pit, at an increase of about 19 percent over the CLDS. The third least costly alternative is use as fill in a marsh creation project at Sandy Point in West Haven, at twice the cost of placement at the CLDS. The Morris Cove borrow pit fill (2.3 times CLDS), and Milford Harbor CDF fill (2.9 times CLDS) are the next least costly alternatives for the fine-grained material. Placement upland in a landfill is about three times the cost of placement at the CLDS.

<u>Housatonic River</u>: Future maintenance dredging of the Housatonic River FNP will yield both sand from the lower (18-foot) channel below Pope's Island, and fine-grained material from the 7-foot channel above Pope's Island to Derby. All material is expected to be suitable for open water placement. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, or for other upland applications. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for the Housatonic River FNP are shown below.

The least cost placement alternative for the maintenance dredging of sand from the lower Housatonic River channel is direct placement on Short Beach in Stratford. However, the beach does not have the capacity to accept the entire volume of material that would be dredged. The second least costly alternative would be open water placement at the Central Long Island Sound site at an increase of 47 percent over Short Beach. The third least costly alternative is open water placement at the WLDS at about twice the cost of Short Beach. Placement nearshore off one of four evaluated beaches in Connecticut or New York is 2.6 times the cost of placement at Short Beach. Placement at the CSDS would be 2.7 times the cost of using Short Beach. Use of the sand as cap for nearby CDF sites is between 3.5 and 6.6 times the cost of placement at Short Beach.

Table 5-108 - Housatonic River – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	833,400	2015-2020	Central Long Island Sound DS	$28
Lower	201,800	2026-2030	New Haven Breakwaters CDF – Cap	$111
18-Foot	201,800	2036-2040	Stratford Point CDF – Cap	$111
Channel			Penfield Reef CDF – Cap	$111
			Western Long Island Sound DS	$38
			Sherwood Island Borrow Pit – Cap	$28
			Falkner Island CDF – Cap	$126
			Norwalk Harbor Islands Marsh – Cap	$120
			Morris Cove CAD – Cap	$67
			Short Beach, Stratford – Beach	$19
			Yellow Mill Channel CDF – Cap	$111
			Hammonasset State Park – Nearshore	$50
			Asharoken Beach – Nearshore	$50
			Hither Hills State Park – Nearshore	$50
			Theodore Roosevelt County Park – NS	$50
			Cornfield Shoals Disposal Site	$52
Suitable Fine	203,900	2041-2045	Sherwood Island COW – Fill	$32
Upper	As much		Sherwood Island COW – Cap	$32
7-Foot	As Half		Morris Cove Pit CAD Cell – Fill	$67
Channel	May be		Central Long Island Sound DS	$32
	Sandy		New Haven Breakwaters CDF – Fill	$113
			Norwalk Harbor Islands CDF – Fill	$123
			Yellow Mill Channel CDF – Fill	$113
			Milford Harbor CDF – Fill	$113
			Norwalk Harbor Islands Marsh – Fill	$123
			Stratford Point CDF – Fill	$113
			110 Sand Company Site, NY	$127
			Western Long Island Sound DS	$56
			Falkner Island CDF – Fill	$128
			Sandy Point West Haven Marsh	$64
			Generic In-River Placement	$20
			Generic Onshore Upland Placement	$28

The least cost placement alternative for the Housatonic River upper channel's fine-grained materials is in-river placement in former borrow pits in the upper river. The second least costly alternative would be placement onshore along the upper river, at an increase of 40 percent over in-river placement, if adequate sites can be found and permitted. The next least costly alternatives would be placement either at the CLDS, or in the Sherwood Island offshore borrow pit site as either fill or cap material, all at an increase in cost of 60 percent over in-river placement. The next least costly alternative is placement at the Western Long Island Sound site, at 2.8 times the cost of in-river placement. Use as fill in a marsh creation project at Sandy Point in West Haven would be the next least costly alternative at 3.2 times the cost of in-river placement. The next least costly alternative is placement as cap material at the Morris Cove Borrow Pit CAD cell site in New Haven Harbor at 3.4 times the least cost alternative. Placement of the material as cap at shoreline and island CDF sites in Connecticut ranges from 5.6 to 6.4 times the least cost alternative.

It is possible that sections of the upper channel will produce sandy dredged materials. If that proves to be the case, then beneficial use alternatives such as beach and nearshore nourishment should be investigated for those materials in comparison to the in-river and on-shore placement options discussed above. The combination of navigation, storm damage reduction and other benefits may, together with cost-sharing, result in a different recommendation for use of such materials.

5.10.8 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-109 - Federal Navigation Project Base Plans
Housatonic-Milford Area Dredging Center Projects

FNP Project and Segment	Material Type	Federal Base Plan
Milford Harbor		
Entrance Channel	Sand	Gulf Beach or Silver Sands State Beach (On-Beach)
Inner Harbor	Suitable Fines	Central Long Island Sound DS
Housatonic River		
Lower Channel	Sand	Central Long Island Sound DS or Short Beach, Stratford (On-Beach)
Upper Channel	Suitable Fines	In-River or On-Shore Placement, or if Unavailable then Central Long Island Sound DS

Alternatives to the Federal Base Plan: For Milford Harbor's sandy entrance material, the Federal base plan is beneficial use placement on one of two nearby beaches as nourishment.

For the Milford's inner harbor silty material, the base plan is open water placement at the CLDS. Placement in the Sherwood Island offshore COW site at a 19 percent increase over CLDS may be a cost-effective if it were available at the time Milford is next dredged. Use in a potential marsh creation project at Sandy Point in West Haven, at twice the cost of CLDS would only be implemented if non-Federal funding were available for the additional cost, or if the marsh project was implemented through a state-USACE partnership under another USACE authority, such as Section 204.

For the sandy materials of the lower Housatonic River channel, placement as nourishment at short beach is a base plan for only a small part of the material to be removed. Only 8 percent of the initial operation volume and 36 percent of the future periodic operation volumes could be accommodated at Short Beach. The base plan must therefore include the next least costly alternative, placement in open water at the CLDS. There are at least four other beaches within a distance that would result in a cost for nearshore placement of 2.6 times Short Beach, which could be used if non-Federal funding were provided for the additional cost or another USACE authority applied and a project was found to be in the Federal interest.

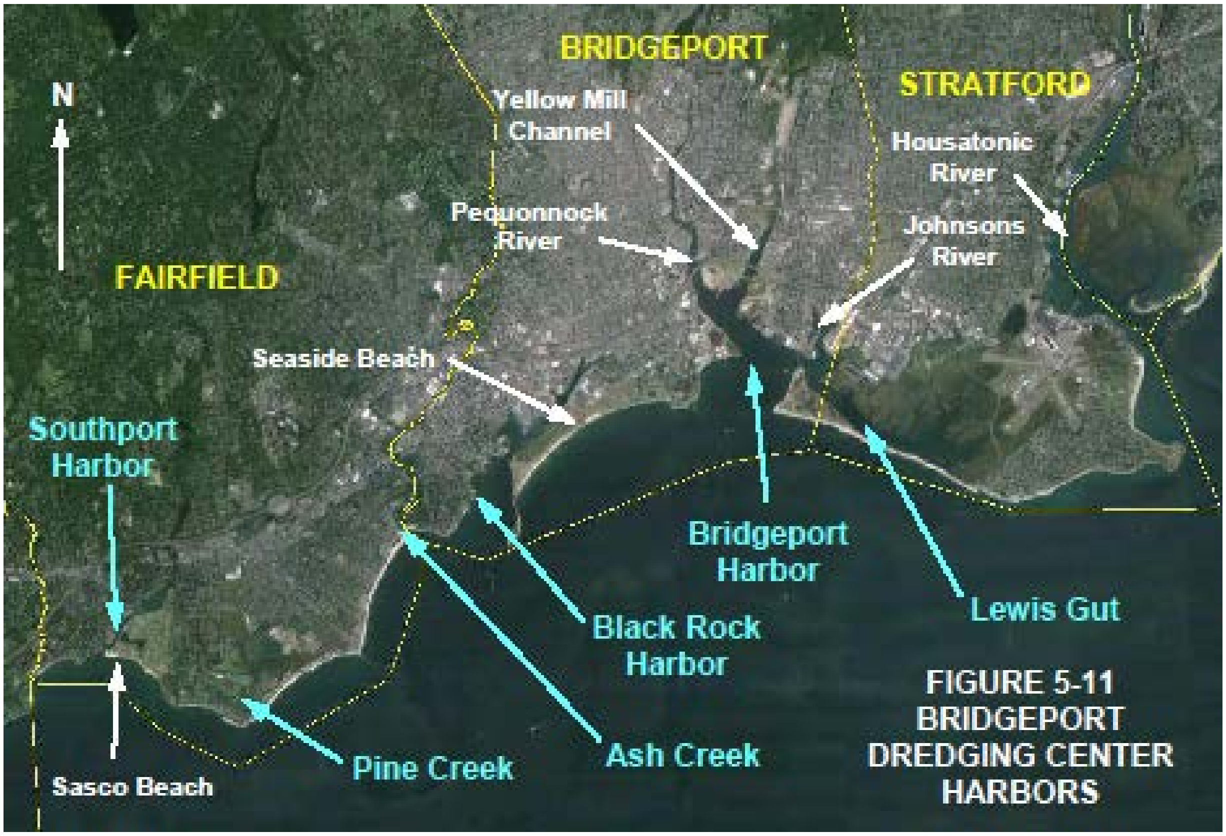
For the silty material from the upper (7-foot) channel, the Federal base plan is placement in deep areas in-river, or if insufficient, then upland along the river shore as was done in the past. Open water at the CLDS or in the Sherwood Island offshore COW site would be the least cost if the in-river and on-shore alternatives proved unavailable or infeasible. Non-open water options such as Morris Cove or the Sandy Point marsh creation site would cost more than twice the cost of the CLDS, and would not be cost effective. As with the other harbors in the area, the marsh creation project would only be feasible if non-Federal funding or another USACE authority were available.

5.11 Bridgeport Area Dredging Center

The Bridgeport Area Dredging Center consists of the towns of Stratford (West part), Bridgeport and Fairfield, Connecticut, and includes the Federal Navigation Projects for Bridgeport Harbor, Black Rock Harbor, and Southport Harbor. The dredging center stretches from Stratford Point, westerly to Sasco Brook (the Fairfield/Westport boundary). The dredging center also includes Ash Creek, a small local harbor that has been the past source of nourishment sand for the Federal Jennings Beach project. Two other small shallow waterways with limited boat access to Long Island Sound, Lewis Gut in Stratford and Pine Creek in Fairfield are also in this dredging center. The principal waterways in this area are:

Bridgeport Harbor – Includes FNP and its three improved tributaries
Black Rock Harbor and Cedar Creek – Includes FNP
Ash Creek (Fairfield)
Southport Harbor – Includes FNP

This dredging center also includes the offshore island reef called Stratford Shoals located south of Stratford Point in LIS.



The waterways in this dredging center yield a mix of material types, all found suitable for unconfined open water placement, except for materials from the inner harbor and tributaries at Bridgeport Harbor. Ash Creek, in the past, has yielded predominantly sand suitable for beach nourishment. Black Rock Harbor yields principally silty material. Southport Harbor yields a mix of sand in its entrance channel and more silty materials in the upstream reaches. Bridgeport Harbor entrance channel material has been used in the past for nourishment of Seaside Beach in that city, though recent testing indicates that direct beach placement may not be advisable due to fines above thirty percent in some samples.

The riverine tributaries contribute silty shoal material to the harbor, resulting in harbor maintenance materials which are predominantly fine-grained. Outer harbor materials are somewhat sandier, though not sufficiently so to present beach nourishment opportunities or other non-treated beneficial uses other than marsh creation.

5.11.1 Federal Navigation Projects - Maintenance

The dredged features of the three FNPs in this dredging center have each been maintained most recently as shown below.

Table 5-110 - Federal Navigation Project Dredging History Bridgeport Area Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Bridgeport Harbor				
Entrance Channel	1961-63	765,000	Beaches	Suitable Mixed
Inner Harbor Areas	1961-62	1,433,000	Bridgeport DS	Fines
Main Channel & Anchorage Areas	1960	347,000	BPDS	Fines
	1956	632,100	BPDS	Unknown
	1947-48	2,641,600	Unknown	Unknown
	1943-44	252,200	Unknown	Unknown
	1941	122,000	Unknown	Unknown
	1938-39	940,900	Unknown	Unknown
Johnson's River	1963	24,000	Bridgeport DS	Fines
	1944	20,500	Unknown	Unknown
Yellow Mill Channel	1952	55,000	Bridgeport DS	Fines
	1944	48,700	Unknown	Unknown
	1938-39	118,100	Unknown	Unknown
Pequonnock River	1944	48,800	Bridgeport DS	Fines
	1936-38	145,800	Unknown	Unknown
Outer Anchorage Deepening	1982-83	23,000	CLDS	Suitable Fine
Black Rock Harbor	1982-83	210,000	CLDS	Suitable Fine
	1954-55	263.600	Bridgeport (West) DS	Suitable Fine
	1943	215.500	Unknown	Unknown
	1937-38	121,800	Unknown	Unknown
Southport Harbor	2004-05	56.700	CLDS	Suitable Mixed
	1961-62	41,200	Southport DS	Suitable Mixed
	1948	25,300	Southport DS	Unknown
	1936	113,000	Unknown	Unknown

Bridgeport Harbor: The FNP for Bridgeport Harbor consists of the following features:

- A 35-foot deep entrance channel from deep water in LIS to a 35-foot inner harbor basin extending upstream to below the I-95 highway bridge
- A 35-foot deep turning basin in the inner harbor east of the channel
- A 35-foot and 25-foot deep stepped anchorage east of the channel and south of the turning basin
- An 18-foot deep waterfront channel between the 35-foot basin and the south waterfront
- An 18-foot deep tributary channel in the Pequonnock River,
- An 18-foot deep tributary channel in the Yellow Mill Channel
- A 15-foot deep lower channel and 9-foot upper channel in the Johnsons River with adjoining 9-foot and two 6-foot anchorage areas
- Two rubblestone breakwaters separating the inner harbor from Long Island Sound

Main Harbor Features: The 35-foot modified project features have not been maintained since their initial construction in 1962. At that time, dredging of the entrance channel was accomplished by hydraulic pipeline dredge with placement of the sandy material on Pleasure Beach to the east and Seaside Beach to the west. The more silty materials from the remainder of the inner harbor were dredge mechanically and placed at the Bridgeport Disposal Site. The 35-foot main harbor segments currently have accumulated, together with the 25-foot and 18-foot main harbor areas, about 1,582,300 CY of shoal material (Survey BRH-539, 2010). Measured since 1962, this yields a shoaling rate of about 30,400 CY annually for the main project segments, and an estimated total volume of about 1,700,000 CY through 2014, of which about 665,600 CY is suitable material from the entrance channel, and the remainder unsuitable material from the inner harbor.

Pequonnock River Channel: The Pequonnock River segment of the FNP for Bridgeport Harbor consists of a -18-foot MLLW channel generally 200 to 150 feet wide from the head of the 35-foot channel at the I-95 bridge, upriver to a point about 500 feet below the Berkshire Avenue Dam, for a total length of about 1.1 miles. This river channel was last dredged in late 1944, when about 48,800 CY were removed and placed at the Bridgeport Disposal Site. The Pequonnock River Channel had a total of 164,700 CY of shoal material in a 2004 condition survey (Survey BRH-537, 2004).

Yellow Mill Channel: The Yellow Mill Channel segment of the FNP for Bridgeport Harbor consists of an -18-foot MLLW channel 150 feet wide, narrowed in its passage through the Stratford Avenue Bridge from the 35-foot channel upstream to a point about 370 feet below Crescent Avenue, for a total length of about one mile. This river channel was last dredged in late 1952, when about 55,000 CY were removed. The Yellow Mill Channel had a total of 164,700 CY of shoal material in a 2004 survey (Survey BRH-536, 2004).

Johnsons River Features: The Johnsons River segment of the FNP for Bridgeport Harbor consists of a -15-foot MLLW lower channel and -9-foot MLLW upper channel extending from the head of the 35-foot turning basin through the Pleasure Beach Bridge and upriver to a point about 600 feet below Hollister's Dam, for a total length of about one mile. There is also a 9-foot anchorage and two 6-foot anchorage areas, one at the head of the channel. This river channel was last dredged in late 1963, when about 24,000 CY were removed when the material was placed at the Bridgeport Disposal Site. While this project segment was surveyed in 2004, no quantities were run on that data (Survey BRH-535, 2004). Prior to 1963 this project segment was last dredged in 1948. This represents a shoaling rate of about 1,600 CY/year. At that rate about 88,000 CY would have accumulated in the Johnsons River segment by about 2018.

Maintenance of the Bridgeport Harbor FNP has typically used open water placement in LIS, at the historic Bridgeport Disposal Site. Under a separate DMMP for Bridgeport Harbor, it has been proposed to create CAD cells in the inner harbor to accommodate the unsuitable material from inside the breakwaters in the harbor and its tributaries. Of the 1,657,100 CY of material to be removed to create the CAD cell, about 53,800 CY from the upper 2 feet is deemed unsuitable, while the remaining 1,603,300 CY is suitable for unconfined open water placement. Maintenance of Bridgeport Harbor is anticipated to occur sometime before 2021. Bridgeport Harbor and its tributaries would likely only require maintenance once during the DMMP planning horizon.

Black Rock Harbor: The FNP for Black Rock Harbor consists of an 18-foot deep entrance channel from deep water in LIS up-harbor to two branch channels at the same depth in the East and West Branches of Cedar Creek, a total length of about 2.4 miles. The project was last maintained in 1982-1983 when about 210,000 CY were removed and placed in the CLDS. Also in 1983, Black Rock Harbor was the site of a field demonstration project by the USACE environmental laboratory (today part of ERDC) and the U.S. EPA, wherein the Burr Creek channel and anchorage portion of the FNP was deauthorized, diked and filled as a dredged material containment facility for maintenance of unsuitable dredged material from the Black Rock Harbor FNP. Since its last improvement in 1932 (deepening the channels to 18 feet), the project was maintained four times (1937-1938, 1943, 1954-1955 and 1982-1983). Shoaling over that 50-year period from 1932 to 1982 averaged 16,220 CY annually. The project currently has about 434,900 CY of shoal material accumulated (Survey BLA-541, 2013). When the shoal volume through 2013 is added-in, the annual shoaling rate declines to 15,380 CY. That rate declines further to 14,500 CY per year when only measuring the difference between 1983 and 2013. Using the middle of the three annual rates plus the 2013 shoal volume, it is estimated that this project will require maintenance dredging once during the 30-year DMMP planning horizon in about 2025, generating about 619,500 CY of mixed fine-grained material. The project would then require maintenance of about 384,500 CY on a 25-year frequency.

Southport Harbor: The Southport Harbor FNP consists of a 9-foot deep channel from deep water in LIS upriver to a 9-foot anchorage basin. The project includes two stone jetties at the harbor entrance. The project was last maintained in 2004-2005 when about 56,700 cubic yards were removed and placed in the WLDS. Since its last improvement in 1936, the project was maintained three times, in 1948, 1961, and 2005, for an average annual shoaling rate of about 1,790 CY over that 69-year period. Twice in the past (1916 and 1925), private construction operations have used the harbor as a source of borrow material for upland fill for golf course and residential property development by filling marshlands. In the 1961 and 1948 FNP maintenance operations, the material was placed at the Southport Disposal Site in LIS south of the harbor (July 1961 and January 1948 Plans and Specifications). The Southport Harbor project currently has about 18,800 CY in shoal material, including allowable overdepth (Survey SPH-573, 2012), of which 8,400 CY is in the entrance channel and 10,400 CY is in the inner harbor areas. When this amount is added, the annual shoaling rate increases to 1,870 CY. If just measuring the change between 2005 and 2012, the annual rate increases further to 2,680 CY. It is assumed for this DMMP that the Southport Harbor FNP would be maintained twice during the 30-year planning horizon, initially in about 2024 and then at a 20-year frequency (2044). The 2024 operation would remove about 18,400 CY of sand from the entrance channel and 22,800 CY of silty material from the inner harbor project features. The next (2044) operation would remove about 16,700 CY of sand and 20,700 CY of silty material.

The dredging activity timeline over the planning horizon for the three FNPs in the Bridgeport Area Dredging Center is shown below.

Table 5-111 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Bridgeport Area Dredging Center

Project/Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Bridgeport Harbor						
Entrance Channel	665,600					
Inner Main Harbor	1,034,400					
Yellow Mill Channel	126,900					
Pequonnock River	164,700					
Johnsons River		88,000				
CAD Cell Overburden	53,800					
CAD Cell at Depth	1,603,300					
Black Rock Harbor		619,500				
Southport Harbor						
Entrance Channel		18,400				16,700
Inner Features		22,800				20,700
Total Sand		18,400				16,700
Total Suitable Fine	2,268,900	642,300				20,700
Total Unsuitable	1,379,800	88,000				

5.11.2 Harbor Characterization for Federal Navigation Projects

Bridgeport Harbor Federal Navigation Project – In General: The Bridgeport Harbor FNP is the subject of a separate DMMP currently being finalized by the USACE, which will be summarized in this regional DMMP. Bridgeport Harbor can be divided into two areas for purposes of sediment classification. Based on test results from 1973, 1975, 1976, 1982, and 1998 the sediments present in the inner harbor channel and basin, anchorage areas, and the harbor's three dredged tributaries (Pequonnock River, Yellow Mill Channel and Johnsons

River) are primarily fine grained organic silt, whereas sediments in the outer harbor and entrance channel were predominantly coarser grained as described below. Chemical and biological testing in 1982 for a proposed improvement project to deepen the major portions of the harbor to 40 feet (which was never constructed) showed that the inner harbor sediments were moderately highly to highly contaminated and suitable for capped placement at CLDS. Sediments in the entrance channel and outer harbor did not exhibit any significantly high values for any parameters in 1975 and 1976 and were found suitable for uncapped placement at CLDS in the 1982 improvement studies. However, other than the outer anchorage deepening in 1983 (July 1982 EA and October 1982 Plans and Specifications), no dredging has occurred in the Bridgeport Harbor FNP since 1962-1963.

The Bridgeport Harbor DMMP that is currently being prepared as a separate document proposes maintenance dredging of approximately 1,774,000 cy of dredged material to maintain the current authorized depths in the navigation channels, anchorages, turning basin and tributary channels in Bridgeport Harbor, except for Johnsons River. Whether or not this project will ultimately be constructed, or whether some lesser dimensions will be pursued for all or portions of the project is the subject of ongoing discussions between the USACE, state, city, and port users. Available information on dredged material characteristics, shoal sediment sampling and testing, and suitability for alternative placement options are discussed below.

The proposed Bridgeport Harbor maintenance project would dredge material with a mechanical dredge and place it into scows for placement. Of that amount, approximately 665,600 CY of material was found suitable for unconfined ocean placement at CLDS, and the other 1,326,000 CY was determined not suitable for unconfined ocean placement (see above table). The Federal base plan would dispose of the unsuitable material into a CAD cell(s) located in Bridgeport Harbor, with some potentially placed at the Morris Cove borrow pit located in New Haven Harbor. The Southeast CAD Cell would be constructed in Bridgeport Harbor to the east of the navigation channel and just north of the east breakwater. This CAD cell would be dredged to a depth of about -90 feet MLLW and would contain the majority of the unsuitable material dredged from Bridgeport Harbor. The remainder of the unsuitable material from the harbor, as well as the top two feet of unsuitable shoal overburden removed from atop the Southeast CAD Cell (about 53,800 CY), would be disposed at the Morris Cove borrow pit, or at a “starter” CAD cell excavated elsewhere at Bridgeport Harbor (north of the west breakwater or beneath the entrance channel). The suitable material excavated to form the Bridgeport Southeast CAD cell (about 1,603,300 CY) would be disposed at the CLDS. Of the 665,600 CY of suitable material removed from the entrance channel, 73,200 and 150,000 would be used to cap the Bridgeport Southeast CAD cell and the Morris Cove or Bridgeport “starter” CAD cells, respectively.

Table 5-112 - Bridgeport Harbor DMMP Quantities (CY) and Source of Dredged Material for Base Plan Placement Options					
Source of Dredged Material	PLACEMENT & BENEFICIAL USE LOCATIONS				
	CLIS	Southeast CAD Cell		Morris Cove Pit^	
	Suitable	Unsuitable	Suitable Cap	Unsuitable	Suitable Cap
Entrance Channel	442,400^{+}		73,200*		150,000*
Main Channel, Turning Basin, and Anchorages		838,200			
Pequonnock River		164,700			
Yellow Mill Channel		126,900			
Main Channel (remaining)				196,200	
Top 2 Feet SE CAD				53,800	
SE CAD Cell	1,603,300				
Placement Subtotals *Cap Material	2,045,700	1,129,800	73,200*	250,000	150,000*
		1,203,000		400,000	
+ Note: Some entrance channel materials may also be suitable for nearshore bar placement. ^ Note: Numbers are for using Morris Cove Borrow Pit as starter cell. Bridgeport West CAD cell site or entrance channel CAD cell site are also alternatives for a starter cell.					

<u>Bridgeport Harbor Main Channels, Anchorages and Turning Basin</u>: For the August 1998 Bridgeport Harbor sediment evaluation vibracore samples were collected from 20 stations including the entrance channel, main ship channel inside the breakwaters, and the 35-foot turning basin and anchorage area for physical and chemical analysis. A box core was used to collect sediment required for performing bio-toxicity evaluations (2014 Draft DMMP and Draft EA, Bridgeport Harbor). Samples recovered inside the breakwaters were primarily black silt to the full penetration depth, except adjacent to the ferry landing where a hard gray clay-silt was recovered indicative of the indigenous materials at depth. The entrance channel, located outside the breakwaters, was generally silt overlying fine sand. Larger proportions of sand were seen further seaward in the entrance channel. All the samples were analyzed for grain size and bulk chemistry. Results showed levels generally above the CLDS reference sample.

Biological testing of the sediments using composites was evaluated against the CLDS reference sediment. Benthic toxicity testing and water column testing showed the inner harbor shoal materials would not be acceptable for unconfined open water placement at CLDS. Test results from entrance channel materials showed unusual variability among replicates and warranted further testing. In September 2001 an additional 15 vibracore samples were taken from the entrance channel for physical, bulk chemical and biological (bioassay, bioaccumulation) testing and additional evaluations were conducted. Risk-based evaluations were then used to determine compliance with the MPRSA. Based on these analyses, it was determined that the material from the entrance channel was suitable for open water placement (USACE, 2013d). A more detailed explanation of the testing procedures followed and the test results for Bridgeport Harbor is provided in the Harbor Characterization Appendix.

Bridgeport Harbor FNP – Pequonnock River: Maintenance dredging of the Pequonnock River segment of the Bridgeport Harbor FNP is included in a separate DMMP being prepared for that FNP. As with the other materials from the inner harbor, this material was to be removed and placed in CAD cells constructed within Bridgeport Harbor. Sediment testing from 2013 showed sediments with relatively high levels of contaminants relative to reference site material. Thus, project material was determined to be suitable only for CAD placement. Sediment testing for both the Yellow Mill Channel and Pequonnock River (tributaries to the Bridgeport Harbor) also took place in 1973. Those results showed that sediments in both channels were primarily gray or black organic silt and contained moderately high to high concentrations of potential pollutants.

Bridgeport Harbor FNP – Yellow Mill Channel: Maintenance dredging of the Yellow Mill Channel segment of the Bridgeport Harbor FNP is included in the separate DMMP being prepared for that FNP. As with the other materials from the inner harbor, this material was to be removed and placed in CAD cells constructed within Bridgeport Harbor. Sediment testing from 2013 showed sediments with relatively high levels of contaminants relative to reference site material. Thus, project material was determined to be suitable only for CAD placement. Sediment testing for the Yellow Mill Channel also took place in 1973. The results showed that sediments were primarily gray or black organic silt and contained moderately high to high concentrations of potential pollutants.

Bridgeport Harbor FNP - Johnsons River Tributary: Johnsons River is a tributary of Bridgeport Harbor. Sediment sampling was last undertaken in 1973 when sediments were found to be primarily gray or black organic silt (64 to 93 percent fines) and to contain moderately high to high concentrations of metals and volatile solids (1980 Harbor Sediment Atlas).

Black Rock Harbor: Black Rock Harbor was the subject of a series of sediment sampling and testing efforts in 1973, 1975-76, 1979-80 leading up to the maintenance operation carried out in 1982-83 for the 18-foot channels (material placed at CLDS) and construction of the Burr Creek dredged material containment facility for receipt of New Haven Harbor dredged materials. The work supported the July 1982 EA covering the channel maintenance activity. The range and average percent fines from these sampling and testing efforts were as follows:

1973 Sampling	68 to 98 % fines	87% average
1975-76 Sampling	65 to 97 % fines	84% average
1979-80 Sampling	34 to 90 % fines	67% average

No FNP shoal sediment sampling and testing has been undertaken since the 1980 sampling for bioassay-bioaccumulation testing. Shoal material at Black Rock Harbor today and in the future is expected to be silts. Its suitability for open water or other placement options will need to be demonstrated by further sampling and testing. Since this harbor was fully maintained in 1983, for the purposes of this DMMP it will be assumed that the bulk of that material will be found suitable for open water placement, although capping in conformance with the state of Connecticut's Clean Water Act protocols would likely be required. Black Rock Harbor dredged material could also be placed in a CAD cell or regional CDF that would need to be developed, if it proves unsuitable for open water placement. Upland placement on the Black Rock Harbor side of Bridgeport's Seaside Park has been proposed in the past, and there is already a small soil processing operation adjacent to the park, and another on the opposite (west) shore of Cedar Creek.

Southport Harbor: Sediment sampling and testing for the FNP at Southport Harbor has been undertaken twice, in 1972 and in 1997-1998. The 1972 tests showed the material in the entrance channel to be zero to 1.4 percent fines, while the shoal material in the anchorage was 55 to 89 percent fines. In 1997 to 1998 sediment samples were taken for physical, chemical and biological testing in support of a November 2003 EA covering the maintenance operation carried out in 2004-2005. Entrance channel shoal materials were shown to average about 7 percent fines (range of 2 to 14 percent), while materials from the inner harbor averaged 59 percent fines (range of 4 to 95 percent). Chemical and biological testing showed the material to be suitable for placement at either the CLDS or WLDS. Similar results are expected in the future, with entrance channel materials, at least seaward of the jetties, to be sand suitable for beach or nearshore bar placement as nourishment. Inner harbor materials will most like prove to be clean fine-grained material suitable for open water placement, marsh creation/ restoration, or other beneficial uses for which structural properties are not required.

5.11.3 Historical and Potential Federal Navigation Project Placement Options

Maintenance of the three FNPs has typically used open water placement in LIS, at the CLDS or historically at the Bridgeport Disposal Site. Upland placement for land reclamation (Southport, Bridgeport, and Stratford) and beach nourishment (Bridgeport) have also been used for cleaner and sandier materials. In earlier times, significant areas of wetlands were filled in the immediate area of all three harbors for port and land development at all three harbors.

Maintenance of all three projects is expected to generate mainly fine-grained materials, with those from Southport, Black Rock and the outer entrance channel at Bridgeport Harbor suitable for unconfined open water placement. However, materials from the inner harbor and tributaries at Bridgeport have failed toxicity testing and are unlikely to be suitable for open water placement. As mentioned above, confined placement is already proposed for those materials.

Entrance channel materials at Southport are sandy materials likely suitable for nourishment of adjacent beaches, provided that funding for a second dredge plant can be made available. As inner harbor materials are not likely suitable for beach placement they must be dredged mechanically. At Bridgeport, material from the entrance channel has been used for beach nourishment in the past (1962), but sediment testing of current shoal materials shows a higher fines component than would typically be used for direct beach placement. Nearshore placement of these materials, to allow natural sorting to occur in the littoral zone, may be possible with further investigation. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

Potentially suitable fine-grained material from these three harbors could be used to create salt marsh in shallow tidelands to replace marsh lost in other areas to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. However, no opportunities for such beneficial or adaptive use were identified in this dredging center area.

The suitable fine-grained material could also be placed at an ocean site, the closest being the CLDS. The material could also be placed upland, with dewatering and re-handling if found cost-effective for some public purpose (brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary this would require further investigation in the future.

Should creation of a confined placement facility at the New Haven breakwaters, Falkner Island, Stratford Shoals or elsewhere in the vicinity be pursued, then material from these three harbors or other sources in the dredging center could potentially provide material towards that purpose.

5.11.4 Other Federal Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Bridgeport Area Dredging Center.

5.11.5 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Bridgeport Area Dredging Center that periodically generate dredged material. These include the deep draft cargo terminals at Bridgeport and Black Rock Harbors (petroleum, coal, and aggregates), ferry terminals at Bridgeport, large and small marinas, yacht club and boat yard operations in all of the waterways listed above, and private residential and public access facilities at many other locations throughout the dredging center. The harbors in this dredging center consist of Lewis Gut, Bridgeport Harbor, Black Rock Harbor, Ash Creek, Pine Creek and Southport Harbor.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 287,800 CY of maintenance dredging and 369,200 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the Table 5-113 below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CLDS being the closest approved site. These activities could also take advantage of whatever alternative placement methods are used for the three FNPs in this dredging center, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-113 - Dredging Activity Timeline – Bridgeport Area Dredging Center Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	106,000	91,800	17,500	17,500	27,500	27,500
Improvement	283,200	46,000	10,000	10,000	10,000	10,000
Total Non-Federal	389,200	137,800	27,500	27,500	37,500	37,500

5.11.6 Placement Alternatives Available to Dredging Center Activities

This dredging center is expected to produce a large range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to major port berth deepening generating up to 100,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at the CLDS. However, port fill and upland fill for specific purposes have been used as well, with some beach nourishment. Several investigations of placement alternatives identified the following as opportunities for management of dredged material for projects from this dredging center.

Table 5-114 - Bridgeport Area Dredging Center Available/Potential Placement Alternatives

Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Central Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Western Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Bridgeport Southeast (Main) CAD Cell	- Fill	CAD Cell	986,000	One-Time Use	Unsuitable
	- Cap		79,000		All Suitable
Bridgeport West CAD Starter Cell – Fill	- Fill	CAD Cell	382,200	One-Time Use	Unsuitable
	- Cap		86,800		All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT		CAD Fill	466,100	All Until Filled	All
		CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit		COW Fill	266,000	All Until Filled	All Suitable
		COW Cap	484,000		
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable
Milford Harbor CDF	- Fill	Shore CDF	219,100	All Until Filled	All
	- Cap		50,900		All Suitable
Stratford Point CDF	- Fill	Shore CDF	33,666,900	All Once Built	All
	- Cap		5,283,100		All Suitable
Penfield Reef CDF	- Fill	Shore CDF	33,539,300	All Once Built	All
	- Cap		5,010,700		All Suitable
110 Sand Co., Melville, NY		Upland	1,000,000	Until Filled	All Suitable
Manchester City Landfill, CT		Upland	1,200,000	All	All
Brookhaven Town Landfill		Upland	700,000	All	All
Long Beach, Stratford		Beach	31,300	Recurring	Suitable Sand
		Nearshore	45,300		

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Sherwood Island State Park	Nearshore	105,900	Recurring	Suitable Sand
Southport Beach	Beach	21,200	Recurring	Suitable Sand
	Nearshore	27,200		
Jennings Beach, Fairfield	Beach	33,400	Recurring	Suitable Sand
Sasco Hill Beach, Southport	Beach	8,500	Recurring	Suitable Sand
	Nearshore	20,100		
Burial Hill Beach	Nearshore	12,700	Recurring	Suitable Sand
Seaside Park Beach, Bridgeport	Beach	176,700	Recurring	Suitable Sand
	Nearshore	143,100		

Bridgeport Harbor Specific CAD Cells: Bridgeport Harbor is the subject of a separate harbor-specific DMMP now under review by the USACE. The DMMP calls for placement of unsuitable dredged materials from the inner harbor and its tributaries into CAD cells constructed specifically and solely for use by Bridgeport Harbor FNP. A main cell, called the Southeast CAD cell, inside of and north of the east breakwater would accommodate about 90 percent of the harbor's shoal materials. A starter CAD cell would need to be constructed first to accommodate the unsuitable surface overburden atop the main CAD cell site and the remaining ten percent of the harbor's shoal material. The starter cell could be constructed on the west side of the inner harbor north of the west breakwater or the Morris Cove Burrow Pit could be used for Bridgeport's starter cell. The Bridgeport CAD cells are described as follows.

Bridgeport Harbor West CAD Starter Cell: The Bridgeport Harbor West CAD cell site alternative is a potential starter CAD cell west of the Bridgeport Harbor Main Channel and north (harbor side) of the west breakwater in Bridgeport, Connecticut. The Bridgeport Harbor West CAD cell is not located at an existing depression or borrow pit, and would need to be excavated. The footprint of the potential containment cell is approximately 14 acres. Its design fill volume is 469,000 CY of which about 87,000 CY would be needed for capping material. This cell is intended as a starter cell for development of the larger Southeast CAD Cell located across the channel on the east side of the inner harbor. Further details on the Bridgeport Harbor West CAD cell design are available in the 2013 draft Bridgeport Harbor DMMP.

Bridgeport Harbor Southeast (Main) CAD Cell: The Bridgeport Harbor Southeast (Main) CAD Cell site alternative is a potential CAD cell east of the Bridgeport Harbor Main Channel and north (harbor side) of the east breakwater at Bridgeport, Connecticut. The Bridgeport Harbor Southeast CAD cell is not located at an existing depression or borrow pit, and would need to be excavated. The footprint of the potential containment facility is approximately 16 acres. Its design volume is 1,065,000 CY. Construction of this cell requires a starter cell for placement of about 54,000 CY of unsuitable overburden that must be removed from the footprint before the bulk of the cell can be excavated. Starter cell alternatives include the Morris Cove Borrow Pit site at New Haven Harbor, the Bridgeport Harbor West CAD Cell site, and a plan for creating a starter cell beneath the Bridgeport Harbor entrance channel. Once the unsuitable overburden is removed, excavation of the cell would require the removal of about 1,603,000 CY of suitable parent material which could be placed at the CLDS. Further details on the Bridgeport Harbor Southeast (Main) CAD Cell design are available in the 2013 draft Bridgeport Harbor DMMP.

Morris Cove CAD Cell, Potential Starter Cell for Bridgeport Harbor: The Morris Cove site is a potential CAD cell located in outer New Haven Harbor. The site is a former sand borrow pit offshore of Fort Nathan Hale Park and Pardee Parkway. The existing borrow pit from the construction of I-95 is approximately 217 yards wide and 817 yards long with depths ranging from 9.8 to 29.5 feet below MLLW. The footprint of the potential containment facility is approximately 30 acres. This site has been used for dredged material placement by the USCG from dredging of their New Haven facility. The site has a remaining fill capacity (pre-cap) of about 466,000 CY. The Morris Cove site becomes anoxic during summer months leading to a degraded habitat. Filling in the Borrow Pit and capping it with suitable material would create shellfish habitat on the Borrow Pit footprint.

Bridgeport Dredging Center Alternatives: Alternatives for placement of materials other than the unsuitable materials from Bridgeport's inner harbor have been identified within and outside of the dredging center. Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Other than in Bridgeport inner harbor, no unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Beach and Nearshore Nourishment Sites: There are a number of large and small public and private beaches in this dredging center that could benefit from either direct placement or nearshore bar/berm placement of clean sand dredged from area harbors. Those beaches within a two-mile distance from a dredging site could receive material via pipeline from a hydraulic cutterhead dredge. Those beaches more than two miles from the dredging site could receive material placed in a longshore berm by scow or hopper in their nearshore bar system. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from the Bridgeport area. The seven beaches listed above in this dredging center were identified by the screening process, or are beaches in the vicinity that were constructed with Federal assistance.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Central Long Island Sound site located offshore of New Haven Harbor. The Western Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained.

Table 5-115 - Haul Distances to Beach and Nearshore Placement Sites										
Project or Harbor (Distances in Statute Miles)	Compo Beach	Sherwood Island State Park	Burial Hill Beach	Sasco Hill Beach	Jennings Beach	Seaside Park	Stratford Point Beaches	Silver Sands B Milford	Woodmont Beach	Prospect Beach
Bridgeport Harbor (Basin)	12.7	11.5	11.1	10.0	5.8	2.8	9.0	14.0	17.8	19.6
Black Rock Harbor	10.1	8.9	8.4	7.3	2.1	3.6	7.9	13.0	16.7	18.8
Ash Creek	9.4	8.2	7.9	6.6	0.7	2.9	7.6	11.8	16.2	17.9
Southport Harbor	4.7	3.3	2.8	0.7	6.5	7.8	11.3	16.1	20.4	22.1

Table 5-116 - Scow Haul Distances to In-Water Placement Sites											
Project (Distances in Statute Miles)	HARS	Stamford DS	WLIS DS	Eatons Neck East DS	Southport DS	Bridgeport East	Milford DS	CLDS	Branford DS	Guilford DS	Falkner Island CDF
Bridgeport Harbor (at I-95)	86.4	23.1	21.4	18.4	10.1	8.2	12.2	20.1	25.1	29.1	32.6
Black Rock Harbor	83.5	20.9	19.2	16.2	8.0	7.5	11.2	19.0	24.0	28.0	31.5
Ash Creek	82.9	20.3	18.6	15.6	7.3	7.0	11.0	18.8	23.9	27.9	31.4
Southport Harbor	78.7	16.0	14.4	11.8	4.6	8.6	14.4	22.4	27.3	31.3	34.9

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The potential CDF sites located near this dredging center or identified in the screening process include Milford Outer Harbor, Penfield Reef, Bridgeport Yellow Mill Channel, and Stratford Point.

5.11.7 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Bridgeport Area Dredging Center, the analysis matched projects with placement alternatives as follows.

Bridgeport Harbor – Johnsons River: The Bridgeport Harbor DMMP now under review does not cover the Johnsons River segment of the Bridgeport Harbor FNP, and so this waterway segment will be covered in this LIS DMMP. Future maintenance dredging of the Johnsons Creek FNP will likely yield unsuitable fine-grained material. This unsuitable dredged material must be isolated from the environment by containment in a CDF, CAD cell or upland landfill approved to receive such material. Unsuitable material can also sometimes be treated to reduce its level of contamination and make it suitable for placement or other uses. The top-scoring alternatives from the site screening process for Johnsons River are shown below.

Table 5-117 - Bridgeport Harbor – Johnsons River
FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Unsuitable Fines	88,000	2021-2025	Morris Cove Pit CAD Cell – Fill	$79
			Yellow Mill Channel CDF – Fill	$99
			New Haven Breakwaters CDF – Fill	$126
			Norwalk Islands CDF – Fill	$126
			Milford Harbor CDF – Fill	$116
			Norwalk Island Marsh – Fill	$126
			Stratford Point CDF – Fill	$99
			Penfield Reef CDF – Fill	$116
			Falkner Island CDF – Fill	$133
			Captain Harbor CDF – Fill	$133
			Duck Island Roads CDF – Fill	$164
			Twotree Island CDF – Fill	$164

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained material from Johnsons River is placement as fill in the Morris Cove Borrow Pit CAD cell in New Haven Harbor. The next least costly alternatives are placement in CDFs that would need to be constructed in the upper Yellow Mill Channel or at Stratford Point at an increase of 25 percent over Morris Cove. The next least costly alternatives are placement in CDFs constructed in the upper Milford Outer Harbor or Penfield Reef, at an increase of 47 percent over Morris Cove. Placement in one of the several other CDF sites along the Connecticut shore would cost between 1.6 and 2.1 times the cost of the least cost alternative.

Black Rock Harbor: Future maintenance dredging of the Black Rock Harbor FNP will yield fine-grained material, suitable for open water placement. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Black Rock Harbor are shown below.

Table 5-118 - Black Rock Harbor – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	619,500	2021-2025	Western Long Island Sound DS	$27
			Central Long Island Sound DS	$27
			New Haven Breakwaters CDF – Fill	$119
			Stratford Point CDF – Fill	$111
			Sherwood Island Borrow Pit – Cap	$18
			Morris Cove CAD – Fill	$67
			Penfield Reef CDF – Fill	$88
			Norwalk Islands Marsh – Fill	$119
			Sherwood Island Borrow Pit – Fill	$18
			Falkner Island CDF – Fill	$125
			Yellow Mill Channel CDF – Fill	$111
			110 Sand Company Site, NY	$99
			Manchester City Landfill	$124
			Brookhaven Town Landfill	$124
			Hempstead Harbor CDF – Fill	$143

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Black Rock Harbor FNP is placement as both fill and cap at the Sherwood Island offshore borrow pit. If such a plan were accomplished the volume from Black Rock Harbor would completely fill and cap that borrow pit. The second least costly alternative would be open water placement at either the Central or Western LIS sites at a 50 percent increase in cost. Placement as fill in the Morris Cove Borrow Pit CAD cell in New Haven Harbor would cost 3.7 times the cost of using the Sherwood Island borrow pit site, and would consume Morris Cove's entire capacity. Placement in a CDF constructed at Penfield Reef would cost about 4.9 times the cost of using the Sherwood Island borrow pit site. Other CDF and upland sites would cost between 5.5 and 8 times the cost of using the Sherwood Island borrow pit site.

Southport Harbor: Future maintenance dredging of the Southport Harbor FNP will yield both sand from the entrance channel and fine-grained material from the inner harbor, all suitable for open water placement. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, of for other upland applications. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Southport Harbor are shown below.

The least cost placement alternative for the maintenance dredging of sand from the Southport Harbor entrance channel would be beach or nearshore placement on either Sasco Hill Beach to the east of the inlet or Southport Beach to the west. The next least costly alternative (a 15 percent increase) is as cap for the Sherwood Island Borrow Pit once the pit is filled with material from another source. Open water placement at the WLDS would be about 25 percent more costly than the least cost alternative. Placement nearshore off either Sherwood Island State Beach, Compo Beach in Westport, or Seaside Beach in Bridgeport would cost about 53 percent more than the least cost alternatives. Nearshore placement at Long Beach in Stratford would entail a 75 percent increase in cost over the least cost alternative. Use as cap material at one of the several CDF sites along the Connecticut coast would cost between 2.7 and 3.1 times the least cost alternative.

Table 5-119 - Southport Harbor – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand Entrance Channel	18,400	2021-2025	Sherwood Island Borrow Pit – Cap	$61
	16,700	2041-2045	Western Long Island Sound DS	$66
			Southport Beach – On-Beach	$53
			Yellow Mill Channel CDF – Cap	$145
			New Haven Breakwaters CDF – Cap	$162
			Norwalk Islands CDF – Cap	$145
			Milford Harbor CDF – Cap	$162
			Norwalk Islands Marsh – Cap	$145
			Stratford Point CDF – Cap	$145
			Southport Beach – Nearshore Berm	$53
			Penfield Reef CDF – Cap	$145
			Sasco Hill Beach – Nearshore Berm	$53
			Sherwood Island State Park – Berm	$81
			Long Beach (Stratford) – Nearshore	$93
			Seaside Beach (Bridgeport) Berm	$81
			Compo Beach – Nearshore	$81
			Sasco Hill Beach – On-Beach	$53

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine Inner Harbor	22,800 20,700	2021-2025 2041-2045	Sherwood Island Borrow Pit – Cap	$51
			Sherwood Island Borrow Pit – Fill	$51
			Western Long Island Sound DS	$55
			Yellow Mill Channel CDF – Fill	$132
			New Haven Breakwaters CDF – Fill	$153
			Norwalk Islands CDF – Fill	$132
			Milford Harbor CDF – Fill	$153
			Norwalk Islands Marsh – Fill	$132
			Stratford Point CDF – Fill	$132
			Penfield Reef CDF – Fill	$132
			Central Long Island Sound DS	$69
			110 Sand Company Site, NY	$89
			Sandy Point West Haven Marsh	$94

The least cost alternative for placement of fine-grained material from inner areas of Southport Harbor would be as either fill or cap at the Sherwood Island Borrow Pit offshore COW site. The second least costly alternative for the silty material would be open water placement at the WLDS at an eight percent increase over Sherwood Island COW site, followed by the CLDS at a 35 percent increase. Upland placement at a landfill in New York would cost 1.8 times the least cost alternative. Beneficial use as fill in a marsh creation project at Sandy Point in West Haven would cost 1.8 times the least cost alternative. Placement in a CDF along the Connecticut coast would cost from 2.6 to 3.0 times the least cost alternative.

5.11.8 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-120 - Federal Navigation Project Base Plans Bridgeport Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
Bridgeport Harbor		
Entrance Channel	Suitable Mixed	Central Long Island Sound DS
Inner Harbor	Unsuitable	In-Harbor CAD Cells and Starter Cells
Pequonnock River and Yellow Mill Channel	Unsuitable	In-Harbor CAD Cells
CAD Cell Overburden	Unsuitable	Starter Cells In-Harbor or Morris Cove
CAD Cell Excavate	Suitable Fines	Central Long Island Sound DS
Johnsons Creek	Unsuitable	Morris Cove Pit CAD Cell - Fill
Black Rock Harbor	Suitable Fines	Sherwood Island Borrow Pit - Fill
Southport Harbor		
Entrance Channel	Sand	Sasco Hill Beach or Southport Beach
Inner Harbor	Suitable Fines	Sherwood Island Borrow Pit – Fill or Cap

Alternatives to the Federal Base Plan: Bridgeport Harbor and two of its tributary channels are the subject of a separate DMMP currently under review. Johnsons Creek (Johnsons River) is the only project segment not currently included in that project-specific DMMP and was evaluated in this study. The base plan for the unsuitable shoal material in Johnsons Creek is placement as fill in the Morris Cove CAD cell. Given the limited capacity of the Morris Cove CAD cell, the likelihood that it will remain available for use by the time Johnsons Creek is dredged is in doubt. The only other containment options for unsuitable material are CDFs or other CAD cells constructed within harbors. Use of a CAD cell constructed in upper Yellow Mill Creek at Bridgeport or at a nearby site like Stratford Point, would be about 25 percent more costly than using Morris Cove.

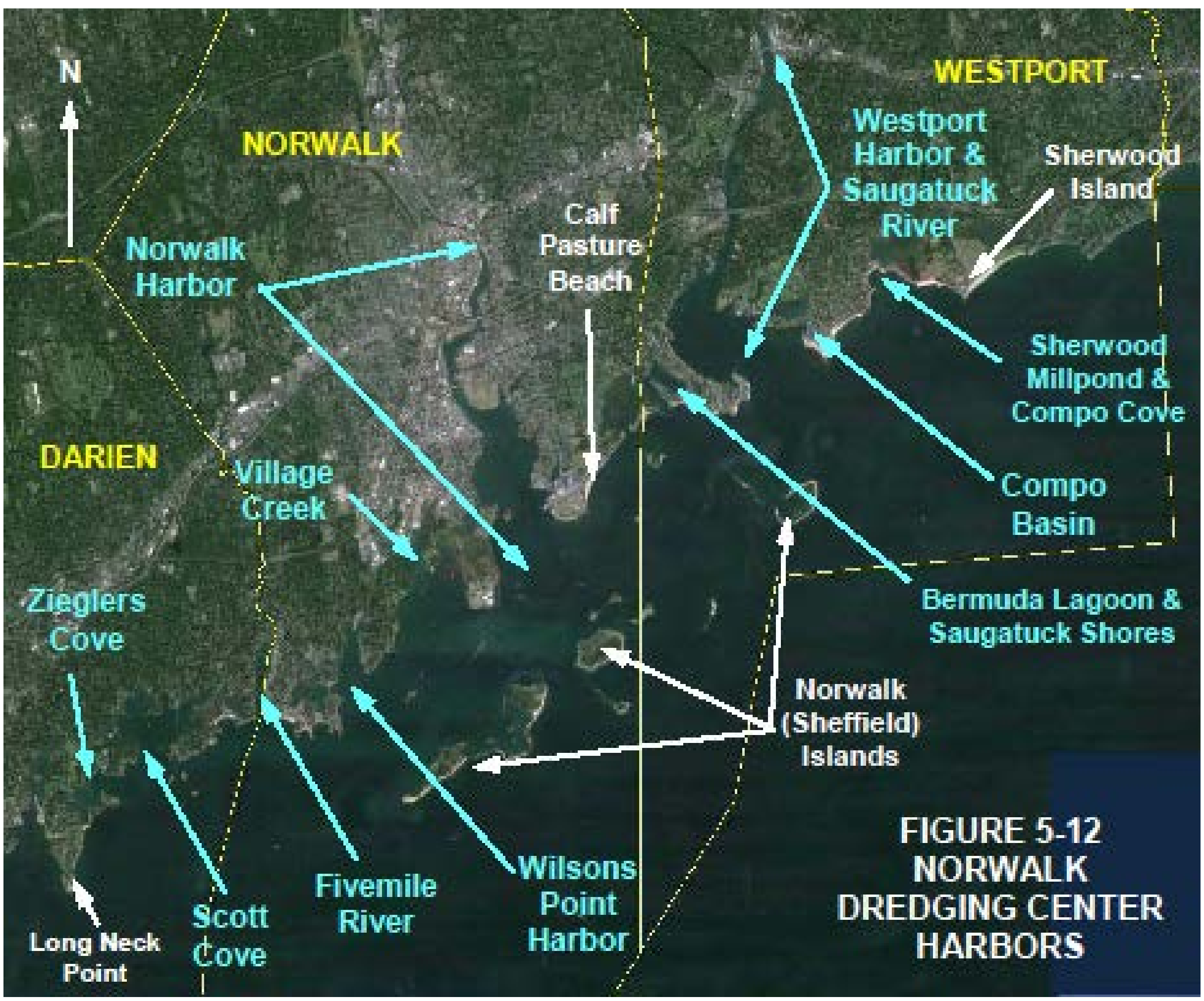
For the fine-grained material from both Black Rock Harbor and the inner harbor at Southport, the Federal base plan is the Sherwood Island offshore COW site. The second least cost alternative for both harbors is open water placement at either CLDS or WLDS. Non-open water alternatives for Black Rock Harbor are potential upland or CDF sites at 4 to 6 times the cost, and are considered not cost-effective solutions. For the silty inner harbor at Southport alternatives to open water placement are landfills or potential marsh creation at Sandy Point in New Haven Harbor at a 60 to 70 percent increase, and again not considered cost effective.

For the sandy material produced by the lower areas of Southport Harbor, the Federal base plan for use as beach or bar nourishment is a beneficial use. Placement as cap material at the Sherwood Island site, assuming it is available and ready to be capped at the time Southport is next dredged, would require a 15 percent increase in cost. Other alternatives are open water or transport to more distant beaches at a cost increase above 50 percent. More distant beaches could be pursued with non-Federal funding, or with USACE assistance if another authority, such as Section 204, were found to be in the Federal interest.

5.12 Norwalk Area Dredging Center

The Norwalk Area Dredging Center consists of the towns of Westport, Norwalk and part of the Town of Darien, Connecticut, and includes the Federal Navigation Projects for Westport Harbor and Saugatuck River, Norwalk Harbor, Wilsons Point Harbor, and Fivemile River. The dredging center stretches from the Fairfield/Westport boundary in the east to Long Neck Point in Darien in the west. The dredging center also includes a number of other small harbors, coves, and rivers which provide navigation access to Long Island Sound for commercial fishermen and boaters and small commercial cargo facilities. The principal waterways in this area are:

Compo Cove and Sherwood Millpond
Westport Harbor and the Saugatuck River – Includes FNP
Bermuda Lagoon and Saugatuck Shores
Norwalk Harbor – Includes FNP
Wilsons Point Harbor – Includes FNP
Fivemile River – Includes FNP
Scott Cove and Zieglers Cove



This dredging center also includes a number of offshore islands which require navigation access collectively called the Norwalk Islands. The waterways in this dredging center yield a mix of material types, all found suitable for unconfined open water placement. The riverine tributaries contribute silty shoal material to the harbor, resulting in harbor maintenance materials which are predominantly fine-grained. The majority of the center's dredging sources, including all of the FNPs, yield fine-grained materials that are not recommended for beach nourishment or nearshore placement. Outer harbor materials in some locations around the mouth of the Saugatuck River can be somewhat sandier, though not sufficiently so to present beach nourishment opportunities or other non-treated beneficial uses other than marsh creation.

5.12.1 Federal Navigation Projects - Maintenance

The dredged features of the four FNPs in this dredging center have each been maintained or improved most recently (or in recent decades) as shown below.

Table 5-121 - Federal Navigation Project Dredging History
Norwalk Area Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Westport Harbor and the Saugatuck River	1970	25,900	Norwalk DG	Suitable Fine
	1947	15,100	Unknown	Unknown
Norwalk Harbor	2006-2013	469,200	CLDS	Suitable Fine and Sand
		30,600	CAD	Unsuitable
	1980	276,000	CLDS	Suitable Fine
		2,000	CAD	Unsuitable
	1969	62,300	Norwalk DG	Unknown
	1964	184,700	Norwalk DS	Unknown
	1960	77,300	Norwalk DS	Unknown
	1956	73,700	Norwalk DS	Unknown
	1954	214,500	Norwalk DS	Unknown
	1949-50	177,500	Norwalk DS	Mud
Wilsons Point Harbor	1889-92	509,600	Unknown	Suitable Fine
Fivemile River Harbor	1999	48,000	CLDS & WLDS	Suitable Fine
	1968	47,700	Norwalk DS	Unknown
	1937-38	65,100	Unknown	Mud

Westport Harbor and Saugatuck River: The FNP for Westport Harbor and Saugatuck River consists of a 4-foot channel from deep water in the lower river up to a point below the U.S. Route 1 Bridge at Westport. Since its last improvement in 1896 the channel has been maintained twice in 1947 and most recently in 1970 when approximately 25,900 CY was dredged mechanically and placed at the historic WLIS-I site in LIS south of the river's mouth. The most recent condition survey of the project shows that about 19,300 CY of shoal material has accumulated (Survey WES-748, 2012). This yields an annual shoaling volume of about 700 CY since the 1947 maintenance. An Environmental Assessment is currently being prepared in anticipation of maintenance dredging within the next few years. At the current shoaling rate and volume, if maintenance were to occur no later than 2020 then a volume of about 50,700 CY could be expected. Testing has shown the material to be fine-grained and suitable for open water placement. Given the low shoaling rate, it is anticipated that this channel would require maintenance only once during the DMMP planning horizon.

Norwalk Harbor: The FNP for Norwalk Harbor consists of a 12-foot entrance channel from deep water in the Sound into and through the outer harbor, a 10-foot anchorage in the lower harbor, a 6-foot channel and anchorage in the East Branch, and a 10-foot channel in the West Branch with a turning basin at its head. Norwalk Harbor recently completed a major maintenance operation which was carried-out in three phases in 2006, 2009, and 2013, wherein a total of about 469,200 CY of suitable material was removed, including about 53,600 CY removed to create a CAD cell under the West Branch Channel. The CAD cell was constructed to receive 30,600 CY of material from the West Branch found unsuitable for open water placement. Another CAD cell, the first in New England, had been constructed in the same area as part of a 1981 maintenance operation for the same purpose (Nov 1979 Plans & Specifications, 2,000 CY of unsuitable material).

Since its last improvement (channel widening) in 1950 the Norwalk Harbor FNP has undergone maintenance six times prior to the recent three-phase operation. The total volume dredged from 1950 to 2013 was about 1,356,700 CY, indicating an average annual shoaling rate of 21,500 CY over that 63-year period. The project was maintained every four to five years prior to 1981, but only twice since that time. After-dredge surveys for the various project features from 2009 (Survey NWH-868) and 2014 (Survey NWH-871) indicate that about 41,000 CY in shoal material remains distributed among the several features. If this harbor were to be maintained on a 10-year frequency similar to New Haven Harbor, then a shoal volume of 256,400 CY could be expected in about 2024, and 215,300 CY every ten years after that. As with recent maintenance operations, the majority of this material is likely to be fine-grained material suitable for open water placement. In the immediate future, small amounts of unsuitable material may again be found in the West Branch, and can be dealt with by constructing additional small CAD cells beneath that channel bottom. For purposes of this DMMP, it is assumed that about 20,000 CY of the volume in the next several maintenance cycles will be unsuitable for open water placement and will require some form of containment or treatment.

Wilsons Point Harbor: The Wilsons Point Harbor FNP in Norwalk consists of a 15-foot channel from deep water in the Sound to the basin west of Wilson's Point. Originally constructed to serve as access to the stone wharf at that location, the harbor is now used primarily as an anchorage for large and small recreational craft. The project was initially constructed between 1889 and 1892 when about 509,600 CY of material were removed to form the 15-foot area. There is no record of where this material was placed. The project has not been maintained since its initial construction.

Based on the latest condition survey (Survey WIL-1, 2004), Wilsons Point Harbor currently has accumulated about 502,300 CY of sediment. Over the 112 years since its last dredging, that indicates a shoaling rate of about 4,500 CY annually. If this harbor were to receive funding for maintenance near the middle of the DMMP planning horizon (2030) it would be expected to have accumulated a total of about 618,900 CY of shoal material. This material is likely to be fine-grained and suitable for open water placement, given the lack of commercial pollutant sources in the area of this harbor.

Fivemile River Harbor: The Fivemile River Harbor FNP lies on the border between Norwalk and Darien, Connecticut and consists of a 6-foot MLLW channel extending about nine tenths of a mile upriver from deep water in the Sound. Since its last improvement in1907, the project has been maintained four times (approximately once every thirty years), most recently in 1999 when a total of about 48,000 CY was removed mechanically and placed at the CLDS.

The Fivemile River Harbor project currently has accumulated about 21,500 CY in shoal material, including allowable overdepth (Survey FIV-277, 2008). This yields an annual shoaling rate of about 2,100 CY annually over that 101-year period. It is assumed for this DMMP that the Fivemile River Harbor FNP would be maintained once during the DMMP planning horizon in about 2024, when about 55,400 CY of sediment will have accumulated.

The dredging activity timeline over the planning horizon for the four FNPs in the Norwalk Area Dredging Center is shown below.

Table 5-122 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Norwalk Area Dredging Center

Project/Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Westport Harbor and Saugatuck River	50,700					
Norwalk Harbor						
Suitable Material		236,400		195,300		195,300
Unsuitable West Branch		20,000		20,000		20,000
Wilsons Point Harbor			618,900			
Fivemile River Harbor		55,400				
Suitable Fine-Grained	50,700	291,800	618,900	195,300		195,300
Unsuitable Material		20,000		20,000		20,000

5.12.2 Harbor Characterization for Federal Navigation Projects

Maintenance of the four FNPs has typically used a mechanical bucket dredge with open water placement in LIS, at the WLDS or CLDS. Other historic sites such as the Norwalk Dumping Ground, Norwalk Disposal Site, Eaton's Neck, and others were used before the 1980s. It is likely that dredged material from Norwalk Harbor was used in earlier times as fill for commercial port development.

Maintenance of all four projects is expected to generate mainly fine-grained materials suitable for unconfined open water placement. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

<u>Westport Harbor and Saugatuck River FNP</u>: The June 1969 plans and specifications for the last maintenance dredging of Westport Harbor (1970) refer to the dredged material as "soft", but provide no test results or other data to characterize the material. The FNP was proposed for maintenance in the 2000s, but funds for that work were not made available. Sediment sampling and testing in anticipation of that work was carried out in December 2003 to January 2004. Samples ranged from 16 to 84 percent fines with an average of 37 percent. Chemical and biological testing of the material showed it to be suitable for unconfined open water placement at the CLDS or WLDS.

<u>Norwalk Harbor FNP</u>: The third and final phase of the most recent maintenance of the Norwalk FNP in 2013 involved the removal of approximately 150,000 CY of material by mechanical bucket dredge from the -12-foot MLLW channel of the FNP south of the Route 136 bridge which was placed at CLDS. The Connecticut Department of Energy and Environmental Protection (CT DEEP), under their Clean Water Act authority, required the Norwalk Harbor material, which was predominantly clayey silt, be capped with cleaner dredged sediment from the maintenance dredging of New Haven Harbor (February 2005 EA, Norwalk Harbor). The second phase, which began in 2008 and was completed in 2009, included work to dredge a total of approximately 195,000 CY of material from the -6-foot MLLW East channel, the -12-foot MLLW entrance channel, and the -10-foot south anchorage (which was only maintained to a depth of -6 feet MLLW). A mechanical bucket dredge removed the material which was then placed at CLDS and capped with about 75,000 CY of material from the maintenance dredging of the North Cove FNP (Annual Report, FY 2009). Although the material was found suitable for unconfined ocean placement after testing, the capping was required by the CT DEEP under their Clean Water Act authority and the additional cost for hauling the North Cove material to CLDS rather than the CSDS was paid by the City of Norwalk.

The first phase of the maintenance project began in 2006. Mechanical bucket dredging of the -10-foot MLLW upper channel and a small portion of the 6-Foot East channel began in 2005 and was completed in 2006 with a total of roughly 154,000 CY of material removed. About 65,400 CY was removed from the -10-foot MLLW channel and capped at CLDS with roughly 53,600 CY of material removed from the creation of two in-river CAD cells beneath the -10-foot MLLW channel. The 30,600 CY of unsuitable material dredged from the 10-foot channel was placed in the CAD cells, along with 1,700 CY from three marinas. The CAD cells were capped with about 2,200 CY from the 6-foot channel and 3,000 CY from the 10-foot channel (Annual Report, FY 2006).

As part of the three phased project, sediment cores were taken from 28 locations throughout the FNP for analysis in two steps (February 2005 EA). First, samples taken in August 1998 were subjected to physical and bulk chemical tests (ENSR Final Report, April 1999). These samples were predominantly silt and clay from all four project segments and ranged from 24 to 98 percent fines with an average of 91 percent. However, one area in the northern portion of the West Branch Channel (Norwalk River) was composed of sandy-gravelly material. Bulk chemistry test results indicated that the outer harbor area had relatively low levels of contaminants when compared to reference values. The inner harbor contained areas of relatively moderate to higher levels of contaminants. In the second phase of testing, samples taken in January 2000 were composited into 9 samples for physical, chemical and biological testing. Grain size analysis showed that sediments were uniform black silty clay or black clayey silt to a 6 to 7 foot depth at all stations then became gravelly sand. The samples ranged from 25 to 99 percent fines, with an average of 86 percent. Shoal sediments from all but one area of the project were determined suitable for unconfined open water placement at CLDS documented through a series of sampling compliance adequacy memos, and interagency suitability memos between January 2001 and February 2004. As described earlier, the sediments from one section of the FNP (represented by sampling sites D, E and F in the vicinity of the Interstate 95 Bridge) were found to be toxic in a bioassay and were only suitable for placement in a CAD cell. Materials excavated from depths below -15 feet MLLW to create the CAD cells were found to be similar to reference site material from WLDS and CLDS and deemed suitable for unconfined open water placement at WLDS or CLDS.

In 1980–1981, the Norwalk Harbor FNP underwent maintenance dredging of the 12-foot, 10-foot, and 6-foot deep channels, and the 6-foot deep anchorage. Shoal sediments from the FNP were tested in 1978 and 1979 for physical, chemical and biological testing. In physical tests the 1978 samples averaged 92% total fines for three samples (range of 79 to 99 percent fines); and in the 1979 samples the mean was 85% total fines for 18 samples (range of 12 to 99 percent fines). Nearly all areas of the project were found acceptable for placement in open water in LIS, and about 276,000 CY of primarily organic silt and clay was removed by mechanical bucket dredge from the FNP and placed at the CLDS (October 1979 EA). Approximately 2,000 CY of dredged material from a small area of the West Branch Channel was found to be contaminated with relatively high levels of naphthalene and nitrobenzene. This West Branch material was determined unsuitable for unconfined open water placement; therefore, it was placed in a CAD cell dredged beneath the 10-foot Federal channel and capped with a minimum of five feet of clean dredged material.

Sediment sampling and testing of Norwalk Harbor was also conducted in 1972 and 1975. Grain size analysis from those years characterized the material as primarily silt and clay with the following average percent total fines: 1972 – average 81% total fines for 13 samples (range of 1 to 96 percent fines); 1975 – average of 78% total fines for 16 samples (range of 6 to 97 percent fines). Chemical analyses from these years and the 1978-1979 testing indicated that both the East and West Branch Channels of the FNP had elevated levels of mercury. Also, the West Branch materials showed abnormally high values for volatile solids, zinc, and chemical oxygen demand across multiple years (1980 USACE Sediment Atlas). FNP dredging in 1969 and earlier was not subject to sediment sampling and testing requirements.

In summary, the long history of sediment analysis for the Norwalk Harbor FNP has shown nearly all materials suitable for open water placement in LIS, with some management (capping) required by CT DEEP under their CWA authority. A small area of the West Branch Channel immediately upstream and downstream of the Interstate 95 Bridge has been found unsuitable for unconfined open water placement during the last two maintenance dredging cycles. This area will require further scrutiny during evaluations for any future dredging projects. However, the majority of Norwalk Harbor FNP dredged material should prove suitable for open water placement in the future.

Wilson Point Harbor FNP: Wilson Point Harbor has not been dredged since its initial improvement in 1889 to 1892. Material encountered in the 1892 work was described as mud and sand; about 179,000 CY were removed (AR, 1892). The 1891 improvement dredging of approximately 125,000 CY was also described as sand and mud (AR, 1891). The roughly 110,000 CY of improvement material dredged in 1889 was stated as sand, mud, and clay (AR for 1889). Three locations in the project were sampled in April 2015, with grain size ranging from 44 to 85 percent fines. If this material were considered similar to the material found in the adjacent outer reaches of the Norwalk Harbor FNP, then it can be expected to be silty/clayey material and likely suitable for unconfined open water placement in LIS.

In a suitability determination prepared 28 August 2013 by NAE for the dredging of about 9,880 CY from the Wilson Cove Marina at the head of the harbor, those sediments were found suitable for unconfined open water placement at the WLDS, and most of the same sediments were found suitable for placement at CLDS.

Fivemile River FNP: The Fivemile River FNP was most recently dredged in 1999 when about 48,000 CY of material was removed from the river. Dredged material was found suitable for unconfined open water placement at the CLDS and WLDS. Sediment sampling from17 locations in the FNP for physical and bulk chemical testing was carried out in June 1995. Additional shoal sediment was sampled in June 1996 for solid phase bioassay testing, and in December 1998 for water column toxicity and elutriate testing. While bulk chemistry test results did not indicate high values for any contaminants, the reason for dividing the placement across the two sites was to minimize exposure of the environment to large quantities of varying degrees of sediment contaminants however minor (February 1999 EA – with MPRSA Site Selection Memo of 29 January 1999). Grain size analysis indicated that the material from the FNP channel and anchorage was predominantly silt and clay ranging from 36 to 96 percent fines.

Sediment sampling was also carried out in the Fivemile River in 1974, which indicated that sediments were within normal reporting limits for chemical testing except in the uppermost section of the channel where TOC, a couple of metals, and volatile solids were high. Grain size analysis completed in 1974 showed that sediments were 57 to 96 percent fines, with an average of 80 percent (USACE 1980 Harbor Sediment Atlas).

Maintenance dredging of approximately 47,700 CY of material was conducted in 1968 for the Fivemile River FNP with that material placed at the Norwalk Dumping Ground in LIS (January 1968 Plans and Specifications). No characterization of the material was provided from that event (Annual Report for 1968).

Maintenance materials dredged from the Fivemile River FNP in the future are most likely to be fine-grained shoal materials suitable for unconfined open water placement in LIS. Potentially, the fine-grained material could be used to create saltmarsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise.

The material could also be placed at an ocean site, the closest being the CLDS. The material could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary, this would require further investigation in the future.

One proposal suggested in recent years is to create a confined placement facility among the Norwalk Islands which would eventually be developed and managed as parkland and mixed wildlife habitat of salt marsh, other wetlands, and uplands. This concept could be pursued further if the state and community wish to share in its cost and acquire the necessary real estate interests. Similar projects have been successfully undertaken in the Chesapeake Bay region on a much larger scale using regionally generated dredged materials.

5.12.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Norwalk Area Dredging Center.

5.12.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Norwalk Dredging Center that periodically generate dredged material. These include the deep draft commercial facilities along the West Branch of Norwalk Harbor, and large and small marina, yacht club and boat yard operations in all of the waterways listed above, private residential and public access facilities at many other locations throughout the dredging center, and offshore island access points. The 2009 Dredging Needs Update report projected, based on facility surveys, that 331,800 CY of maintenance dredging and 27,100 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the table below.

Table 5-123 - Dredging Activity Timeline – Norwalk Area Dredging Center Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	58,800	144,000	27,000	27,000	37,500	37,500
Improvement	12,100	7,500	7,500			
Total Non-Federal	70,900	151,500	34,500	27,000	37,500	37,500

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS and CLDS being regularly used approved sites for this area. These activities could also take advantage of whatever alternative placement methods are used for the four FNPs in this dredging center, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

5.12.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to large private permit activities and FNP maintenance activities and generating up to the 250,000-600,000 CY range are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at the CLDS. Several investigations of management alternatives identified the following as opportunities for dredged material management for projects from this dredging center.

The October 1979 EA for Norwalk Harbor considered nine on-shore sites as alternatives to open water placement. However, four of these were marsh fill or shallow tideland or tidal flat fill sites, unlikely to be acceptable from an impact standpoint. Two were less than 10,000 CY in capacity and all but one of the others were slated for development for commercial use or power plant expansion. The final site was a public park the City of Norwalk did not want unavailable for the several years it would take dredged material to dewater and consolidate.

Table 5-124 - Norwalk Area Dredging Center
Available/Potential Placement Alternatives

Placement Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Norwalk Outer Harbor Islands CDF - Fill	Island CDF	242,600	All Once Built	All
- Cap		157,400		All Suitable
Penfield Reef CDF - Fill	Shore CDF	33,539,300	All Once Built	All
- Cap		5,010,700		All Suitable
Bridgeport Yellow Mill Channel CDF - Fill	Shore CDF	197,900	All Until Filled	All
- Cap		102,100		All Suitable

Placement Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Falkner Island CDF - Fill	Island CDF	16,010,200	Once Built	All
- Cap		1,169,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Duck Island Road CDF - Fill	Island CDF	1,376,100	All Once Built	All
- Cap		233,900		All Suitable
Twotree Island CDF, CT - Fill	Island CDF	2,966,200	All Once Built	All
- Cap		433,800		All Suitable
Clinton Harbor CDF - Cap	Shoreline CDF	59,800	All Once Built	All
- Fill		640,200		All Suitable
Norwalk Outer Harbor Islands – Marsh Creation - Fill	Marsh Shore CDF	554,000	All Once Built	Suitable Fine
110 Sand Co., Melville, NY	Upland	1,000,000	Until Filled	All Suitable
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Norwalk West Branch	CAD Cells	Unknown	All	Unsuitable
Marsh Creation – Sandy Point New Haven Harbor	Marsh Fill	1,100,000	All Once Built	All Suitable

This dredging center is projected to yield only fine-grained dredged materials, both suitable and unsuitable, during the 30-year DMMP planning horizon. Alternatives for placement of materials have been identified within and outside of the dredging center. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Alternatives for fine-grained unsuitable materials include isolation from the environment by containment in CAD cells and CDFs.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located southwest of Norwalk Harbor. The Central Long Island Sound site located offshore of New Haven Harbor is more distant. These sites could receive any suitable material, either sandy or fine-grained.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Table 5-125 - Haul Distances to Beach and Nearshore Placement Sites										
Project or Harbor (Distances in Statute Miles)	Norwalk Islands CDF	Cove Island Park	Calf Pasture Beach	Compo Beach	Sherwood Island State Park	Burial Hill Beach	Sasco Hill Beach	Jennings Beach	Seaside Park	New Haven Breakwaters CDF
Westport Harbor and the Saugatuck River	9.8	15.0	7.3	4.0	5.6	6.0	8.0	11.9	13.5	28.2
Norwalk Harbor FNP	3.6	8.8	3.1	12.8	13.3	13.8	15.3	18.8	20.2	34.6
Wilsons Point Harbor FNP	1.3	5.5	3.5	8.9	9.4	10.0	11.8	15.4	16.7	31.2
Fivemile River FNP	3.0	5.0	8.8	9.6	10.3	10.8	12.6	16.1	17.4	32.0

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material. CAD cells have been constructed at Norwalk Harbor in the past in the West Branch in the vicinity of the I-95 Bridge as needed to accommodate unsuitable maintenance material from the West Branch Channel. Additional harbor-specific CAD cells could be constructed in this area in the future if needed.

Table 5-126 - Scow Haul Distances to In-Water Placement Sites										
Project (Distances in Statute Miles)	HARS	Stamford DS	WLIS DS	Eaton's Neck East DS	Southport DS	Bridgeport East	Milford DS	CLDS	Branford DS	Guilford DS	Falkner Is CDF
Westport Harbor & Saugatuck River	78.8	16.1	14.5	12.0	7.6	13.9	20.3	28.4	33.4	37.4	40.9
Norwalk Harbor FNP	73.3	10.4	9.0	8.2	12.6	19.1	26.3	34.5	39.4	43.5	47.1
Wilsons Point Harbor FNP	69.8	7.0	5.5	4.8	9.3	15.8	23.1	31.2	36.2	40.2	43.8
Fivemile River FNP	69.7	6.7	5.4	5.3	9.9	16.4	23.6	31.7	36.7	40.7	44.3

Confined Disposal Facilities: In the past, many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The ten CDFs sites located near this dredging center or identified in the screening process include Norwalk Outer Harbor Islands, Penfield Reef, Bridgeport Yellow Mill Channel, Stratford Point, Milford Outer Harbor, New Haven Breakwaters, Falkner Island, Clinton Harbor, Duck Island Roads, and Twotree Island (Waterford).

5.12.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Norwalk Area Dredging Center, the analysis matched projects with placement alternatives as follows.

Westport Harbor and Saugatuck River: Future maintenance dredging of the Westport Harbor and Saugatuck River FNP will yield fine-grained material, suitable for open water placement. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Westport Harbor are shown below.

Table 5-127 - Westport Harbor and Saugatuck River FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	50,700	2015-2020	Sherwood Island Borrow Pit – Cap	$31
			Sherwood Island Borrow Pit – Fill	$31
			Western Long Island Sound DS	$43
			Yellow Mill Channel CDF – Fill	$133
			Norwalk Islands CDF – Fill	$121
			Captain Harbor CDF – Fill	$133
			Milford Harbor CDF – Fill	$133
			Norwalk Islands Marsh – Fill	$121
			Stratford Point CDF – Fill	$133
			Penfield Reef CDF – Fill	$121
			Morris Cove Pit CAD Cell – Fill	$83
			Central Long Island Sound DS	$48
			Falkner Island CDF – Fill	$167
			Duck Island Roads CDF – Fill	$167
			New Haven Breakwaters CDF – Fill	$138
			Hempstead Harbor CDF – Fill	$138

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Westport Harbor FNP is placement as both fill and cap at the Sherwood Island offshore borrow pit. The second least costly alternative would be open water placement at either the Western LIS site (a 39 percent increase over the least cost alternative), or at the Central LIS site (a 55 percent increase over the cost of Sherwood Island COW). Placement as fill at the Morris Cove borrow pit CAD cell site in New Haven Harbor would cost about 2.7 times the least cost alternative. CDF fill at nearby sites would be 3.9 to 5.4 times the cost of Sherwood Island.

Norwalk Harbor: Future maintenance dredging of the Norwalk Harbor FNP will likely yield fine-grained material suitable for open water placement, except for the small area of the West Branch Channel in the vicinity of I-95 that has twice in the past yielded unsuitable material that was placed in CAD cells beneath that channel. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The unsuitable dredged material must be isolated from the environment by containment in a CDF, CAD cell, or upland landfill approved to receive such material. Unsuitable material can also sometimes be treated to reduce its level of contamination and make it suitable for placement or other uses. The top-scoring alternatives from the site screening process for Norwalk Harbor are shown below.

Table 5-128 - Norwalk Harbor - FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable	236,400	2021-2025	Western Long Island Sound DS	$26
Fines	195,300	2031-2035	Stratford Point CDF – Fill	$123
	195,300	2041-2045	Sherwood Island Borrow Pit – Cap	$21
			Penfield Reef CDF – Fill	$113
			Norwalk Islands Marsh – Fill	$94
			Captain Harbor CDF – Fill	$123
			110 Sand Company Site, NY	$77
			Sherwood Island Borrow Pit – Fill	$21
			Central Long Island Sound DS	$37
			New Haven Breakwaters CDF Fill	$128
			Norwalk Islands CDF – Fill	$94
			Manchester City Landfill	$128
			Brookhaven Town Landfill	$128
			Hempstead Harbor CDF – Fill	$128

Material Type	CY	Year	Alternative	Cost/CY
Unsuitable	20,000	2021-2025	Yellow Mill Channel CDF – Fill	$156
Fines	20,000	2031-2035	Norwalk Islands CDF – Fill	$126
West Branch	20,000	2041-2045	Captain Harbor CDF – Fill	$156
			Norwalk Islands Marsh – Fill	$126
			Stratford Point CDF – Fill	$156
			Penfield Reef CDF – Fill	$136
			Morris Cove Pit CAD – Fill	$107
			New Haven Breakwaters CDF Fill	$160
			Milford Harbor CDF – Fill	$160
			Hempstead Harbor CDF – Fill	$160
			Falkner Island CDF – Fill	$193
			Duck Island Roads CDF – Fill	$193
			Twotree Island CDF – Fill	$193
			Clinton Harbor CDF – Fill	$193
			Norwalk West Branch CAD – Fill	$108

The least cost placement alternatives for the maintenance dredging of suitable fine-grained material from Norwalk Harbor is placement either as fill or cap at the Sherwood Island offshore borrow pit site. Use of the Sherwood Island borrow pit for this purpose could only be accomplished once, as the volume of the first Norwalk placement there would nearly consume the site's entire fill volume. The second least costly alternative would be open water placement at the Western Long Island Sound site, at an increase in cost of 24 percent over the Sherwood Island COW site. The next least costly alternative is open water placement at the CLDS (an increase of 76 percent over the least cost alternatives). Transport and placement at an upland landfill in Connecticut or New York would be about 3.7 to 6.3 times as costly as Sherwood Island or CLDS. Placement in a Norwalk Islands CDF would be about 4.5 times as costly as the least cost alternative.

For Norwalk Harbor's unsuitable material, placement in the Morris Cove borrow pit site CAD cell as fill was the least cost alternative. The second least costly alternative is placement in a CAD cell dredged beneath the west branch channel at Norwalk, as has been done in the past two maintenance cycles for this harbor, at an increase in cost of less than one percent over use of Morris Cove. The third least costly alternative is placement as fill in a Norwalk Islands CDF at an increase of about 18 percent over the least cost alternative. Placement in a shoreline CDF at Penfield Reef would cost 1.3 times the cost of the least costly alternative. Use of other more distant CDF sites would be about 1.5 to 1.8 times the cost of using Morris Cove.

<u>Wilsons Point Harbor</u>: Future maintenance dredging of Wilsons Point Harbor FNP is expected to yield fine-grained material, suitable for open water placement. Suitable fine-grained

materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Wilsons Point Harbor are shown below.

Table 5-129 - Wilsons Point Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	618,900	2026-2030	Hempstead Harbor CDF – Fill	$119
			Stratford Point CDF – Fill	$119
			Penfield Reef CDF – Fill	$119
			Norwalk Islands Marsh – Fill	$88
			Captain Harbor CDF – Fill	$119
			110 Sand Company Site, NY	$99
			Western Long Island Sound DS	$18
			New Haven Breakwaters CDF – Fill	$125
			Sherwood Island Borrow Pit – Cap	$18
			Norwalk Islands CDF – Fill	$88
			Sherwood Island Borrow Pit – Fill	$18
			Brookhaven Town Landfill	$124
			Manchester City Landfill	$124
			Falkner Island CDF – Fill	$143
			Duck Island Roads CDF – Fill	$143
			Central Long Island Sound DS	$38

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from Wilsons Point Harbor FNP is either open water placement at the Western Long Island Sound site, or placement as either fill or cap at the Sherwood Island offshore borrow pit site. The second least costly alternative is placement at the Central Long Island Sound site, at about 2.1 times the cost of the least cost alternative. The third least costly alternative is placement at a Norwalk Outer Harbor Islands CDF site, which would cost 4.9 times the cost of using the WLDS. Placement at an upland landfill in either Connecticut or New York would cost from 5.5 to 6.9 times the least cost alternative. Placement at other CDF sites along the Connecticut shore would cost about seven to eight times the least cost alternative.

<u>Fivemile River Harbor</u>: Future maintenance dredging of the Fivemile River Harbor FNP will yield fine-grained material, suitable for open water placement. Suitable fine-grained materials may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. The top-scoring alternatives from the site screening process for Fivemile River Harbor are shown below.

Table 5-130 - Fivemile River Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	55,400	2021-2025	Sherwood Island Borrow Pit – Fill	$34
			Sherwood Island Borrow Pit – Cap	$34
			Western Long Island Sound DS	$34
			Yellow Mill Channel CDF – Fill	$131
			Norwalk Islands CDF – Fill	$120
			Captain Harbor CDF – Fill	$131
			Hempstead Harbor CDF – Fill	$131
			Norwalk Islands Marsh – Fill	$104
			Stratford Point CDF – Fill	$131
			Penfield Reef CDF – Fill	$131
			110 Sand Company Site, NY	$79
			Morris Cove Pit CAD – Fill	$82
			Brookhaven Town Landfill	$108
			Manchester City Landfill	$108
			Central Long Island Sound DS	$68
			New Haven Breakwaters CDF – Fill	$137

The least cost placement alternatives for the maintenance dredging of fine-grained material from the Fivemile River Harbor FNP would be either open water placement at the Western Long Island Sound site, or placement as either fill or cap for the Sherwood Island offshore borrow pit COW site. The next least costly alternative is open water placement at the Central Long Island Sound site at twice the cost of placement at WLDS. Placement upland at landfills in either Connecticut or New York would be 2.3 to 3.2 times the cost of using the WLDS. Placement in the Morris Cove borrow pit CAD cell site as fill would cost 2.4 times placement at the WLDS. Placement in a Norwalk Harbor Islands CDF for either marsh creation or containment would be 3.1 and 3.5 times the cost of using the WLDS, respectively.

5.12.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-131 - Federal Navigation Project Base Plans Norwalk Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
Westport Harbor and Saugatuck River	Suitable Fines	Sherwood Island Borrow Pit – Cap or Fill
Norwalk Harbor	Suitable Fines	Western Long Island Sound DS or Sherwood Island Borrow Pit – Fill/Cap
Portion of West Branch	Unsuitable	Morris Cove Pit CAD – Fill or a Norwalk West Branch CAD - Fill
Wilsons Point Harbor	Suitable Fines	Western Long Island Sound DS or Sherwood Island Borrow Pit – Fill/Cap
Fivemile River Harbor	Suitable Fines	Western Long Island Sound DS or Sherwood Island Borrow Pit – Fill/Cap

Alternatives to the Federal Base Plan: The Federal base plan for placement of the suitable silty material from all four FNPs in this dredging center is at the Sherwood Island offshore COW site, or if already filled or of insufficient capacity, then in open water at the WLDS. Non open water alternatives to the base plans are the Morris Cove CAD cell, if available, at about 2.5 times the cost of the base plan, or use in a CDF or marsh creation project at the Norwalk Harbor Islands site at three to four times the cost of the base plan. There are no cost-effective alternatives to the base plans for these four projects without non-Federal funding.

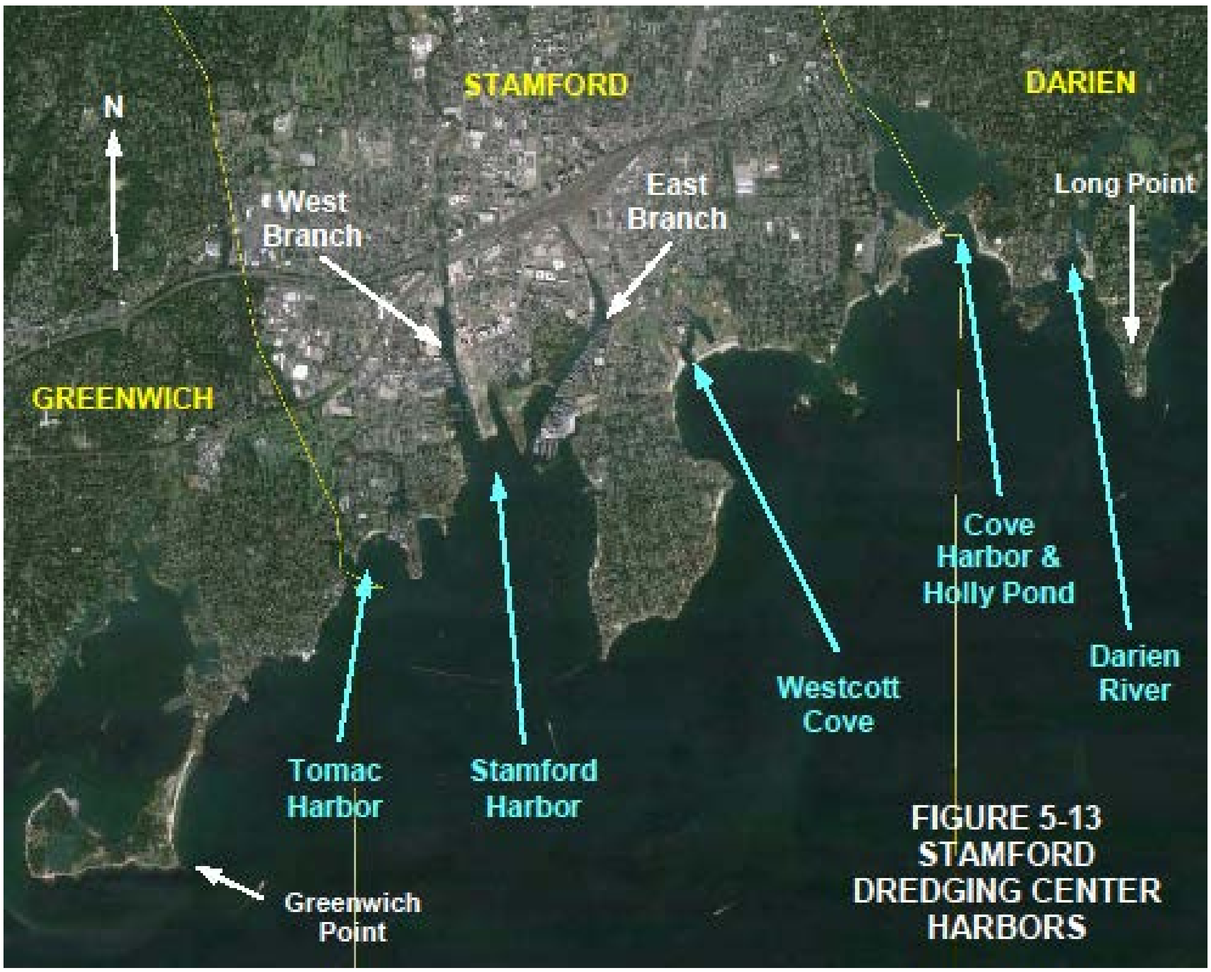
For the unsuitable material from the Norwalk Harbor West Branch Channel, the base plan is placement either in a CAD cell constructed at Norwalk Harbor, or placement in the Morris Cove CAD cell. Containment in a Norwalk Harbor Islands CDF or marsh creation project would be feasible at an increase in cost of 18 percent over the in-harbor CAD cell.

5.13 Stamford Area Dredging Center

The Stamford Area Dredging Center consists of the cities of Stamford and portions of the towns of Darien and Greenwich, Connecticut. The dredging center includes the Federal Navigation Projects (FNP) for Westcott Cove and Stamford Harbor, both in the City of Stamford. The dredging center stretches from Long Point in Darien in the east to Greenwich Point in the west. The dredging center also includes several other small harbors, coves, and rivers which provide navigation access to Long Island Sound for commercial fishermen and boaters, and small-scale barge cargo operations in Stamford Harbor. The principal waterways in this area are:

Darien (Goodwives) River
Cove Harbor and Holly Pond
Westcott Cove – Includes FNP
Stamford Harbor – Includes FNP
Tomac Harbor and Dolphin Cove

The waterways in this dredging center yield a mix of material types, and materials from the two FNPs have always been found suitable for unconfined open water placement. At Stamford Harbor and elsewhere in the dredging center, rivers and other coastal watercourses contribute silty shoal material to the harbors, resulting in harbor maintenance materials which are predominantly fine-grained, and not recommended for beach nourishment or nearshore placement. However, some materials from Westcott Cove have been sand, and were placed on adjacent city beaches.



5.13.1 Federal Navigation Projects - Maintenance

The dredged features of the two FNPs in this dredging center have each been most recently dredged as shown in the following table.

Table 5-132 - Federal Navigation Project Dredging History Stamford Area Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Westcott Cove				
Silty Channel Elevations	1978	13,000	City Park	Suitable Fine
Sandy Portion of Channel		7,500	West Beach	Suitable Sand
Entire Channel	1972	6,000	West Beach	Suitable Sand
Entire Channel	1963	6,700	Stamford DS	Unknown
Entire Channel	1956-57	57,500	Upland	Unknown
Stamford Harbor				
Outer 18-Foot Refuge Project	1941-44	274,900	Unknown	Unknown
15-Foot Main & West Branch Channels and Basin	1963	100,000	Stamford DS	Suitable Fine
	1945-46	46,900	Unknown	Unknown
	1939-40	7,900	Unknown	Unknown
	1937-38	389,600	Unknown	Unknown
12-Foot East Channel	1980	78,000	CLDS	Suitable Fine
	1938	77,200	Unknown	Unknown

Westcott Cove: The FNP for Westcott Cove consists of an 8-foot MLLW channel from deep water in the outer cove into the city marina in the inner Lagoon. The project was initially constructed in 1957 when about 57,500 CY were dredged, and has been maintained twice since then; in 1963, when 6,700 CY of material was placed in open water at the Stamford Disposal Site, in 1972, when 6,000 CY was placed on West Beach, and most recently in 1978, when 13,000 CY of silty materials from lower elevations were placed upland north of the city boat ramp, and 7,500 CY of sandy surface materials were placed on the adjacent West Beach. Soundings from the most recent condition survey (August 2001) indicate that about 36,800 CY of shoal material has accumulated in the channel since 1978. This, together with the prior maintenance events since the 1957 improvement, yields an annual shoaling rate of about 1,500 CY. If this harbor were maintained once in the DMMP planning horizon in about the 2023 timeframe, then a total of about 68,700 CY of shoal material could be expected. The material is likely to be mixed sand and fine-grained material of which a portion (about half) would be available for beach nourishment purposes, and the remaining silty portion suitable for open water placement.

Stamford Harbor: The FNP for Stamford Harbor can be divided into three segments for planning purposes. The project consists of an 18-foot entrance channel and refuge anchorage in the outer harbor protected by two large rubblestone breakwaters. An inner 15-foot main channel splits into a 15-foot West Branch channel with a basin at its upper end, and a 12-foot East Branch channel.

The outer 18-foot refuge features were last dredged for their initial construction in 1944, when about 274,900 CY was removed. No placement location is cited in the records and no maintenance dredging has been conducted since its initial construction. The latest condition survey (STA-726, 2009) indicates that about 146,300 CY of shoal material has accumulated in these outer project features. The period of 1944 to 2008 when the soundings were made represents an annual shoaling rate of about 2,300 CY. If Stamford Harbor were to be maintained during the last half of the DMMP planning horizon (e.g. 2033), then a total of about 203,500 CY would have accumulated in the 18-foot outer project features by that time. For DMMP planning purposes these outer harbor project feature materials are expected to be found suitable for unconfined open water placement.

The 15-foot main and West Branch channels and basin were last improved in 1937 to 1940, when a total of 397,500 CY was removed. Since that time, these features have been maintained twice, in 1945-1946 (46,900 CY), and most recently in 1963, when about 100,000 CY was removed and placed at the Stamford Disposal Site in LIS. The latest condition survey (STA-726, 2009) indicates that about 169,500 CY of shoal material had accumulated in these project features to that point. For the maintenance record period of 1938 to 2008, this represents an average annual shoaling rate of about 4,500 CY. If Stamford Harbor were to be maintained during the last half of the DMMP planning horizon, (say 2033) then a total of about 282,500 CY would have accumulated in this project segment by that time. For DMMP planning purposes, these upper main channel and West Branch Channel materials are expected to be found suitable for unconfined open water placement.

The 12-foot East Branch Channel extends northeasterly from the main channel to above the hurricane barrier. This channel was initially constructed in 1923 and has been maintained five times since then, most recently in 1980 when about 78,000 CY was removed and placed at the CLDS to cap materials dredged from New Haven Harbor in New England's first demonstration of deep-water mound capping. Prior to that the channel was maintained in 1938 when about 77,200 CY was removed. The latest condition survey (STA-726, 2009) indicates that about 70,400 CY of shoal material had accumulated in these project features to that point. For the maintenance record period of 1932 to 2008 this represents an average annual shoaling rate of about 3,000 CY. If this project feature was maintained with the rest of the project in about 2033 then a total of about 144,600 CY would have accumulated in this project segment by that time. Based on the test results from before the 1980 maintenance operation, it is considered unlikely, for DMMP planning purposes, that East Branch materials would be found suitable for unconfined open water placement, at least for its next maintenance dredging action.

The dredging activity timeline over the planning horizon for the two FNPs in the Stamford Area Dredging Center is shown below. Material dredged during the future maintenance of Stamford Harbor is expected to be suitable fine-grained material as in the past.

Table 5-133 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Stamford Area Dredging Center						
Project/Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Westcott Cove						
Channel – Sand Portion		34,300				
Channel – Fines Portion		34,400				
Stamford Harbor						
Outer 18-Foot Refuge				203,500		
15-Foot Channels				282,500		
12-Foot East Channel				144,600		
Total – Suitable Sand		34,300				
Total – Suitable Fine		34,400		486,000		
Total – Unsuitable				144,600		

5.13.2 Harbor Characterization for Federal Navigation Projects

The two FNPs in this dredging center have been managed differently over the years due to differences in material type and the limited availability of small public upland sites around Westcott Cove. Westcott Cove materials have been placed on the beach and upland more often than in open water. Stamford Harbor materials in the past half century have only gone to open water sites (Stamford Disposal Site or more recently CLDS). It is also likely that before the 1940s, dredged material from Stamford Harbor was occasionally used as fill for commercial port development along the channel shores.

Westcott Cove FNP: Westcott Cove was dredged in 1956, 1963, 1972, and 1978. The 1978 maintenance operation removed approximately 20,500 CY which was deposited upland on the west side of the harbor. About 18,000 CY of the dredged material was found suitable for beach nourishment and was placed on the adjacent city West Beach to the west of the inlet, and the remainder of the material was silt which was placed in a diked area upland on parkland owned by the City of Stamford (March 1978 Final EA) north of the boat ramp. Four sediment samples taken in 1975 were analyzed for chemical composition and grain size. The one silty sample showed about 83 percent fines, while the three sandy samples averaged about 10 percent fines (range of 5 to 18 percent). In 1977, sixteen additional sediment samples were taken to delineate the sand and silt areas in the channel. It was found that the sediments in Westcott Cove range from black, fine sandy organic silt (6 samples averaging 75 percent fines), to gray, coarse and fine sand (10 samples averaging less than one percent fines). The sediments were relatively clean with low levels of volatile solids, oil and grease, heavy metals, and other potential pollutants (March 1978 Final EA).

In the 1972 maintenance operation, roughly 6,000 CY of dredged material from the Westcott Cove channel was sand and was placed on West Beach. The 6,700 CY of material dredged in the 1963 maintenance operation was disposed at Stamford Dumping Ground. The original improvement dredging of 57,500 CY in 1956-1957 placed material upland to the west of the harbor between Rippowam and Shippan Avenues. Westcott Cove has and will likely continue to produce shoal materials in of both silty and sandy materials. Whether or not they will be located within the channel so as to enable separate dredging and placement methods during a particular maintenance operation will only be determined during the planning for that action. There are adjacent public beaches that could benefit from sand nourishment if sand is readily available.

Stamford Harbor FNP: The three segments of the Stanford Harbor FNP are characterized individually for planning purposes. The -18-foot MLLW entrance channel and outer anchorage have not been dredged since their 1944 improvement. The sediments in the -18-foot MLLW main entrance channel were tested in 1975 and 1976. The 1975 samples only underwent elutriate testing. Grain size results from the three samples in 1976 averaged 81 percent fines. The test results from both efforts did not exhibit any significantly high values for any of the chemical parameters tested (1980 Harbor Sediment Atlas).

The 15-foot Upper Main Channel, West Branch Channel and Turning Basin of the Stamford Harbor FNP were last maintained in 1963. Approximately 100,000 CY of “ordinary material” was deposited at the Stamford Dumping Grounds (Annual Report for 1964; and April 1963 Plans and Specification). No chemical or physical data on the project material is available from that operation. The 15-foot project segment sediments were tested in 1975 and 1976. The 1975 samples only underwent elutriate testing. The 1976 sampling consisted of six grab samples which averaged 83 percent fines (range 42 to 96 percent).

In a June 1975 EA it was proposed to place the East Branch materials at the Eaton’s Neck Disposal Site, and conduct a long-term monitoring program comparing the placement mound created there with a similar mound to be created at the same site with materials to be dredged the same season from Eastchester Creek and Milton Harbor, New York. Sampling in the East Branch in 1971 conducted for the 1975 EA revealed that the southernmost sample contained abnormally high values for oil and grease and lead. None of the other samples taken below the hurricane barrier gave any unusually high values. Above the hurricane barrier, abnormally high values were found for all chemical parameters tested. That work was put on hold while other placement options were investigated. A proposal by the City of Stamford to construct a containment facility with dikes and timber bulkheads to fill the tidal flats between the East Branch channel and Kosciuszko Park was ultimately abandoned for cost reasons.

The 12-foot MLLW East Branch Channel and Basin of the Stamford Harbor FNP were last maintained in 1980, when approximately 78,000 CY of sandy organic silts was dredged from the channel and disposed at the CLDS. Several sediment sampling and testing efforts were carried on in anticipation of the 1980 action (1971, 1975, 1976, 1978, and 1979). All of these efforts except for the 1975 work included physical and bulk chemical testing. The 1975 and 1976 efforts included elutriate testing, and the 1978 and 1979 efforts included bioassay tests. Chemical testing of the Stamford East Branch sediments in 1978 showed that they contained relatively high levels of some metals, leading to the decision to isolate the East Branch materials at the placement site with a cap of cleaner material. The 1978 sample sites showed an average of 80 percent fines (range of 35 to 94 percent). A second EA finalized in October 1978 covered the maintenance of both Stanford's East Branch Channel and entrance channel at New Haven Harbor.

Additional sampling from 29 sites in 1979 showed an average of 71 percent fines (range of 8 to 99 percent). All samples taken above the hurricane barrier presented abnormally high or moderately high values for all parameters. Below the barrier, only two samples showed high values: one for mercury and the other sample for vanadium (1980 Harbor Sediment Atlas). Based on these tests, the East Branch materials were found suitable for placement at the CLDS, but with capping. Maintenance material dredged from the New Haven Harbor FNP that same season was then used as a cap for the Stamford Harbor material at CLDS.

An EA for the dredging of a small amount of material (about 250 CY) from under the navigation gate of the Stamford Hurricane Barrier, dated 1984, described the sediments beneath the navigation gate of the Stamford Hurricane Barrier as silty, sandy, clayey material (0.2% - 77% fines with an average of 49%). The proposed placement site was a small upland storage yard near the Federal project. Bulk chemistry results revealed that the sediments were contaminated with relatively high levels of zinc, cadmium, and lead (USACE, 1984b). This project was completed in January 1985.

The Stamford Dredging Center in General: As described above the dredging of these two FNPs yields significantly different types and quantities of material. Westcott Cove yields both sandy and silty material which has been placed upland most often in the past using hydraulic pipeline dredge. Stanford Harbor has most often used a mechanical bucket dredge with open water placement at various sites in central and western LIS to dispose of its fine grained materials. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

Maintenance of Stamford Harbor is expected to generate fine-grained materials largely suitable for unconfined open water placement. Potentially, the fine-grained material could be used to create salt marsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. The fine materials could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (brownfields, highway landscaping). However, no such purposes were identified by this study. These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary this would require further investigation in the future.

Maintenance of Westcott Cove is anticipated to generate both sandy and suitable fine-grained material. Whether any discrete portion of this mixed material can be removed in a manner that would make it available for nearshore or direct beach placement would need to be shown by sampling and testing at the time of the action. Material that is shown to be available can be used, as in the past, on adjacent city beaches. The fine-grained materials, as with Stamford Harbor, could be placed at an open water site or made available for other uses. Whether upland placement on city lands could be used again would need to be investigated at that time.

Creation of a confined placement facility among the Norwalk Islands could be further examined either as a smaller-scale area to serve the needs of Norwalk Harbor, or on a larger scale as a regional facility. Such a facility could eventually be developed and managed as parkland and mixed wildlife habitat of salt marsh, other wetlands, and uplands depending on its final size. This concept could be pursued further if the state and community wish to share in its cost, acquire the necessary real estate interests, and manage the facility. Similar projects have been successfully undertaken in the Chesapeake Bay region on a much larger scale using regionally generated dredged materials. Materials from this dredging center could also be placed at an ocean site as at present, the closest being the WLDS.

5.13.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Stamford Area Dredging Center.

5.13.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Stamford Dredging Center that periodically generate dredged material. These include the deep draft commercial facilities along the West Branch of Stamford Harbor, large and small marinas, yacht club and boat yard operations in all of the waterways listed above, private residential and public access facilities at many other locations throughout the dredging center.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 331,800 CY of maintenance dredging and 27,100 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the table below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS and CLDS being regularly used approved sites for this area. These activities could also take advantage of whatever alternative placement methods are used for the four FNPs in this dredging center if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-134 - Dredging Activity Timeline – Stamford Dredging Center Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	74,600	50,000	20,000	20,000	30,000	30,000
Improvement	100,000					
Total Suitable Fine	174,600	50,000	20,000	20,000	30,000	30,000

5.13.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to large-sized range of dredging project sizes over the DMMP planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to large private permit activities, and FNP maintenance activities and generating up to the 100,000-630,000 CY range are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at open water sites in LIS. Several investigations of management alternatives identified the following as opportunities for management of dredged material for projects from this dredging center.

Table 5-135 - Stamford Area Dredging Center Available/Potential Placement Alternatives					
Placement Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT		CAD Fill	466,100	All Until Filled	All
		CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit		COW Fill	266,000	All Until Filled	All Suitable
		COW Cap	484,000		
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable
Norwalk Outer Harbor Islands CDF	- Fill	Island CDF	242,600	All Once Built	All
	- Cap		157,400		All Suitable
Norwalk Outer Harbor Islands Marsh Creation	- Fill	Marsh Shore CDF	554,000	All Once Built	Suitable Fine
	- Cap		376,000		
Captain Harbor CDF Greenwich	- Fill	Island CDF	498,200	Once Built	All
	- Cap		331,800		All Suitable
Falkner Island CDF Guilford	- Fill	Island CDF	16,010,200	Once Built	All
	- Cap		1,169,800		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Duck Island Road CDF	- Fill	Island CDF	1,376,100	All Once Built	All
	- Cap		233,900		All Suitable
Twotree Island CDF, CT	- Fill	Island CDF	2,966,200	All Once Built	All
	- Cap		433,800		All Suitable
Milford Harbor CDF	- Fill	Shore CDF	219,100	All Once Built	All
	- Cap		50,900		All Suitable
Hempstead Harbor NY CDF	- Fill	Shore CDF	2,787,700	All Once Built	All
	- Cap		712,300		All Suitable

Placement Alternative	Site Type	CY Capacity	Years Available	Material Accepted
Stamford Harbor CDF - Fill	Island CDF	1,700,000	Once Built	All
110 Sand Co., Melville, NY	Upland	1,000,000	Until Filled	All Suitable
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Cummings Park Beach	Beach	52,200	Recurring	Suitable Sand
West Beach (Westcott Cove)	Beach	8,000	Recurring	Suitable Sand
Greenwich Point Park	Nearshore	148,000	Recurring	Suitable Sand
Cove Island Park	Beach or Nearshore	27,100 28,200	Recurring	Suitable Sand
Calf Pasture Beach (Norwalk)	Beach or Nearshore	43,000 30,200	Recurring	Suitable Sand
Sandy Point Beach, RI	Nearshore	80,000	Recurring	Suitable Sand

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement alternatives available for unsuitable materials from the inner areas of Greenwich Harbor include containment in CDFs and CAD cells or in upland landfills approved to receive such materials.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

<u>Beach and Nearshore Nourishment Sites</u>: The coastline of the Stamford dredging center is a mix of small beaches and rocky coast, with small coastal plain river inlets, small bays and coves, and rocky headlands and islands. There are a few small public and private beaches. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from the Stamford area. Six beaches listed above were identified by the screening process, or are beaches in the vicinity that were constructed with Federal assistance. The closest public beaches that could receive clean dredged sand are shown below.

Table 5-136 - Haul Distances to Beach and Nearshore Placement Sites										
Project or Harbor (Distances in Statute Miles)	Norwalk Islands CDF	Greenwich Point Beach	Cummings Park Stamford	Cove Island Park	Calf Pasture Beach	Compo Beach	Sherwood Island State Park	Burial Hill Beach	Sasco Hill Beach	New Haven Breakwaters CDF
Darien River	5.9	6.3	2.9	1.9	10.9	11.6	12.2	12.6	14.5	34.0
Cove Harbor	6.0	5.8	2.4	0.3	11.0	11.7	12.3	12.7	14.6	34.1
Westcott Cove	6.6	5.4	0.2	2.4	11.8	12.7	13.1	13.8	15.5	35.0
Stamford Harbor (at the Barrier)	9.2	3.6	5.0	5.4	14.5	15.2	15.8	16.5	18.1	37.6

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained.

Table 5-137 - Scow Haul Distances to In-Water Placement Sites in Statute Miles											
Project	HARS	Stamford DS	WLIS DS	Eatons Neck East DS	Southport DS	Bridgeport East	Milford DS	CLDS	Branford DS	Guilford DS	Falkner Is CDF
Darien River	69.7	4.8	4.0	5.8	12.0	18.5	25.7	33.7	38.8	42.8	46.4
Cove Harbor	66.6	4.5	3.9	6.0	12.1	18.6	25.8	33.8	38.9	42.9	46.5
Westcott Cove	66.5	4.3	4.0	6.5	13.0	19.5	26.6	34.8	39.8	43.8	47.4
Stamford Harbor (at the Barrier)	65.7	4.1	5.0	8.5	15.6	22.0	29.3	37.4	42.4	46.4	50.0

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood

Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor (New York), Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, Bridgeport Yellow Mill Channel, Milford Outer Harbor, New Haven Breakwaters, Falkner Island, Duck Island Roads, and Twotree Island (Waterford).

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands.

Stamford Outer Harbor Site: A portion of the outer harbor at Stamford in the lee of the refuge breakwater and west of the outer harbor anchorage has been suggested in the past as a site for a semi-regional CDF or CAD cell to handle material from the harbors in western Fairfield County. A CDF at this site would use the breakwater as its seaward containment and construct armored dikes on its other sides. A CDF could accept all types of dredged materials with any unsuitable dredged materials segregated to the center of the filled area at lower elevations. Alternatively, a CAD cell could be constructed beneath the harbor bottom at the same location should subsurface conditions allow significant depth of excavation. Such a CAD cell should be sized to accept unsuitable materials from both Stamford and Greenwich, and once filled could be capped with suitable material from either harbor.

5.13.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Stamford Area Dredging Center, the analysis matched projects with placement alternatives as follows.

Westcott Cove: Future maintenance of the Westcott Cove FNP will yield two different types of dredged material over the DMMP planning horizon. Clean sand has been found in the surface sediments in the middle reaches of the entrance channel, while siltier material has been found elsewhere in the channel. The sandy material could be beneficially used for beach or nearshore bar nourishment, or as CDF or CAD cell cap material. The only beaches within hydraulic pipeline dredge pumping distance are the east and west beaches at Cummings Park. More distant beaches would require nearshore bar system placement by scow or hopper dredge.

Both sandy and silty materials could be placed at open water sites, or in containment facilities (CDFs). While this may not be the best use of clean sand as a resource, it may in some cases be less costly. Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically. Both types of material are suitable for open water placement. The top-scoring alternatives from the site screening process for Westcott Cove are shown below.

Table 5-138 - Westcott Cove FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Clean Sand	34,300	2021-2025	Sherwood Island Borrow Pit – Cap	$47
			Western Long Island Sound DS	$39
			Cummings Park Beaches – On-Beach	$33
			Norwalk Islands CDF – Fill	$123
			Cove Island Park Beach – Nearshore	$38
			Captain Harbor CDF – Cap	$123
			Hempstead Harbor CDF – Cap	$141
			Norwalk Islands Marsh – Cap	$123
			Penfield Reef CDF – Cap	$141
			Cove Island Park Beach – On-Beach	$38
			Bayville Beach – Nearshore	$66
			Calf Pasture Beach – Nearshore	$66
			Sherwood Island State Park – Berm	$82
Suitable Fine	34,400	2021-2025	Norwalk Islands CDF – Fill	$123
			Captain Harbor CDF – Fill	$123
			Hempstead Harbor CDF – Fill	$141
			Norwalk Islands Marsh – Fill	$123
			Penfield Reef CDF – Fill	$141
			Sherwood Island Pit COW – Cap	$47
			Sherwood Island Pit COW – Fill	$47
			110 Sand Company, Melville NY	$79
			Western Long Island Sound DS	$39
			Yellowmill Channel CDF – Fill	$143
			Morris Cove Pit CAD Cell – Fill	$91
			Manchester City Landfill	$114
			Central Long Island Sound DS	$78
			New Haven Breakwaters CDF – Fill	$173
			Stamford Harbor CDF – Fill	$123

The least cost placement alternative for the maintenance dredging of suitable sand material from the Westcott Cove FNP is direct placement on the Cummings Park beaches east and west of the cove inlet. The second least costly alternatives are placement at Cove Island Beach, either nearshore or directly on the beach, at a 15 percent increase over placement at Cummings Park. The next least costly alternative is open water placement at the Western Long Island Sound site at an increase of 18 percent over placement at Cummings Park. The next least costly alternative is placement as cap material at the Sherwood Island offshore borrow pit COW site after it has been filled by other projects, at an increase of 42 percent in cost over Cummings Park. Nearshore nourishment of more distant beaches such as Bayville, New York or Calf Pasture in Norwalk would be about twice the cost of the least cost alternative. Placement as cap at various CDF sites in the western sound would be 2.5 to 4.3 times the cost of the least cost alternative.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Westcott Cove FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 21 percent. The next least costly alternatives would be placement in open water at the Central Long Island Sound site, or transport and placement upland at a landfill in New York at about twice the cost of using the WLDS. Next least costly is placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at 2.3 times the cost of using the WLDS. Transport and placement at an upland landfill in CT would be about three times the cost, while placement as CDF fill or marsh creation fill at the Norwalk Harbor Islands site would be about 3.2 times the cost of the least cost alternative.

Stamford Harbor: Future maintenance of the Stamford Harbor FNP will yield two different types of dredged material over the DMMP planning horizon. Fine-grained material from the outer harbor and western channels is expected to be found suitable for unconfined open water placement, while materials from the East Branch channel are expected to be found unsuitable. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement. Unsuitable materials must be either contained in a CAD cell or CDF, or treated before placement or use.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Stamford Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at about twice the cost of using the WLDS. The next least costly alternatives would be placement in open water at the Central Long Island Sound site (3.9 times the cost of using the WLDS), use as cap material at the Morris Cove borrow pit CAD cell site (5.2 times the cost of WLDS), placement in a CDF constructed in Stamford Harbor (6.9 times the cost of WLDS), or transport and placement upland at a landfill in New York at about seven times the cost of using the WLDS. Next least costly is placement at either the Norwalk Islands or Captain Harbor CDF sites as fill at about 8.5 times the cost of using the WLDS.

Table 5-139 - Stamford Harbor FNP – Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	486,000	2031-2035	Captain Harbor CDF – Fill	$111
			Hempstead Harbor CDF – Fill	$120
			Norwalk Islands Marsh – Fill	$111
			Penfield Reef CDF – Fill	$120
			110 Sand Company, Melville NY	$92
			Sherwood Island Pit COW – Cap	$27
			Western Long Island Sound DS	$13
			Norwalk Islands CDF – Fill	$111
			Stratford Point CDF – Fill	$125
			Sherwood Island Pit COW – Fill	$27
			Morris Cove Pit CAD Cell – Fill	$67
			Manchester City Landfill	$118
			New Haven Breakwaters CDF – Fill	$144
			Central Long Island Sound DS	$51
			Stamford Outer Harbor CDF – Fill	$89
Unsuitable Fine	144,600	2031-2035	Norwalk Islands CDF – Fill	$114
			Captain Harbor CDF – Fill	$114
			Hempstead Harbor CDF – Fill	$125
			Norwalk Islands Marsh – Fill	$114
			Penfield Reef CDF – Fill	$125
			Yellow Mill Channel CDF – Fill	$130
			Milford Harbor CDF – Fill	$130
			Stratford Point CDF – Fill	$130
			Morris Cove Pit CAD Cell – Fill	$71
			Falkner Island CDF – Fill	$161
			Duck Island Roads CDF – Fill	$161
			New Haven Breakwaters CDF – Fill	$161
			Stamford Harbor CAD – Fill	$67
			Stamford Outer Harbor CDF – Fill	$95

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained material from the Stamford Harbor FNP is placement in a CAD cell constructed beneath Stamford Harbor. The second least costly alternative is placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at a six percent increase in cost. The third least costly alternative is placement in a CDF to be constructed at Stamford Outer Harbor, at a 42 percent increase in cost over the harbor CAD cell. The next least costly alternatives are placement as fill in the CDF sites at Norwalk Harbor Island and Captain Harbor, at a 70 percent increase over Morris Cove. Use of the Hempstead, New York or Penfield Reef CDF sites would entail an 87 percent increase over Morris Cove.

5.13.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-140 - Federal Navigation Project Base Plans
Stamford Area Dredging Center Projects

FNP Project and Segment	Material Type	Federal Base Plan
Westcott Cove	Sand	Cummings Park Beaches – On-Beach
	Suitable Fines	Western Long Island Sound DS
Stamford Harbor	Suitable Fines	Western Long Island Sound DS
East Branch	Unsuitable	Stamford in-Harbor CAD Cell, or Morris Cove Pit CAD Cell Fill

Alternatives to the Federal Base Plan: The Federal base plan for placement of the sandy materials from Westcott Cove is as nourishment on the beaches at Cummings Park, with placement as nourishment Cove Island Beach at a 15 percent increase.

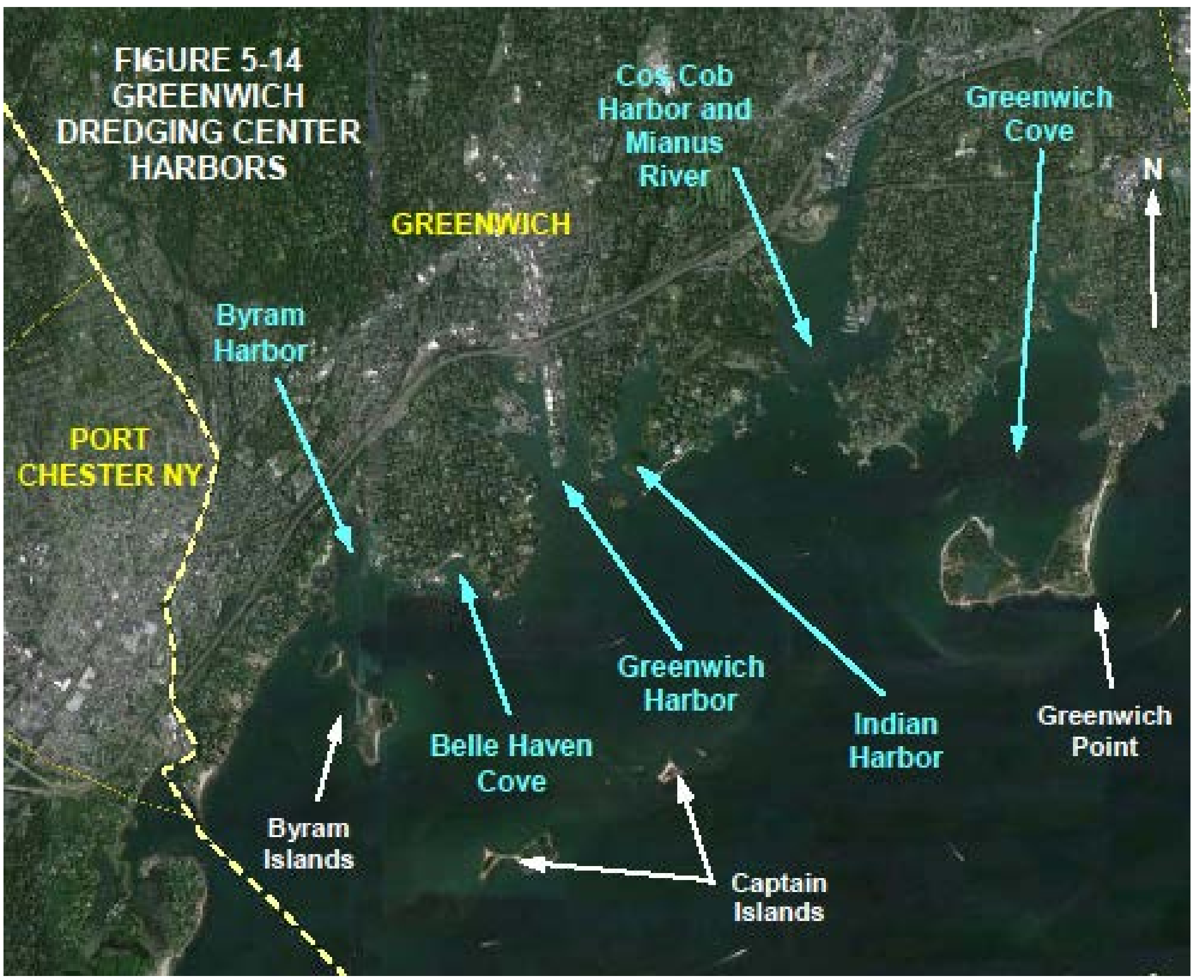
For the suitable fine-grained material from both FNPs in this dredging center, the Federal base plan is open water placement at the WLDS. Placement at the Sherwood Island COW site is the least costly non-open water alternative for both harbors. The cost difference over using the WLDS site is only 21 percent more for Westcott Cove, but twice the cost for Stamford Harbor, due to differences in distance and project volumes. Use of the Westcott Cove materials in a Norwalk Harbor Islands CDF or marsh creation project would be more than 3 times the cost and uneconomic unless non-Federal funding was provided. Also not cost-effective would be placement in a CDF constructed at Stamford Harbor at nearly seven times the cost of open water placement.

For the unsuitable material from the Stamford Harbor East Branch Channel, the base plan is placement either in a CAD cell constructed at Stanford Harbor, or placement in the Morris Cove CAD cell at a six percent increase in cost. Containment in a Stamford Harbor CDF or at a Norwalk Harbor Islands marsh creation project would be not cost-effective at increases in cost of 42 and 70 percent, respectively, over the in-harbor CAD cell, unless another Federal authority and or non-Federal funding were available.

5.14 Greenwich Area Dredging Center

The Greenwich Area Dredging Center consists of most of the shore areas of the town of Greenwich, Connecticut, and includes the Federal Navigation Projects (FNP) for the Mianus River and Greenwich Harbor. The dredging center stretches from Greenwich Point in the east westerly to Byram Point on the east side of the entrance to Port Chester Harbor and the Byram River, the boundary between Connecticut and New York. The dredging center also includes a number of other small harbors and coves which provide navigation access to Long Island Sound for commercial fishermen and boaters. The principal waterways in this area are:

Greenwich Cove
Mianus River and Cos Cob Harbor – Includes FNP
Indian Harbor
Greenwich Harbor – Includes FNP
Belle Haven Cove
Byram Harbor
Captain Harbor and its offshore islands



This dredging center also includes a number of offshore islands which require navigation access, mainly the Captain Islands. The waterways in this dredging center yield mainly fine-grained materials, all found suitable for unconfined open water placement. In entrance channels, shoal material can be sandier, though not so as to make it suitable for direct beach placement or nearshore bar nourishment.

5.14.1 Federal Navigation Projects - Maintenance

The dredged features of the two FNPs in this dredging center have each been dredged most recently as shown below.

Table 5-141 - Federal Navigation Project Dredging History
Greenwich Area Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Mianus River (Cos Cob Harbor)	1985	52,700	WLIS-III	Suitable Fine
	1964	18,000	Stamford DS	Unknown
Improvement	1951	211,100	Stamford DS	Mud
Greenwich Harbor				
Entrance Channel	1968	39,800	Stamford DS	Suitable Fine
All Areas including Anchorages	1951	408,000	Stamford DS	Suitable Fine
Entrance Channel	1940	110,200	Unknown	Unknown
	1931	41,800	Unknown	Unknown

Mianus River and Cos Cob Harbor: The FNP for the Mianus River consists of a 6-foot deep entrance channel from deep water in Cos Cob Harbor upriver to a point just below the US Route 1 Bridge. The channel was last improved in 1950-1951 when about 211,100 CY was removed and placed at the Stamford Disposal Site. Since that time, the channel has been maintained twice. In 1964 about 18,000 CY were removed and also placed at the Stamford Disposal Site. And in 1985 about 52,700 CY were removed and placed the Western Long Island Sound III (WLIS-III) placement site located south of the harbor. The most recent condition survey shows that about 63,600 CY of shoal material has accumulated in the project since 1985 (MIA-261, 2011, with soundings from September 2009), yielding an average annual shoaling rate for that 24-year period of about 2,600 CY. The project is currently being considered for maintenance dredging. If the project were maintained in 2017 a total of about 84,700 CY could be expected at that time. If future maintenance were to occur on a twenty year frequency, then another maintenance operation carried out in 2037 could be expected to generate about 53,000 CY.

Greenwich Harbor: The FNP for Greenwich Harbor consists of a 12-foot deep entrance channel about 130 feet wide, from deep water in LIS up to a point abreast the old steamboat wharf. Above this point in the inner harbor the 12-foot channel narrows to 100 feet and continues to the head of the cove at Arch Street. Two anchorage areas lie west of the upper channel, an 8-foot anchorage located south and east of Grass Island, and a 6-foot anchorage located northeast of Grass Island. The entrance channel was last improved in 1919-1920 and has since been maintained five times, most recently in 1968 when about 39,800 CY was removed and placed at the Stamford Disposal Site. The most recent condition survey shows that about 63,600 CY of shoal material has accumulated in the project since 1968 (GRW-300, 2012, with soundings from December 2011), yielding an average annual shoaling rate for that 43-year period (1968-2011) of about 2,600 CY. The project is currently being considered for maintenance dredging. If the project were maintained in 2019, then a total of about 130,500 CY could be expected from the channel at that time. If future maintenance were to occur on a twenty year frequency, then another maintenance operation carried out in 2039 could be expected to generate about 51,200 CY.

The inner harbor project features at Greenwich Harbor were last dredged in 1951 as part of the improvement project to add those features to the FNP. The two anchorage areas were part of this action. At that time about 408,000 CY was removed from the inner harbor and placed at the Stamford Disposal Site in LIS. The 2012 condition survey (GRW-300) shows about 167,800 CY of accumulated shoal material in the two anchorage areas, yielding an average annual shoaling rate for that 60-year period (1951 to 2011) of about 2,800 CY. If these features of the project were maintained concurrently with the 12-foot channel, then about 190,100 CY could be expected for removal in 2019 and about 55,900 CY in 2039.

The dredging activity timeline over the planning horizon for the two FNPs in the Greenwich Area Dredging Center is shown below.

Table 5-142 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Greenwich Area Dredging Center

Project/Segment	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Mianus River	84,700				53,000	
Greenwich Harbor						
Entrance Channel	65,200				25,600	
Inner Channel	65,300				25,600	
Inner Harbor	190,100				55,900	
Total Suitable Fine	149,900				78,600	
Total Unsuitable	255,400				81,500	

5.14.2 Harbor Characterization for Federal Navigation Projects

The two FNPs in this dredging center have been managed similarly over the past half century as they have yielded similar material types and quality, with materials from both harbors found suitable for unconfined open water placement in LIS (Stamford Disposal Site and the WILS III site). However, recent sediment testing shows significant differences in material quality due to elevated levels of contaminants identified in portions of the Greenwich Harbor FNP. It is also likely that before the 1940s, dredged material from portions of Greenwich Harbor was used as fill for port development along the harbor shores.

<u>Mianus River FNP</u>: The Mianus River sediments have been consistently fine-grained. The 1985 maintenance dredging of the Mianus River FNP was documented by a January 1985 EA (signed March 1985). That NEPA document was supported by sediment sampling and testing carried out in 1983. The seven samples tested in that effort showed an average grain size of 93 percent fines (range of 68 to 98 percent). An earlier set of six sediment samples, taken in 1980, averaged 88 percent fines (range 67 to 99 percent). A January 1977 Draft Environmental Statement had also been prepared, but the work was not carried out at that time due to lack of an approved placement site. Sediment sampling and testing in support of that EA was carried out in 1975, with the five samples tested averaging 78 percent fines (range of 36 to98 percent). Bulk chemistry test results indicated that the samples had low (Category 1) levels of contaminants when compared to the Connecticut guidelines in use at that time.

In anticipation of upcoming maintenance dredging the project shoal sediments were again sampled in 2005. Twelve sample locations were tested for grain size, bulk chemistry, and bioassay/ bioaccumulation testing. The average grain size was 87 percent fines (range 65 to 94 percent). Samples were composited for chemical testing from the three river reaches (below the railroad bridge, between the railroad and interstate bridges, and two composites from above the Interstate 95 Bridge). Bulk chemistry results indicated low levels of contaminants.

The bioassay/bioaccumulation tests conducted for the 2005 samples were used to determine the suitability of the material for unconfined open water placement. Woods Hole Group (2005) prepared a report to document the methods and results of the three biological tests performed. EPA ran a risk-assessment model of the bioaccumulation results. For these compounds, the toxicological significance of bioaccumulation from the sediment into benthic organisms was evaluated. It was determined that the placement of the material as proposed would not cause any significant undesirable effects, and that the proposed dredged material was suitable for unconfined open water placement as specified by the MPRSA (Marine Protection, Research and Sanctuaries Act) regulations and therefore acceptable for placement at either the WLDS or CLDS. Funds for maintenance dredging in 2005 and subsequent years were not forthcoming until 2015, when sediment testing is planned to be repeated.

<u>Greenwich Harbor FNP</u>: The Greenwich Harbor channel was last dredged in 1968, when approximately 39,800 cy of material was removed and disposed of at the Stamford Dumping Ground (Annual Report for 1968, and January 1968 Plans and Specifications). However, there is no sediment test information available from that event. Sediment test results for the Greenwich Harbor Channel from 1974 indicated that the shoal sediments averaged 58 percent fines (range of 22 to 97 percent). One sample taken from the 1974 testing from the uppermost end of the channel showed abnormally high values for concentrations of the metals lead and mercury (1980 Harbor Sediment Atlas).

Maintenance dredging of all FNP features at Greenwich Harbor was again considered in 2012. Sediment coring and water sampling activities were completed at the Greenwich Harbor FNP in January 2012 as part of the environmental analysis of the proposed maintenance dredging of approximately 300,000 CY of sediments from the Federal project. Cores were collected from

34 locations and water samples from eight locations within the FNP, and sediment grabs and water samples were also collected from the reference placement locations at CLDS and WLDS. Core samples were composited into eight groups, which underwent toxicity testing and bulk chemical analysis (Woods Hole Group, 2012). Harbor sediment consisted mainly of silt and clay overlain by slightly sandy (fine to medium sand) and organic material. Native material beneath the harbor sediment contained less sand and little to no organics. Sediment chemistry results indicated that bioassay/bioaccumulation tests were required. Only the results for one species in one of the three toxicity tests from several of the composites indicted concern. Tissue analysis from the composite sample tests showed that analyte detections increased from the outer harbor to the inner harbor. In accordance with the findings of a 19 May 2014 suitability determination, all shoal sediments in the inner harbor, and from all but the lower reach of the entrance channel, are unsuitable for unconfined open water placement in LIS. The shoal sediments from the outer harbor end of the channel are suitable for unconfined open water placement. For the purposes of this DMMP it is assumed that split between suitable and unsuitable materials in the channel is 50/50.

<u>The Greenwich Dredging Center in General</u>: As described above the future maintenance dredging of these two FNPs is expected to yield a significantly different quality of silty shoal sediments. The testing history for the Mianus River indicates that dredged material from that FNP will continue to be found suitable for unconfined open water placement in LIS. However, future maintenance of the Greenwich Harbor FNP, at least in the next maintenance operation, is expected to yield unsuitable material from at least the inner harbor portion of the project features. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

Maintenance of the two FNPs has typically used open water placement in LIS, at the Stamford or WLDS sites. The Greenwich project also used upland placement as marsh fill for public and private marina development at Grass Island in earlier times. Maintenance of both projects is expected to generate mainly fine-grained materials suitable for unconfined open water placement. Testing prior to each dredging operation will be needed to confirm suitability for alternative placement.

Potentially the fine-grained material could be used to create salt marsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise.

Creation of a confined placement facility among the Norwalk Islands or at outer Stamford Harbor could be examined on a larger scale as a regional facility. Should the state or others decide to pursue creation of a confined placement facility for parkland or habitat development, then Greenwich Dredging Center projects could potentially provide material towards that purpose. Similarly a CAD cell developed in outer Stamford Harbor could also be sized to accommodate the needs of the adjoining Greenwich dredging center. This concept could be pursued further if the state and community wish to share in its cost, acquire the necessary real estate interests, and manage the facility. Similar projects have been successfully undertaken in the Chesapeake Bay region on a much larger scale using regionally generated dredged materials.

Suitable dredged material from the Greenwich dredging center could also be placed at an ocean site, the closest being the WLDS. The material could also be placed upland, with dewatering and re-handling, if found cost-effective for some public purpose (Brownfields, highway landscaping). These methods would require dewatering and transport upland. Lined trucks would be needed to transport material that would be dewatered on-site upland. If determined necessary, this would require further investigation in the future.

5.14.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Greenwich Area Dredging Center.

5.14.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Greenwich Dredging Center that periodically generate dredged material. These include large and small marinas, yacht clubs and boat yard operations in all of the waterways listed above, private residential and public access facilities at many other locations throughout the dredging center, and offshore island access points. The 2009 Dredging Needs Update report projected, based on facility surveys, that 187,900 CY of maintenance dredging and 49,000 CY of improvement dredging would be needed by non-Federal facilities. These totals are shown in the table below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS being the closest approved site. These activities could also take advantage of whatever alternative placement methods are used for the two FNPs in this dredging center, or possibly in the Port Chester-Rye, New York area if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-143 - Dredging Activity Timeline – Greenwich Area Dredging Center Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	82,200	45,500	14,900	14,800	10,300	10,200
Improvement		25,000	12,000	12,000		
Total Non-Federal	82,200	70,500	26,900	26,800	10,300	10,200

5.14.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating 300,000 CY or more are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at the Stamford and WLDS.

However, port/upland fill for specific purposes has been used as well at Greenwich. The several investigations of management alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-144 - Greenwich Area Dredging Center
Available/Potential Placement Alternatives

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	554,000	All Once Built	Suitable Fine
- Cap		376,000		
Norwalk Outer Harbor Islands CDF - Fill	Island CDF	242,600	All Once Built	All
- Cap		157,400		All Suitable
Captain Harbor CDF Greenwich - Fill	Island CDF	498,200	Once Built	All
- Cap		331,800		All Suitable
Falkner Island CDF Guilford - Fill	Island CDF	16,010,200	Once Built	All
- Cap		1,169,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Duck Island Road CDF - Fill	Island CDF	1,376,100	All Once Built	All
- Cap		233,900		All Suitable
Hempstead Harbor NY CDF - Fill	Shore CDF	2,787,700	All Once Built	All
- Cap		712,300		All Suitable
Twotree Island CDF, CT - Fill	Island CDF	2,966,200	Once Built	All
Stamford Harbor CDF – Fill	Island CDF	1,700,000	Once Built	All
Groton Black Ledge CDF – Fill	Island CDF	6,930,000	Once Built	All
Stratford Point CDF – Fill	Shore CDF	33,666,900	Once Built	All
110 Sand Co. Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Greenwich Harbor Specific CAD Cell – Fill and Cap	Harbor CAD	To Design	Once Built	All
Stamford Harbor CAD Cell Fill	CAD Cell	To Design	Once Built	All

No sandy materials are projected to be dredged from the Greenwich dredging center. However, some areas of Greenwich Cove have been dredged by non-Federal interests, and the area has been studied for adoption of a FNP in the past. This non-Federal harbor could produce sandy dredged materials given its geological origins, surrounded by a long sandy spit and barrier beach. The closest public beaches that could receive clean dredged sand, if any were encountered, are shown below.

Table 5-145 - Haul Distances to Beach and Nearshore Placement Sites and CDF Sites

Project or Harbor (Distances in Statute Miles)	Norwalk Islands CDF	Stamford Harbor CDF or CAD	Greenwich Point Beach	Cummings Park Stamford	Cove Island Park	Calf Pasture Beach	Compo Beach	Sherwood Island State Park	Burial Hill Beach	Sasco Hill Beach	New Haven Breakwaters CDF
Greenwich Cove	13.0	4.8	3.9	8.4	8.6	17.3	18.3	18.7	19.2	20.9	40.6
Mianus River (I-95)	13.9	6.6	5.0	9.3	9.6	18.4	19.0	19.6	20.3	21.9	41.9
Greenwich Harbor (Grass Island)	13.9	6.0	5.0	8.8	9.5	16.0	19.2	19.7	20.2	21.9	42.7
Byram Harbor	14.1	6.5	5.3	9.1	9.8	16.2	19.5	20.1	20.6	22.2	42.9

Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement alternatives available for unsuitable materials from the inner areas of Greenwich Harbor include containment in CDFs and CAD cells, or in upland landfills approved to receive such materials.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of New Haven Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Some projects from nearby dredging centers in New York have been taken to the Historic Area Remediation Site (HARS) off the northern New Jersey coast. While use of that site has not been evaluated in this DMMP, costs for that site are provided for some dredging centers and projects for comparison. Distances to various open water sites in the region are shown in the table below.

Table 5-146 - Scow Haul Distances to In-Water Placement Sites											
Project (Distances in Statute Miles)	HARS	Stamford DS	WLDS	Eatons Neck East DS	Southport DS	Bridgeport East	Milford DS	CLDS	Greenwich Captain Harbor CDF	Morris Cove CAD	Falkner Is CDF
Greenwich Cove	61.5	6.0	7.6	11.2	18.7	25.0	32.4	40.4	3.2	42.9	53.0
Mianus River (I-95)	62.7	7.0	8.7	12.3	19.9	26.2	33.6	41.7	4.0	43.9	54.3
Greenwich Harbor (Grass Island)	60.7	7.5	9.2	12.8	20.6	26.7	34.2	42.3	2.0	43.9	55.0
Byram Harbor	59.7	7.6	9.3	12.9	20.8	27.0	34.4	42.5	1.9	44.2	55.2

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor (New York), Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, Stratford Point, New Haven Breakwaters, Falkner Island, Duck Island Roads, Twotree Island (Waterford), and Groton Black Ledge.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands.

Greenwich Harbor CAD Cell: This would be a CAD cell excavated beneath outer Greenwich/ Captain Harbor and sized for the needs of Greenwich Harbor. The cell may also include a starter cell, depending on its location and the quality of its overburden. The exact location, capacity and dimensions of the cell(s) would be determined by future harbor-specific studies. Non-Federal cost-sharing of 20 percent (assuming all source FNPs have no more than a 20-foot design depth) would be required for cell design, construction, capping, and monitoring. Any extra cell capacity for placement of materials from sources other than the FNP would need to be paid for entirely by non-Federal interests.

5.14.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Greenwich Area Dredging Center, the analysis matched projects with placement alternatives as follows.

Mianus River: Future maintenance of the Mianus River FNP will yield fine grained dredged materials suitable for open water placement in LIS over the DMMP planning horizon. These suitable silty materials could be placed at open water sites, or in CDFs. Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically.

Table 5-147 - Mianus River FNP - Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	84,700	2015-2020	Sherwood Island Pit CAD – Fill	$39
	53,000	2036-2040	Sherwood Island Pit CAD – Cap	$39
			Western Long Island Sound DS	$32
			Norwalk Islands CDF – Fill	$118
			Captain Harbor Islands CDF – Fill	$118
			Hempstead Harbor CDF – Fill	$126
			Norwalk Islands Marsh – Fill	$118
			Penfield Reef CDF – Fill	$126
			110 Sand Company Site, NY	$105
			Yellow Mill Channel CDF – Fill	$135
			Stratford Point CDF – Fill	$135
			Central Long Island Sound DS	$65
			Manchester City Landfill	$105
			Stamford Harbor CDF	$118
			Historic Area Remediation Site, NJ	$113

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Mianus River FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 22 percent. The next lest costly alternatives would be placement in open water at the Central Long Island Sound site, or transport and placement upland at a landfill in New York at about twice the cost of using the

WLDS. Transport and placement at an upland landfill in Connecticut would be about 3.2 times the cost of placement at the WLDS. Next least costly would be ocean placement at the HARS at 3.5 times the cost of using the WLDS. Next least costly is placement either as CDF fill or marsh creation fill at the Norwalk Harbor Islands site, at the Captain Harbor CDF site, or at a CDF site to be constructed in Stamford Harbor, each of which would be about 3.7 times the cost of the least cost alternative. Other CDF options would be four times the cost of the WLDS or greater.

Greenwich Harbor: Future maintenance of the Greenwich Harbor FNP will yield two different types of dredged material over the DMMP planning horizon. Fine-grained material from the outer harbor channel has been and is expected to continue to be found suitable for unconfined open water placement. Materials from the Inner Harbor channel reaches and anchorages have been and are expected to be found unsuitable. Suitable materials, even when fined grained, may have beneficial uses, such as for marsh creation or enhancement and can also be placed in open water sites. Unsuitable materials must be either contained or treated before placement or use.

Table 5-148 - Greenwich Harbor FNP - Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	65,200	2015-2020	Sherwood Island Pit CAD – Cap	$44
	25,600	2036-2040	Sherwood Island Pit CAD – Fill	$44
			Western Long Island Sound DS	$37
			Norwalk Islands CDF – Fill	$135
			Captain Harbor CDF – Fill	$107
			Hempstead Harbor CDF – Fill	$135
			Norwalk Islands Marsh – Fill	$135
			110 Sand Company Site, NY	$76
			Yellow Mill Channel CDF – Fill	$140
			Stratford Point CDF – Fill	$140
			Flushing Airport Wetland Creation	$76
			Jamaica Bay Marsh Islands	$111
			Central Long Island Sound DS	$72
			Manchester City Landfill	$111
			Greenwich Harbor CAD – Cap	$81
			Stamford Harbor CDF – Fill	$121
			Historic Area Remediation Site, NJ	$124

Material Type	CY	Year	Alternative	Cost/CY
Unsuitable Fine	255,400 81,500	2015-2020 2036-2040	Captain Harbor CDF – Fill	$94
			Hempstead Harbor CDF – Fill	$124
			Norwalk Islands Marsh – Fill	$124
			Norwalk Islands CDF – Fill	$124
			Stratford Point CDF – Fill	$129
			Penfield Reef CDF – Fill	$129
			Morris Cove Pit CAD – Fill	$69
			Yellow Mill Channel CDF – Fill	$129
			Falkner Island CDF – Fill	$159
			Duck Island Roads CDF – Fill	$159
			New Haven Breakwaters CDF – Fill	$159
			Stamford Harbor CAD – Fill	$69
			Greenwich In-Harbor CAD – Fill	$66
			Stamford Harbor CDF – Fill	$113

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Greenwich Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 19 percent. The next least costly alternative would be placement in open water at the Central Long Island Sound site at slightly less than twice the cost of using the WLDS. Next would be either transport and placement upland at a landfill in New York, or use as wetland restoration material at the Flushing, New York project site, both at slightly more than twice the cost of using the WLDS. Use as CAD cell cap at Greenwich Harbor would be 2.2 times the cost of using the WLDS. Placement at the HARS would cost 3.4 times the cost of using the WLDS. Placement at various CDF sites in the western LIS area would cost between three and four times the cost of using the WLDS.

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained material from the Greenwich Harbor FNP is placement in a CAD cell constructed beneath Greenwich Harbor for the use of that harbor and possibly for adjacent harbors. The second least costly alternative is placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at in increase in cost of five percent. The next least costly alternatives are placement as fill in the CDF sites at Captain Harbor (42 percent increase), or Norwalk Harbor Islands and Hempstead Harbor (both an 88 percent increase), over the cost of using a Greenwich Harbor CAD cell. Use of the Stratford Point or Penfield Reef CDF sites would be twice the cost of the least cost alternative.

5.14.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-149 - Federal Navigation Project Base Plans
Greenwich Area Dredging Center Projects

FNP Project and Segment	Material Type	Federal Base Plan
Mianus River	Suitable Fines	Western Long Island Sound DS
Greenwich Harbor		
Entrance Channel	Suitable Fines	Western Long Island Sound DS
Inner Harbor	Unsuitable	Morris Cove Pit CAD – Fill or Greenwich In-Harbor CAD - Fill

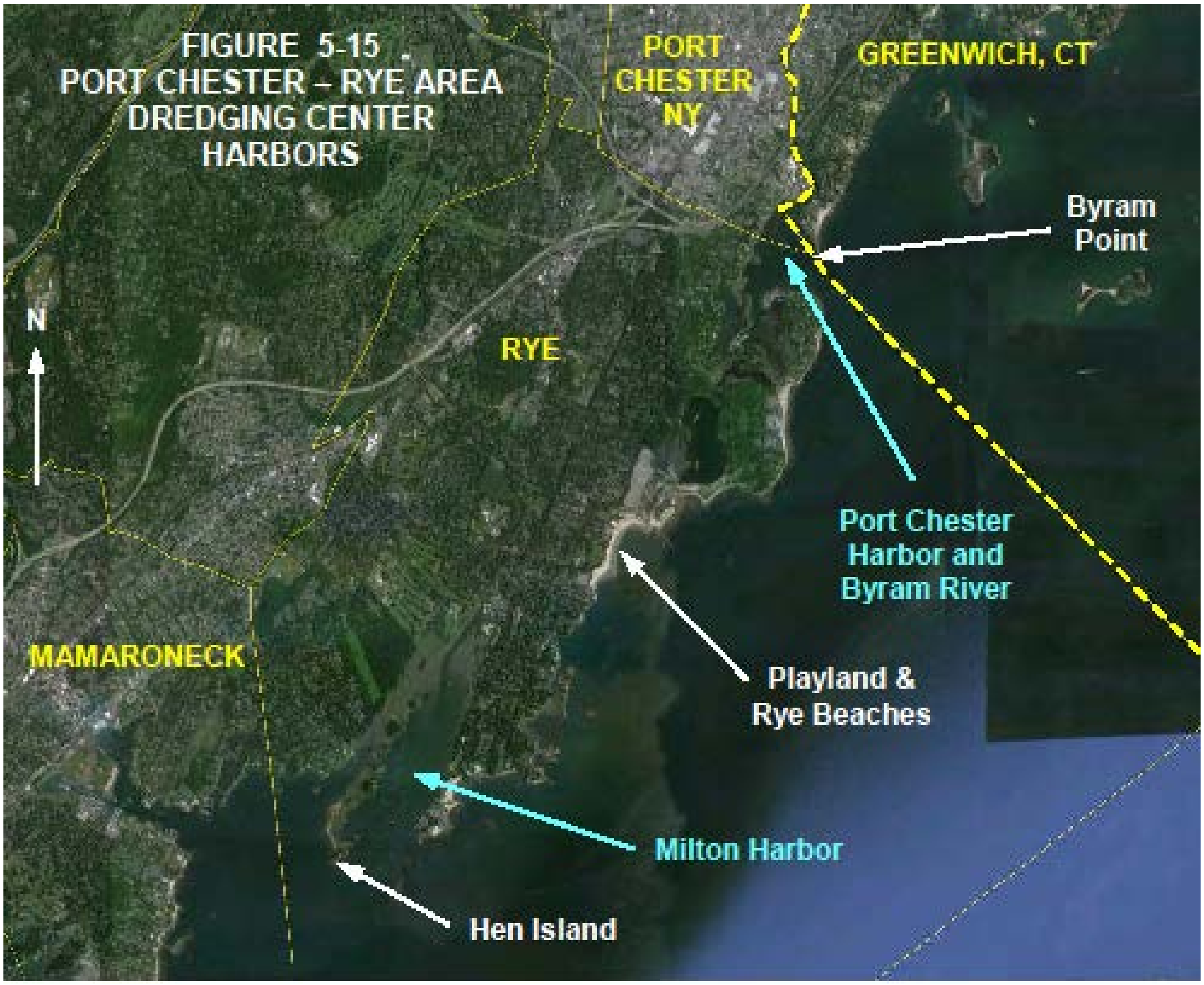
Alternatives to the Federal Base Plan: For the suitable fine-grained material from both FNPs in this dredging center the Federal base plan is open water placement at the WLDS. The least costly non-open water alternative to the base plan is placement at the Sherwood Island COW site for both harbors, at an increase of about 20 percent over using the WLDS. Upland landfill alternatives are not cost-effective at twice the cost of open water placement. Placement of the Mianus River materials at a marsh creation project for the Norwalk Harbor Islands at 3.7 times the cost of the base plan would require significant non-Federal funding, or implementation under a Section 204 project partnership if Federal interest were found warranted.

For Greenwich Harbor's small volume of suitable material, its use to cap a CAD cell in the harbor constructed for unsuitable material could be attractive, even at 2.2 times the cost of open water placement, as cap material must be secured from some source. For the unsuitable material from Greenwich Harbor, the base plan is placement in a CAD cell constructed in the harbor. Placement in the Morris Cove CAD cell could also be cost-effective if that site remaining available. Placement as fill in other CDF sites would only be pursued if a CAD cell at Greenwich proved infeasible.

5.15 Port Chester – Rye Area Dredging Center

The Port Chester-Rye Area Dredging Center consists of most of the shore areas of the municipalities of Port Chester and Rye, New York, from Byram Point on the Connecticut border to Hen Island east of Mamaroneck Harbor. The area includes the Federal Navigation Projects (FNPs) for Port Chester Harbor and Byram River, and Milton Harbor. The dredging center also includes a number of other small harbors and coves which provide navigation access to Long Island Sound for commercial fishermen and boaters. The principal waterways in this area are:

Port Chester Harbor and the Byram River – Includes FNP
Milton Harbor – Includes FNP



The waterways in this dredging center yield mainly fine-grained materials, all found suitable for unconfined open water placement. In entrance channels, shoal material can be sandier, though not so as to make it suitable for direct beach placement or nearshore bar nourishment.

5.15.1 Federal Navigation Projects - Maintenance

The dredged features of the two FNPs in this dredging center have each been dredged most recently as shown below.

Table 5-150 - Federal Navigation Project Dredging History Port Chester – Rye Area Dredging Center					
FNP Activity		Year Dredged	Cubic Yards	Placement Method	Material Type
Port Chester Harbor and Byram River, CT and NY		1990	40,800	WLIS-III or HARS	Suitable Fine
		1985	91,600	WLIS	Suitable Fine
		1966	61,100	Unknown	Unknown
		1959	80,000	Unknown	Unknown
		1947	31,600	Unknown	Unknown
		1938	11,300	Unknown	Unknown
Milton Harbor	(Maintenance)	1993	60,300	HARS	Suitable Fine
	(Maintenance)	1984	76,200	Unknown	Unknown
	(Maintenance)	1976	69,300	Unknown	Unknown
	(Improvement)	1967	147,300	Unknown	Unknown

Port Chester Harbor and the Byram River: Port Chester Harbor and the Byram River for a portion of the boundary between the states of Connecticut and New York. The FNP for Port Chester Harbor and the Byram River consists of a 12-foot deep entrance channel, 12-foot outer harbor anchorage, 10-foot lower river channel and 3-foot upper river channel. The project was last maintained in 1990 when about 40,800 CY of silty material were removed and placed either at the HARS or at the WLIS-III site (an earlier configuration of the present WLDS); available records cite these two different sites as having been used. The project had been maintained five years earlier in 1985 when about 91,600 CY was removed and also placed at the WLDS. The most recent condition survey (Survey 34-4152, July 2014) shows that the project has accumulated 159,700 CY since the 1990 maintenance action. This yields an annual shoaling rate of about 6,700 CY. The project is currently being considered for maintenance dredging. However, based on current sediment sampling it is expected that the silty shoal material from Port Chester will be unsuitable for open water placement in LIS. Upland sites are being investigated by the USACE and the state of New York. If this project were dredged in 2020, then a total shoal volume of 199,600 CY could be expected by that time. If future maintenance were to occur on a twenty-five year frequency, then another maintenance operation carried out in 2045 could be expected to generate about 166,400 CY. With removal of the unsuitable material in about 2020, and continued improvement in water quality and discharge regulations, material removed in subsequent maintenance operations may in the future be found suitable for open water placement, though testing at such time would be required to demonstrate suitability. However, for the purposes of this DMMP future shoal material will be treated as unsuitable for open water placement, as at present.

Milton Harbor: The FNP for Milton Harbor in the Town of Rye consists of a 6-foot MLLW channel from deep water in LIS to two branch channels of the same depth around the Milton

Harbor Marina. The project was initially constructed in March to June 1967 when 172,200 CY were removed. The placement method used for that work is not reflected in the record. The project has been maintained once since that time, in 1993, when about 60,300 CY were removed and placed at the Mud Dump site in New York Bight (present-day Historic Area Remediation Site (HARS). The most recent condition survey (Survey #4036, August 2013) shows that the project has accumulated 54,000 CY since the 1993 maintenance action. This yields an annual shoaling rate of about 2,700 CY. If this harbor were maintained at that same frequency, its next maintenance operation would be in about 2020 by which time it could be expected to have accumulated about 72,900 CY of shoal material. This material would likely be found suitable for open water placement. At a 25-year interval this operation would be repeated in about 2045.

The dredging activity timeline over the planning horizon for the two FNPs in the Port Chester - Rye Area Dredging Center is shown below.

Table 5-151 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Port Chester - Rye Area Dredging Center

FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Port Chester Harbor and Byram River	199,600					166,400
Milton Harbor	72,900					67,500
Total Suitable Fine	72,900					67,500
Total Unsuitable	199,600					166,400

5.15.2 Harbor Characterization for Federal Navigation Projects

Until recently, the two FNPs in this dredging center have been managed similarly as they have yielded similar material types and quality, with materials from both harbors found suitable for unconfined open water placement. However, recent sediment testing shows elevated levels of contaminants in portions of the Port Chester Harbor FNP.

Port Chester Harbor FNP: Sediment samples taken in 1994 from Port Chester Harbor ranged from sand and gravel in the lower project reaches to silty material in the upper areas (Battelle, 1995). The project was last dredged to project dimensions in 1990 with the removal of approximately 40,000 CY of sediment which was placed at the WLIS-III site in LIS (an earlier location for the WLIS site). Material from Port Chester Harbor was also tested in 1974, when elevated levels of some metals were found in a few samples (USACE, 1980a). Current testing indicates that the majority of the material from this FNP is unsuitable for unconfined open water placement in LIS.

Milton Harbor FNP: The most recent testing of Milton Harbor's sediments happened in 1992 in preparation for the 1993 maintenance operation. Eight samples were taken from the FNP and compared to reference material from WLDS. Grain size analysis revealed that the majority of the material was silt (average 66.1%) with some clay (23.5%) and sand (10.4%) (Nytest Environmental, 1992). All eight of the samples in Milton Harbor had higher levels of metals and a few other constituents than the reference material from WLDS.

Additionally, a biological testing report was conducted in 1991 on sediment taken from Milton Harbor and reference sediment from WLDS. Toxicity was tested along with bioaccumulation potential. Total mortality yielded no significant mortality compared to the reference. The state of Connecticut's Department of Environmental Protection required that a cap be used to cover the material being disposed at WLDS due to the high level of mercury in Milton Harbor's sediments (Nytest Environmental, 1991). However, other USACE records indicate that the material was placed at the HARS and not at the WLDS.

Milton Harbor's sediments were also tested in 1974 in preparation for the maintenance work undertaken in 1984 when about 76,200 CY was removed. The samples were shown to have relatively high levels for some metals. The material at that time was found suitable for placement at either Central or Western Long Island Sound sites.

The Port Chester-Rye Area Dredging Center in General: Maintenance of the two FNPs has yielded different material types, with Port Chester materials lately being found unsuitable for open water placement, while Milton Harbor materials have no significant contaminant sources that would lead to a similar conclusion. Testing of each harbor prior to each dredging operation will be needed to confirm suitability for alternative placement. Materials from both harbors are fine-grained and therefore suitable for upland or beneficial uses that could receive such materials. Milton Harbor materials and any suitable materials from Port Chester could be used for marsh restoration, or to create salt marsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. These suitable materials could also be placed at available upland sites, or placed at open water sites.

The material could also be placed upland, with dewatering and re-handling/transport, if found cost-effective for some public purpose (Brownfields, highway landscaping). If determined necessary, this would require further investigation in the future. Haul distances to various alternative placement sites are shown in the table below.

Table 5-152 - Scow Haul Distances to In-Water Placement and CDF Sites

Project (Distances in Statute Miles)	HARS	Greenwich Captain Harbor	Stamford Harbor CDF/CAD	Western LIS DS	Eatons Neck East DS	Norwalk Islands CDF	Bridgeport East	Central LIS DS	New Haven Breakwaters CDF	Morris Cove CAD	Falkner Is CDF
Port Chester Harbor	59.1	3.8	7.7	10.3	13.9	15.3	27.8	43.3	15.3	45.4	56.2
Milton Harbor	54.6	8.3	12.2	14.8	18.4	19.8	32.3	47.8	19.8	49.9	60.7

5.15.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Port Chester-Rye Area Dredging Center.

5.15.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Port Chester-Rye Dredging Center that periodically generate dredged material. At Port Chester these include small marinas, yacht clubs and boat yard operations, and barge berths at commercial facilities. At both harbors and other locations in the dredging center there are private residential and public access facilities including access for offshore islands.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 159,400 CY of maintenance dredging would be needed by non-Federal facilities. These totals are shown in the table below distributed through the DMMP planning horizon.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS being the closest approved site, and HARS and CLDS more distant. These activities could also take advantage of whatever alternative placement methods are used for the two FNPs in this dredging center, or possibly in the Mamaroneck, New York, and the Greenwich or Stamford, Connecticut areas if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-153 - Dredging Activity Timeline – Port Chester - Rye Area Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	75,000	23,000	12,000	13,000	12,000	13,000
Total Non-Federal	75,000	23,000	12,000	13,000	12,000	13,000

5.15.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating nearly 200,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at open water sites, including WLDS, CLDS, and HARS. However, port/upland fill for specific purposes was likely used at Port Chester in earlier times. Several investigations of dredged material management alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-154 - Port Chester - Rye Area Dredging Center Available/Potential Placement Alternatives					
Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Historic Area Remediation Site		Open Water	10,000,000	All	Suitable Fine
Sherwood Island Borrow Pit		COW Fill	266,000	All Until Filled	All Suitable
		COW Cap	484,000		
Morris Cove Borrow Pit CAD, New Haven Harbor, CT		CAD Fill	466,100	All Until Filled	All
		CAD Cap	143,900		All Suitable
Norwalk Outer Harbor CDF Fill		Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation	- Fill	Marsh Shore CDF	554,000	All Once Built	Suitable Fine
	- Cap		376,000		
Captain Harbor CDF	- Fill	Island CDF	498,200	Once Built	All
Greenwich	- Cap		331,800		All Suitable
Falkner Island CDF	- Fill	Island CDF	16,010,200	Once Built	All
Guilford	- Cap		1,169,800		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Hempstead Harbor NY	- Fill	Shore CDF	2,787,700	All Once Built	All
CDF	- Cap		712,300		All Suitable
Bridgeport Yellow Mill Channel CDF	- Fill	Shore CDF	197,900	All Until Filled	All
	- Cap		102,100		All Suitable
Twotree Island CDF, CT	- Fill	Island CDF	2,966,200	Once Built	All
Greenwich Harbor Specific CAD Cell – Fill and Cap		Harbor CAD	To Design	Once Built	All
Stamford Harbor CDF - Fill		Island CDF	1,700,000	Once Built	All
Groton Black Ledge CDF - Fill		Island CDF	6,930,000	Once Built	All
Duck Island Road CDF - Fill		Island CDF	1,376,100	Once Built	All
Stratford Point CDF - Fill		Shore CDF	33,666,900	Once Built	All
110 Sand Company Site, Melville, NY		Upland	1,000,000	All	Suitable Fine
Manchester City Landfill, CT		Upland	1,200,000	All	All
Brookhaven Town Landfill		Upland	700,000	All	All

No sandy materials are projected to be dredged from the Port Chester-Rye dredging center. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement alternatives available for unsuitable materials from Port Chester Harbor include containment in CDFs and CAD cells or in upland landfills approved to receive such materials.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Some projects from nearby dredging centers in New York have been taken to the Historic Area Remediation Site (HARS) off the northern New Jersey coast. While use of that site has not been evaluated in this DMMP, costs for that site are provided for some dredging centers and projects for comparison.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island (COW) could receive materials from this and other dredging centers, as either fill or cap material. Recent test results from neighboring Greenwich Harbor in Connecticut will require consideration be given to locating a CAD cell in that harbor to potentially receive unsuitable dredged materials from that FNP. A CAD cell in Greenwich might also be sized to accommodate the needs of Port Chester Harbor as well.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor (New York), Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, Stratford Point, New Haven Breakwaters, Falkner Island, Duck Island Roads, Twotree Island (Waterford), and Groton Black Ledge. A CDF facility at Hempstead Harbor along the southwest shoreline has been proposed at a former sand mining company site that could accommodate the needs of other harbors in the western sound with its 2.8 million CY capacity.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands.

5.15.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Port Chester-Rye Area Dredging Center analysis matched projects are as follows.

Port Chester Harbor and Byram River: Future maintenance of the Port Chester Harbor FNP is expected to yield fine grained dredged material over the DMMP planning horizon. This material has been and is expected to continue to be found unsuitable for unconfined open water placement. Unsuitable materials must be either contained or treated before placement or use. This limits the potential placement and use alternatives to CAD cells, interior cells of CDFs, and landfill facilities upland (potentially also requiring treatment or augmentation to reduce contaminant levels).

Table 5-155 - Port Chester Harbor FNP - Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Unsuitable Fine	199,600	2015-2020	Captain Harbor CDF – Fill	$94
	166,400	2036-2040	Hempstead Harbor CDF – Fill	$124
			Norwalk Islands Marsh – Fill	$124
			Norwalk Islands CDF – Fill	$124
			Stratford Point CDF – Fill	$129
			Penfield Reef CDF – Fill	$129
			Morris Cove Pit CAD – Fill	$68
			Yellow Mill Channel CDF – Fill	$129
			Falkner Island CDF – Fill	$159
			Duck Island Roads CDF – Fill	$159
			New Haven Breakwaters CDF – Fill	$159
			Greenwich In-Harbor CAD – Fill	$68
			Stamford Harbor CDF – Fill	$113

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained material from the Port Chester Harbor FNP is placement either in the Morris Cove borrow pit CAD cell in New Haven Harbor, or in a CAD cell constructed beneath Greenwich Harbor for use by that harbor and perhaps adjacent harbors. The second least costly alternative is placement as fill in the Captain Harbor CDF site at Greenwich, at a cost increase of 38 percent.

Placement in a CDF or CAD cell constructed in Stamford Harbor would cost about 66 percent more than the least cost alternative. Placement in the Hempstead or Norwalk Islands CDFs would cost 1.8 times the cost of Morris Cove. Placement in more distant CDF sites in Bridgeport or New Haven would cost 2.3 times the cost of using Morris Cove.

Milton Harbor: Future maintenance of the Milton Harbor FNP will yield fine grained dredged materials likely suitable for open water placement in LIS over the DMMP planning horizon. These suitable silty materials could be placed at open water sites, or in containment facilities (CDFs). Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically.

Table 5-156 - Milton Harbor FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	84,700	2015-2020	Norwalk Islands CDF – Fill	$125
	53,000	2041-2045	Captain Harbor CDF – Fill	$118
			Hempstead Harbor CDF – Fill	$118
			Norwalk Islands Marsh – Fill	$126
			110 Sand Co., Melville, NY	$87
			Western Long Island Sound DS	$39
			Penfield Reef CDF – Fill	$135
			Sherwood Island Pit CAD – Cap	$44
			Sherwood Island Pit CAD – Fill	$44
			Morris Cove Pit CAD – Fill	$81
			Manchester City Landfill	$104
			New Haven Breakwaters CDF – Fill	$162
			Falkner Island CDF – Fill	$162
			Central Long Island Sound DS	$65
			Historic Area Remediation Site	$65
			Stamford Harbor CDF – Fill	$126

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Milton Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 13 percent. The next least costly alternative would be placement either in open water at the Central Long Island Sound site, or at the HARS, both at 1.7 times the cost of using the WDLS. The next least costly alternative would be placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at 2.1 times the cost of the least costly alternative. Upland placement at landfills in

Connecticut or New York would cost between 2.2 and 2.7 times the cost of using the WLDS. Placement at various CDF sites in the western LIS area would cost between three and four times the cost of using the WLDS.

5.15.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-157 - Federal Navigation Project Base Plans
Port Chester-Rye Area Dredging Center Projects

FNP Project and Segment	Material Type	Federal Base Plan
Port Chester Harbor	Unsuitable	Morris Cove Pit CAD - Fill
Milton Harbor	Suitable Fines	Western Long Island Sound DS

Alternatives to the Federal Base Plan: The Federal base plan for the unsuitable material from Port Chester Harbor is placement in a CAD cell either at Morris Cove, or one constructed specifically for Port Chester and or Greenwich Harbors. Placement in a CDF constructed at Greenwich at a 38 percent increase in cost, at Stamford Harbor at a 70 percent increase, or at Norwalk at an 80 percent increase, would only be feasible if other harbors were to use those sites as well, and if non-Federal funding were available for facility construction.

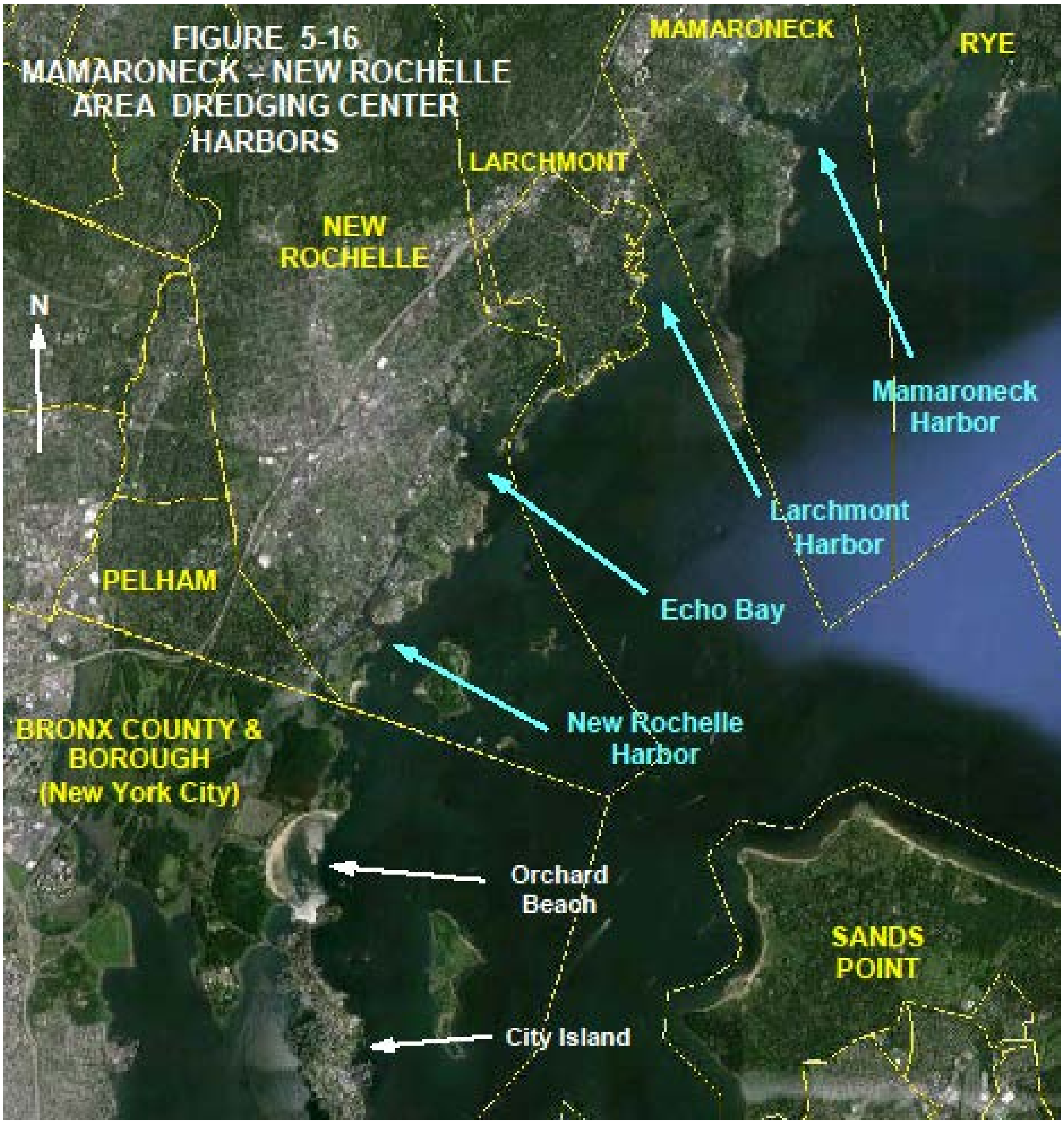
The Federal base plan for the suitable fine-grained material from the Milton Harbor FNP is open water placement at the Western Long Island Sound site. Placement at the Sherwood Island COW site would only require an increase in cost of 13 percent, but would also require the site be available at the time that Milton Harbor is next dredged, and would likely only be the case for the next operation, and not the following one. Placement in the Morris Cove CAD cell, at more than twice the cost of the WLDS, would also require that site to still be available at the time Milton Harbor is next dredged. Upland placement and CDF placement are two to four times the cost of the base plan and not cost-effective.

5.16 Mamaroneck – New Rochelle Area Dredging Center

The Mamaroneck-New Rochelle Area Dredging Center consists of most of the shore areas of the municipalities of Mamaroneck, Larchmont, New Rochelle and Pelham Manor, New York (all in Westchester County), and the Pelham Bay shore area of Bronx County southwest to the City Island causeway bridge. The area includes the Federal Navigation Projects for Mamaroneck Harbor, Larchmont Harbor, Echo Bay and New Rochelle. The FNP for Larchmont Harbor consists solely of a rubblestone breakwater and does not include any dredged features. The dredging center also includes a few other small harbors and coves which provide navigation access to Long Island Sound, and several offshore islands in New Rochelle which have limited waterside access.

The principal waterways in this area are:

Mamaroneck Harbor – Includes FNP
Larchmont Harbor – Includes FNP (Breakwater Only – No Dredged Features)
New Rochelle Harbor – Includes FNP
Echo Bay – Includes FNP



The waterways in this dredging center yield mainly fine-grained materials. In the only one of the FNPs to be recently dredged, Mamaroneck, the dredged material was found suitable for unconfined open water placement. It is unlikely that any materials from this dredging center, even entrance channel materials, would be found sandy enough to make them suitable for beach or nearshore bar placement.

5.16.1 Federal Navigation Projects - Maintenance

The three FNPs in this dredging center which include dredged features have each been dredged most recently as shown below. The FNP for Larchmont Harbor consists of only a breakwater (last repaired in 1969) and therefore has no dredging requirements.

Table 5-158 - Federal Navigation Project Dredging History Mamaroneck-New Rochelle Area Dredging Center					
FNP Activity		Year Dredged	Cubic Yards	Placement Method	Material Type
Mamaroneck Harbor	Maintenance	1999	161,600	CLDS	Suitable Fine
	Maintenance	1990	54,900	Unknown	Unknown
	Maintenance	1981	19,400	Unknown	Unknown
	Improvement	1966	144,200	Unknown	Unknown
	Maintenance	1965-66	73,200	Unknown	Unknown
	Maintenance	1963	57,600	Unknown	Unknown
	Improvement	1949	13,800	Unknown	Unknown
Echo Bay		1949	15,000	Unknown	Unknown
		1931	7,000	Unknown	Unknown
New Rochelle Harbor		1971	43,100	Stamford DS	Suitable Fine
		1936	23,000	Unknown	Unknown
		1931	33,300	Unknown	Unknown

Mamaroneck Harbor: The FNP for Mamaroneck Harbor consists of a 10-foot deep entrance channel, 10-foot east branch channel to 10-foot and 6-foot anchorages in the East Basin, and a 6-foot West Basin channel and anchorage. The project was last maintained in 1999 when about 161,600 CY of silty material was removed from all project areas and placed at the CLDS and WLDS sites. Twenty-one non-Federal harbor facilities also performed maintenance dredging at that time under permit using the same placement sites. Since its last improvement dredging in 1965 the project was maintained four times, including in 1999, an average of every eleven years, with a total of about 259,400 CY removed during those operations. The most recent condition survey (Survey 2128, April 2014) shows that the project has accumulated 31,700 CY since the 1999 maintenance action. This yields an annual shoaling rate of about 5,900 CY over that 49-year period of 1965 to 2014. The 1999 work included an additional foot of overdepth as advanced maintenance to extend the maintenance frequency for the FNP. At twice the eleven-year cycle, the FNP would require maintenance again in 2022, by which time a total of about 79,300 CY would have accumulated at the 49-year rate. Should the project then return to its eleven-year maintenance cycle, it would require dredging in 2033 and 2044 of about 65,400 CY each operation.

With continued improvement in water quality and discharge regulations, material removed in subsequent maintenance operations will likely also be found suitable for open water placement, though testing at such time would be required to demonstrate suitability.

Echo Bay: The FNP for Echo Bay consists of a 10-foot deep (MLLW) channel to a turning basin of the same depth at the New Rochelle city wharf on Beaufort Point at Hudson Park. A 35-acre anchorage with depths of 7 and 6 feet and an eastern entrance channel were authorized in 1973 but never constructed. The 10-foot project features were last maintained in 1949, when about 15,000 CY was removed. The last maintenance prior to that operation was in 1931 when about 7,000 CY was removed. There is no record of the placement method or site used. There is no current hydrographic survey or shoal quantity estimate available. The 18-years between the 1931 and 1949 maintenance operations and the 15,000 CY removed in 1949 yield an annual shoaling rate of 830 CY. If this project were to be maintained in about 2020, at that rate about 59,200 CY should have accumulated in the 10-foot project areas in the 71 years since they were last dredged. While there are no sediment test results available for this FNP, its proximity to Mamaroneck and its similar navigation uses would indicate that the fine-grained material produced by this project would also likely be found suitable for open water placement. This project would likely only be maintained once, if at all, during the DMMP planning horizon.

New Rochelle Harbor: The FNP for New Rochelle Harbor consists of two 8-foot deep channels into and through the upper and lower harbors, which are separated by the bridge connecting Neptune Park to Glen Island. The Upper Harbor channel extends upstream between the mainland and Davenport Neck to a point below the dam near Leeland Avenue. The Lower Harbor channel also serves to access the area of the small Pelham Manor waterfront and the larger Pelham Lagoon to the south. The project has been maintained in 1931, 1936 and most recently in 1971 when about 43,100 CY was removed and placed at the Stamford Disposal Site. The total maintenance material removed in the two operations since 1931 totaled 66,100 CY, yielding an annual shoaling rate of about 1,700 CY over that 40-year period. At that rate, should this project be maintained in 2021 (50 years since its last maintenance) about 82,600 CY of shoal material could be expected. While there are no sediment test results available for this FNP, its proximity to Mamaroneck and its similar navigation uses would indicate that the fine-grained material produced by this project would also likely be found suitable for open water placement. This project would likely only be maintained once, if at all, during the DMMP planning horizon. The dredging activity timeline over the planning horizon for the two FNPs in the Mamaroneck-New Rochelle Area Dredging Center is shown below.

Table 5-159 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Mamaroneck-New Rochelle Area Dredging Center

FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Mamaroneck Harbor		79,300		65,400		65,400
Echo Bay	59,200					
New Rochelle Harbor		82,600				
Total Suitable Fine	72,900	161,900		65,400		65,400

5.16.2 Harbor Characterization for Federal Navigation Projects

In the past, the three FNPs in this dredging center with dredged features have been managed similarly as they have yielded similar material types and quality, with materials from all three harbors placed at open water sites. .

Mamaroneck Harbor FNP: Sediment samples were most recently taken from the Mamaroneck Harbor FNP in 1998 in support of the 1999 maintenance dredging action. Samples were mostly silt and clay, ranging from 36-53% silt and 30-53% clay (overall range of 43 to 94 percent fines). Chemical testing showed that samples were in the low to moderate range for heavy metals and generally low for PAHs (Applied Marine Sciences, 1998). Approximately 161,600 CY of this material was removed from the FNP and additional 131,000 CY from 23 associated private permit dredging projects, and placed at the Central Long Island Sound site in 1999-2000. Dredge material from this harbor, from both the FNP and private permit actions, is expected to be suitable fine-grained material in the future.

Larchmont Harbor FNP: While there are no dredged features included in the Larchmont Harbor FNP, several marinas and other private facilities do dredge access, slip space and berths. NAE permit records show that between 1991 and 2005 there were 11 private dredging projects carried out in Larchmont Harbor totaling about 89,200 CY. Of these eight were placed at either CLDS or WLDS. One used the dredged material as port fill for bulkhead stabilization, and two went to upland sites (one a state bioremediation site). In general, dredged material from this harbor is expected to be suitable fine-grained material in the future.

Echo Bay FNP: Sediment samples were taken from the Echo Bay FNP in 2008 for grain size analysis. Results showed the material to be fine-grained silty sandy and clay with about 40 percent fines. Testing for one private permit project found that material suitable for placement at either WLDS or CLDS. Dredge material from this harbor is expected to be suitable fine-grained material in the future.

New Rochelle Harbor FNP: NAE dredging permit records show that between 1993 and 2008 there were three private dredging projects carried out in New Rochelle Harbor totaling about 19,400 CY. Material from the three projects was placed at either CLDS or WLDS. Dredge material from this harbor is expected to be suitable fine-grained material in the future.

The Mamaroneck-New Rochelle Area Dredging Center in General: Maintenance of the three FNPs yields fine-grained dredged material, with Mamaroneck typically found suitable for open water placement. While the other FNPs lack current sediment testing to confirm their suitability, a review of past permit project decisions indicates that sediments from the Echo Bay and New Rochelle Harbor FNPS will also likely be found suitable for open water placement. Testing of each harbor prior to each dredging operation will be needed to confirm suitability for alternative placement. Materials from these harbors is likely fine-grained and suitable for upland or beneficial uses that could receive such materials, such as for marsh restoration, or to create saltmarsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. These suitable materials could also be placed at available upland sites, or placed at open water sites.

The material could also be placed upland, with dewatering and re-handling/transport, if found cost-effective for some public purpose (brownfields, highway landscaping). However, no such purposes were identified by this study. If determined necessary, this would require further investigation in the future.

5.16.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Mamaroneck-New Rochelle Area Dredging Center.

5.16.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Mamaroneck-New Rochelle Area Dredging Center that periodically generate dredged material. At all four FNP harbors these include both small and large marina, yacht club and boat yard operations. At all four FNP harbors and other locations in the dredging center there are private residential and public access facilities including access for offshore islands.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 215,800 CY of maintenance dredging and 68,000 CY of improvement dredging would be needed by non-Federal facilities. In addition, based on historic trends in smaller-scale permit dredging work, it was concluded that another 209,300 CY of material would be dredged over the 30-year DMMP planning horizon. These totals are shown in the table below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS being the closest approved site, and HARS and CLDS more distant. These activities could also take advantage of whatever alternative placement methods are used for the two FNPs in this dredging center, or possibly in the Mamaroneck, New York, and the Greenwich or Stamford, Connecticut areas if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open water placement for otherwise smaller volumes.

Table 5-160 - Dredging Activity Timeline – Mamaroneck-New Rochelle Area Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	63,800	24,000	23,000	23,000	41,000	41,000
Improvement	18,000	6,000	10,000	10,000	12,000	12,000
Additional Projections	34,800	34,900	34,900	34,900	34,900	34,900
Total Non-Federal	116,600	64,900	67,900	67,900	87,900	87,900

5.16.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating nearly 80,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at open water sites, including CLDS, WLDS, and HARS. However, port/upland fill for specific purposes was likely used at all of these harbors in earlier times. Several investigations of dredged material management alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-161 - Mamaroneck-New Rochelle Area Dredging Center Available/Potential Placement Alternatives

Alternative	Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Historic Area Remediation Site	Open Water	10,000,000	All	Suitable Fine
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Norwalk Outer Harbor CDF Fill	Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	554,000	All Once Built	Suitable Fine
- Cap		376,000		
Captain Harbor CDF Greenwich - Fill	Island CDF	498,200	Once Built	All
- Cap		331,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Hempstead Harbor NY CDF - Fill	Shore CDF	2,787,700	All Once Built	All
- Cap		712,300		All Suitable
Stamford Harbor CDF – Fill	Island CDF	1,700,000	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Manchester City Landfill, CT	Upland	1,200,000	All	All
Flushing Airport Wetlands Restoration Project	Brownfield & Wetlands	140,000	All	All

No sandy materials are projected to be dredged from the Mamaroneck-New Rochelle Area dredging center. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Some projects from nearby dredging centers in New York have been taken to the Historic Area Remediation Site (HARS) off the northern New Jersey coast. While use of that site has not been evaluated in this DMMP, costs for that site are provided for some dredging centers and projects for comparison. Haul distances to various alternative placement sites are shown in the table below.

Table 5-162 - Scow Haul Distances to In-Water Placement Sites

Project (Distances in Statute Miles)	HARS	Greenwich Captain Harbor CDF	Hempstead Harbor CDF	Stamford Harbor CDF/CAD	Western LIS DS	Eatons Neck East DS	Norwalk Islands CDF	Sherwood Island CAD	Bridgeport East	Central LIS DS	New Haven Breakwaters CDF	Morris Cove CAD
Mamaroneck Harbor	53.8	8.0	8.8	11.9	14.5	18.1	19.5	26.4	32.0	47.5	48.4	49.6
Larchmont Harbor	51.7	8.9	8.1	12.8	15.1	18.6	21.0	27.3	32.6	48.2	49.2	50.5
Echo Bay	50.9	10.4	8.4	14.3	16.3	19.8	22.3	28.8	33.8	49.4	50.4	52.0
New Rochelle Harbor	49.8	11.4	8.7	15.3	17.3	20.8	23.2	29.8	34.8	50.4	51.3	53.0

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut, and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternative carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island (COW) could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor (New York), Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, Penfield Reef, Stratford Point, and New Haven Breakwaters. A CDF facility at Hempstead Harbor along the southwest shoreline has been proposed at a former sand mining company site that could accommodate the needs of other harbors in the western sound with its 2.8 million CY capacity.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands.

5.16.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Mamaroneck-New Rochelle Area Dredging Center, the analysis matched projects with placement alternatives as follows.

Mamaroneck Harbor: Future maintenance of the Mamaroneck Harbor FNP is expected to yield fine grained dredged material over the DMMP planning horizon. This material has been and is expected to continue to be found suitable for unconfined open water placement. These suitable silty materials could be placed at open water sites, or in containment facilities (CDFs). Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Mamaroneck Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 13 percent. The next least costly alternative would be placement either in open water at the Central Long Island Sound site, or at the HARS, both at 1.7 times the cost of using the WDLS. The next least costly alternative would be placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at 2.1 times the cost of the least costly alternative. Upland placement at landfills in New York would cost between 2.2 times the cost of using the WLDS. Placement at various CDF sites in the western LIS area would cost between three and four times the cost of using the WLDS.

Table 5-163 - Mamaroneck Harbor FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	79,300	2021-2025	Norwalk Islands CDF – Fill	$126
	65,400	2031-2035	Captain Harbor CDF – Fill	$118
	65,400	2041-2045	Hempstead Harbor CDF – Fill	$118
			Norwalk Islands Marsh – Fill	$126
			110 Sand Co., Melville, NY	$87
			Western Long Island Sound DS	$39
			Penfield Reef CDF – Fill	$135
			Sherwood Island Pit CAD – Cap	$44
			Sherwood Island Pit CAD – Fill	$44
			Morris Cove Pit CAD – Fill	$81
			New Haven Breakwaters CDF – Fill	$162
			Stamford Harbor CDF – Fill	$126
			Historic Area Remediation Site	$65
			Central Long Island Sound DS	$65

Echo Bay: Future maintenance of the Echo Bay FNP will yield fine grained dredged materials likely suitable for open water placement in LIS over the DMMP planning horizon. These suitable silty materials could be placed at open water sites, or in containment facilities (CDFs). Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Echo Bay FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 12 percent. The next least costly alternative would be placement either in open water at the Central Long Island Sound site, or at the HARS, both at 1.6 times the cost of using the WDLS. The next least costly alternative would be use in a Flushing Airport wetlands project at 1.9 times the cost of placement at the WLDS. The next least costly alternatives would be either placement in the Morris Cove borrow pit CAD cell in New Haven Harbor, or upland placement at a landfill in New York, at twice the cost of the least costly alternative. Placement at various CDF sites in the western LIS area would cost between three and four times the cost of using the WLDS.

Table 5-164 - Echo Bay FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	59,200	2015-2020	Captain Harbor CDF – Fill	$119
			Hempstead Harbor CDF – Fill	$119
			Western Long Island Sound DS	$41
			Norwalk Islands CDF – Fill	$136
			Norwalk Islands Marsh – Fill	$136
			Flushing Wetlands Project	$79
			Sherwood Island Pit CAD – Cap	$46
			Sherwood Island Pit CAD – Fill	$46
			110 Sand Co., Melville, NY	$82
			Morris Cove Pit CAD – Fill	$82
			New Haven Breakwaters CDF – Fill	$164
			Stamford Harbor CDF – Fill	$129
			Historic Area Remediation Site	$67
			Central Long Island Sound DS	$67

New Rochelle Harbor: Future maintenance of the New Rochelle Harbor FNP is expected to yield fine grained dredged material over the DMMP planning horizon. This material has been and is expected to continue to be found unsuitable for unconfined open water placement. Unsuitable materials must be either contained or treated before placement or use. This limits the potential placement and use alternatives to CAD cells, interior cells of CDFs, and landfill facilities upland (potentially also requiring treatment or augmentation to reduce contaminant levels).

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the New Rochelle Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 16 percent. The next least costly alternative would be placement either in open water at the Central Long Island Sound site, or at the HARS, both at 1.7 times the cost of using the WDLS. The next least costly alternative would be use in a Flushing Airport wetlands project at 1.9 times the cost of placement at the WLDS. The next least costly alternative would be placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at 2.2 times the cost of the least costly alternative. Upland placement at a landfill in New York would cost about 2.2 times the cost of using the WLDS. Placement at various CDF sites in the western LIS area would cost 3 to 3.5 times the cost of using the WLDS.

Table 5-165 - New Rochelle Harbor FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	82,600	2021-2025	Western Long Island Sound DS	$37
			Captain Harbor CDF – Fill	$125
			Hempstead Harbor CDF – Fill	$117
			Sherwood Island Pit CAD – Cap	$43
			Sherwood Island Pit CAD – Fill	$43
			110 Sand Co., Melville, NY	$88
			Norwalk Islands CDF – Fill	$133
			Norwalk Islands Marsh – Fill	$133
			Flushing Wetlands Project	$76
			Morris Cove Pit CAD – Fill	$80
			New Haven Breakwaters CDF – Fill	$163
			Stamford Harbor CDF – Fill	$125
			Historic Area Remediation Site	$63
			Central Long Island Sound DS	$63

5.16.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

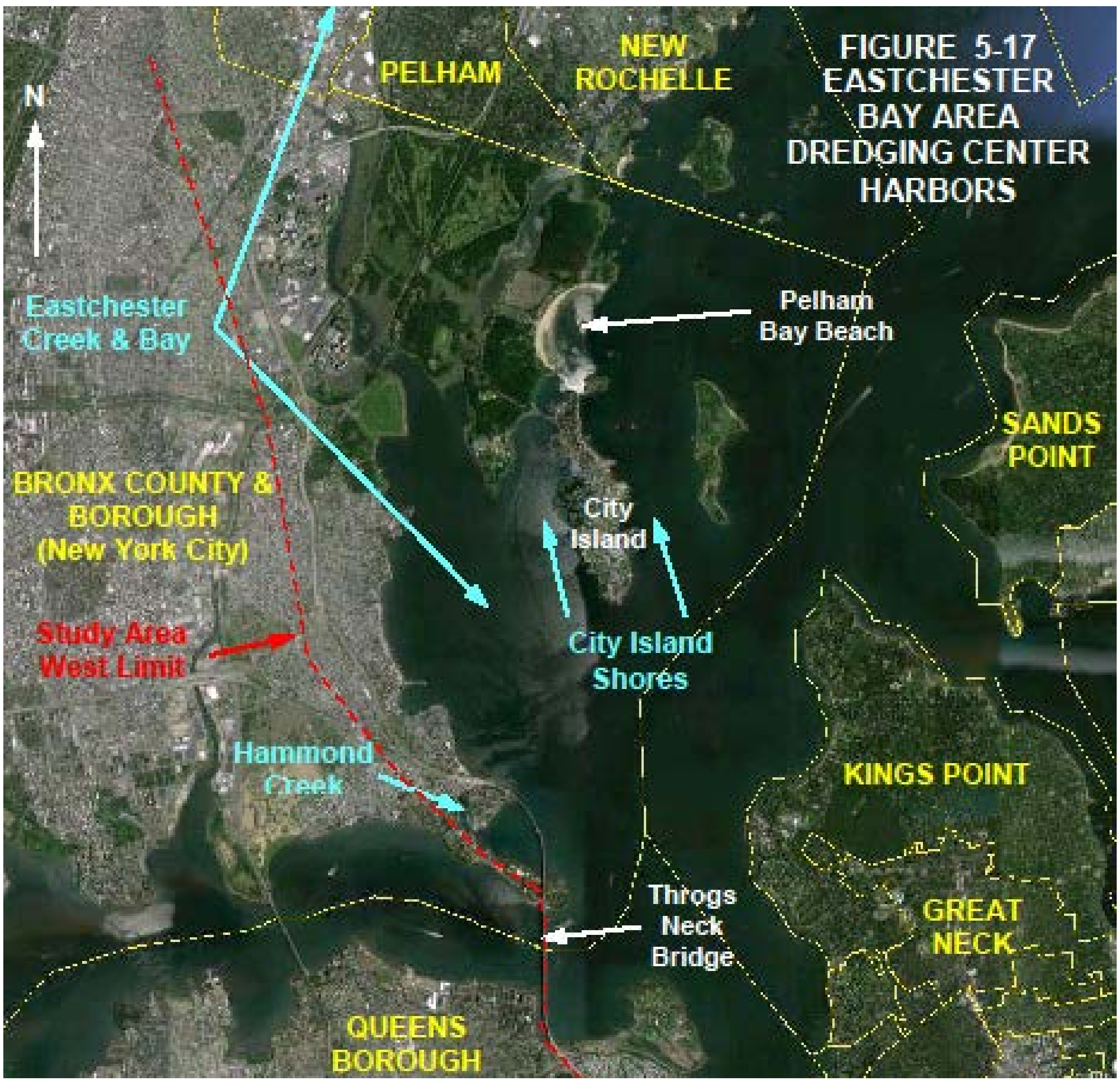
Table 5-166 - Federal Navigation Project Base Plans Mamaroneck-New Rochelle Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
Mamaroneck Harbor	Suitable Fines	Western Long Island Sound DS
Echo Bay	Suitable Fines	Western Long Island Sound DS
New Rochelle Harbor	Suitable Fines	Western Long Island Sound DS

Alternatives to the Federal Base Plan: The Federal base plan for the suitable fine-grained material from all three FNPS in this dredging center with dredged features is open water placement at the Western Long Island Sound site. The next least costly alternative for all three FNPs would be placement at the Sherwood Island COW site, at an increase in cost of 12 to 16 percent, but would also require the site be available at the times that these harbors are next dredged, and would likely only be the case for the next operation, and not the following one. Placement of any of these harbors' dredged material in the Morris Cove CAD cell, at more than twice the cost of the WLDS, would also require that site to still be available at the time each harbor is next dredged. Upland placement and CDF placement are two to four times the cost of the base plan, and not cost-effective.

5.17 Eastchester Bay Area Dredging Center

The Eastchester Bay Area Dredging Center consists of most of the shore areas of the Bronx Borough of New York City (Bronx County) east of the Throgs Neck Bridge to the east side of City Island. It also includes all of the islands within Bronx County in Long Island Sound. The area includes the Federal Navigation Projects for Eastchester Creek. The dredging center also includes the heavily developed waterfronts on the east and west shores of City Island, and a few other small coves on Eastchester Bay which provide navigation access to Long Island Sound. The principal waterways in this area are:

City Island (East and West Shores and Surrounding Waters)
East Chester Bay
Eastchester Creek (Hutchinson River) – Includes FNP
Hammond Creek (Locust Point)



The waterways and facilities in this dredging center yield mainly fine-grained materials. It is unlikely that any materials from this dredging center, even entrance channel materials, would be found sandy enough to make them suitable for beach or nearshore bar placement.

5.17.1 Federal Navigation Projects - Maintenance

The Eastchester Creek FNP, the only FNP in this dredging center, was dredged most recently in 2010 as shown below.

Table 5-167 - Federal Navigation Project Dredging History
Eastchester Bay Area Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Eastchester Creek (Upper Reaches – Partial)	2010	21,300	Upland – NJ Brownfields	Unsuitable
Up to Fulton Ave	1989	36,200	CLDS	Suitable Fine
Entire Channel	1985	54,500	Unknown	Unknown
	1974	45,200	Unknown	Unknown
	1964	17,500	Unknown	Unknown
	1952	153,600	Unknown	Unknown
	1947	6,700	Unknown	Unknown
	1941	224,100	Unknown	Unknown
	1935-36	25,800	Unknown	Unknown
Improvement	1935-36	321,900	Unknown	Unknown
	1931	42,600	Unknown	Unknown

Eastchester Creek: The FNP for Eastchester Creek (also known as the Hutchinson River), as modified through 1930, consists of an 8-foot MLLW channel from deep water in Eastchester Bay through the Bay and upriver to a point about 300 feet above the Fulton Avenue Bridge, a total distance of about 4.7 miles, with a small passing basin between the Post Road and I-95 bridges. A later project for a 10-foot channel adopted in 1950 was never constructed. Since its completion in 1941, the 8-foot project has been maintained seven times (or about once every 9 years), most recently in 2010 when a small portion of the project in its upper reaches was dredged and the 21,300 CY of silty material dewatered and transported upland to brownfield reclamation sites in Teterboro and Bellmawr, NJ. The latest condition survey of the project (Survey #4100, with soundings from April 2014) showed about 204,600 CY in the project limits. When added to the seven maintenance events since 1941 this gives a total of 542,600 CY of shoaling over that 73-year period yielding an annual shoaling rate of about 7,400 CY. The last two maintenance events were 21 years apart (1989 to 2010). If the entire project were to be restored to its authorized and completed dimensions in say 2025 (mid-way between the 21 year and 9-year average frequencies), then about 286,300 CY of shoal material could be expected. At a 15-year frequency the next maintenance operation after that would be in 2040 when about 111,500 CY could be expected.

With continued improvement in water quality and discharge regulations, material removed in subsequent maintenance operations may be found suitable for open-water placement; however, the bulk of the shoal material present in the project in 2010 was not dredged at that time. When and if funds become available for more complete maintenance of the FNP, testing at such time would be required to demonstrate suitability. For the purposes of this DMMP, it will be assumed that the next maintenance operation will yield unsuitable material, and that subsequent operations in future years will yield suitable fine material.

The dredging activity timeline over the planning horizon for the two FNPs in the Eastchester Bay Area Dredging Center is shown below.

Table 5-168 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Eastchester Bay Area Dredging Center

FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Eastchester Creek		286,300			111,500	
Total Suitable Fine					111,500	
Total Unsuitable Material		286,300				

5.17.2 Harbor Characterization for Federal Navigation Projects

Eastchester Creek FNP: Until recently, the one FNP in this dredging center has been managed similar to other projects in LIS as it had yielded fine-grained dredged materials typically found suitable for unconfined open water placement. However, recent sediment testing shows elevated levels of contaminants in portions of the Eastchester Creek FNP. Sediment samples were most recently analyzed for physical and chemical characteristics by Battelle in April 2009. Project samples showed the majority of sediments in East Chester Creek were silt (12-74%) and clay (4.3-34%). Isolated areas of predominantly gravel samples were collected (3.6-84.8%) as well. The material to be dredged was deemed unsuitable for placement at the Historic Area Remediation Site in 2009. The only viable alternative was placement at a permitted and approved upland site. The proposed work was completed and approximately 21,300 CY of sediment was removed from the Federal channel, dewatered and placed upland at brownfield reclamation sites in Teterboro and Bellmawr, NJ. Additionally, sediments from Eastchester Creek were analyzed for chemical composition in 1974. The location of the two samples within the FNP was not given. Both samples tested higher than the EPA criteria at that time for chemical oxygen demand, oil and grease, lead, and zinc. Six samples were also tested for grain size. The material in the two samples was mostly sand (average 68.2%) with some silt (19.45%), gravel (9.96%), and clay (2.67%). Unsuitable material is expected from future maintenance activities at least in the near term. These materials would need either contained placement, or treatment for some other (mainly upland) placement or use, such as brownfield reclamation as was done in 2010.

Over time, continued improvements in water quality and reductions in contaminant discharge could be expected to result in cleaner, perhaps suitable, dredged materials generated by maintenance activities in future decades. The suitable fine material expected in later years may prove usable for more beneficial purposes such as marsh restoration, or to create saltmarsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. These suitable materials could also be placed at available upland sites, or placed at open-water sites, with WLDS, CLDS and the HARS being the closest active sites. Testing of each harbor prior to each dredging operation will be needed to confirm suitability for alternative placement. The material could also be placed upland, with dewatering and re-handling/transport, if found cost-effective for some public purpose (Brownfields, highway landscaping). However, no such purposes were identified by this study. If determined necessary, this would require further investigation in the future.

5.17.3 Other Federal (Non-USACE) Dredging Activities

There are no non-USACE Federal dredging activities or facilities in the Eastchester Bay Area Dredging Center.

5.17.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Eastchester Bay Area Dredging Center that periodically generate dredged material. Most of these are located along the heavily developed shores of City Island, and others are located along the shores of Eastchester Bay, including Hammond Creek (at Locust Point). These facilities include public and private marinas, yacht club and boat yard operations, and private residential and public access facilities including access for offshore islands.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 31,700 CY of maintenance dredging would be needed by non-Federal facilities. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

These activities typically generate suitable fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS being the closest approved site, with HARS and CLDS more distant. These activities could also take advantage of whatever alternative placement methods are used for the Eastchester Bay FNPs in this dredging center, or possibly in the Mamaroneck, New York, Greenwich, Connecticut, or Little Neck/Manhasset Bays, New York areas, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open-water placement for otherwise smaller volumes.

Table 5-169 - Dredging Activity Timeline Eastchester Bay Area Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	13,800	1,800	7,100	7,200	900	900
Additional Projections	0	0	0	0	0	0
Total Non-Federal	13,800	1,800	7,100	7,200	900	900

5.17.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating more than 250,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at open-water sites, including CLDS, WLDS and HARS, though more recently upland placement has also been used. Port/upland fill for specific purposes was also likely used at all of these harbors in earlier times. Several investigations of dredged material management alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-170 - Eastchester Bay Area Dredging Center Available/Potential Placement Alternatives				
Alternative	Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Historic Area Remediation Site	Open Water	10,000,000	All	Suitable Fine
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Norwalk Outer Harbor CDF	Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	242,600	All Once Built	Suitable Fine
- Cap		157,400		
Captain Harbor CDF Greenwich - Fill	Island CDF	498,200	Once Built	All
- Cap		331,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable

Alternative	Site Type	CY Capacity	Years Available	Material Accepted
Hempstead Harbor NY CDF - Fill	Shore CDF	2,787,700	All Once Built	All
Hempstead Harbor NY CDF - Cap	Shore CDF	712,300	All Once Built	All Suitable
Stamford Harbor CDF - Fill	Island CDF	1,700,000	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Manchester City Landfill, CT	Upland	1,200,000	All	All
Flushing Airport Wetlands Restoration Project	Brownfield & Wetlands	140,000	All	All

No sandy materials are projected to be dredged from the Eastchester Bay Area dredging center. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement alternatives available for unsuitable materials from Eastchester Creek include containment in CDFs and CAD cells or in upland landfills approved to receive such materials.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Some projects from nearby dredging centers in New York have been taken to the Historic Area Remediation Site (HARS) off the northern New Jersey coast. While use of that site has not been evaluated in this DMMP, costs for that site are provided for some dredging centers and projects for comparison. Haul distances to various alternative placement sites are shown in the table below.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Table 5-171 - Scow Haul Distances to In-Water Placement Sites												
Project (Distances in Statute Miles)	HARS	Greenwich Captain Harbor CDF	Hempstead Harbor CDF	Stamford Harbor CDF/CAD	Western LIS DS	Eatons Neck East DS	Norwalk Islands CDF	Sherwood Island CAD	Bridgeport East	Central LIS DS	New Haven Breakwaters CDF	Morris Cove CAD
City Island East Shore	45.9	13.1	9.7	17.0	18.8	22.3	24.9	31.5	36.3	51.9	53.0	54.7
Eastchester Creek	47.8	18.8	13.8	22.7	24.0	27.3	29.5	37.2	41.4	56.9	58.0	60.4
Locust Point	43.9	15.9	11.7	19.8	21.6	25.1	27.3	34.3	39.2	54.8	55.3	57.5

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island (COW) could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor, New York, Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, and New Haven Breakwaters. A CDF facility at Hempstead Harbor along the southwest shoreline has been proposed at a former sand mining company site that could accommodate the needs of other harbors in the western sound with its 2.8 million CY capacity.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands. Another habitat project site is a component of the Flushing Airport Brownfield and wetlands project in Queens, New York.

5.17.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Eastchester Bay Area Dredging Center, the analysis matched this FNP with placement alternatives as follows.

Eastchester Creek: Future maintenance of the Eastchester Creek FNP is expected to yield fine grained dredged material over the DMMP planning horizon. This material has been and is expected to continue to be found unsuitable for unconfined open water placement for at least the next major maintenance operation. Unsuitable materials must be either contained or treated before placement or use. This limits the potential placement and use alternatives to CAD cells, interior cells of CDFs, and landfill facilities upland (potentially also requiring treatment or augmentation to reduce contaminant levels). Future maintenance operations may yield material that is suitable due to continued regulatory efforts and improvements in water and sediment quality. Therefore, alternatives for suitable dredged materials have also been evaluated.

The least cost placement alternative for the next maintenance dredging of unsuitable fine-grained material from the Eastchester Creek FNP is placement either in the Morris Cove borrow pit CAD cell in New Haven Harbor, or in a CAD cell constructed in Greenwich Harbor in conjunction with the maintenance of that FNP. The second least costly alternative is placement as fill in the Hempstead Harbor CDF site, at a cost increase of 70 percent. Placement in the Captain Harbor or Norwalk Islands CDFs would cost 1.9 times the cost of Morris Cove. Placement in a CDF constructed at the Norwalk harbor Island or at Stamford Harbor would be 1.9 times the cost of Morris Cove. Placement in more distant CDF sites in Bridgeport or New Haven would cost 2.3 times the cost of using Morris Cove.

Table 5-172 - Eastchester Creek FNP - Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Unsuitable Fine	286,300	2021-2025	Captain Harbor CDF – Fill	$122
			Hempstead Harbor CDF – Fill	$112
			Norwalk Islands Marsh – Fill	$127
			Norwalk Islands CDF – Fill	$127
			Morris Cove Pit CAD – Fill	$66
			Falkner Island CDF – Fill	$153
			Duck Island Roads CDF – Fill	$153
			Twotree Island CDF – Fill	$153
			New Haven Breakwaters CDF – Fill	$153
			Groton Black Ledge CDF – Fill	$153
			Stratford Point CDF – Fill	$153
			Penfield Reef CDF – Fill	$153
			Yellow Mill Channel CDF – Fill	$153
			Greenwich In-Harbor CAD – Fill	$66
			Stamford Harbor CDF – Fill	$127

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	111,500	2036-2040	Western Long Island Sound DS	$33
			Captain Harbor CDF – Fill	$126
			Hempstead Harbor CDF – Fill	$115
			Flushing Wetlands Project	$74
			Sherwood Island Pit CAD – Cap	$40
			Sherwood Island Pit CAD – Fill	$40
			110 Sand Co., Melville, NY	$85
			Norwalk Islands CDF Fill	$131
			Norwalk Islands Marsh – Fill	$131
			Jamaica Bay Marsh Islands	$85
			Morris Cove Pit CAD – Fill	$75
			Manchester City Landfill	$107
			Central Long Island Sound DS	$60
			New Haven Breakwaters CDF – Fill	$164
			Historic Area Remediation Site	$60
			Stamford Harbor CDF – Fill	$131

The least cost placement alternative for the future maintenance dredging of potentially suitable fine-grained material from the Eastchester Creek FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 21 percent. The next least costly alternative would be placement in open water at either the Central Long Island Sound site, or at the HARS, at 1.8 times the cost of using the WLDS. The next least costly alternative would be placement in the Morris Cove borrow pit CAD cell in New Haven Harbor, or use in a wetlands/brownfield restoration project upland such as the Flushing Airport project, both at 2.3 times the cost of the least costly alternative. Upland placement at a landfill in New York, or use in continued marsh restoration efforts in Jamaica Bay would each cost about 2.6 times the cost of using the WLDS. Placement at various CDF sites in the western LIS area would cost about four to five times the cost of using the WLDS.

5.17.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for the one FNP in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-173 - Federal Navigation Project Base Plans Eastchester Bay Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
Eastchester Creek		
Next Maintenance	Unsuitable	In-Harbor CAD Cell or Morris Cove Pit CAD - Fill
Future Maintenance	Suitable Fines	Western Long Island Sound DS

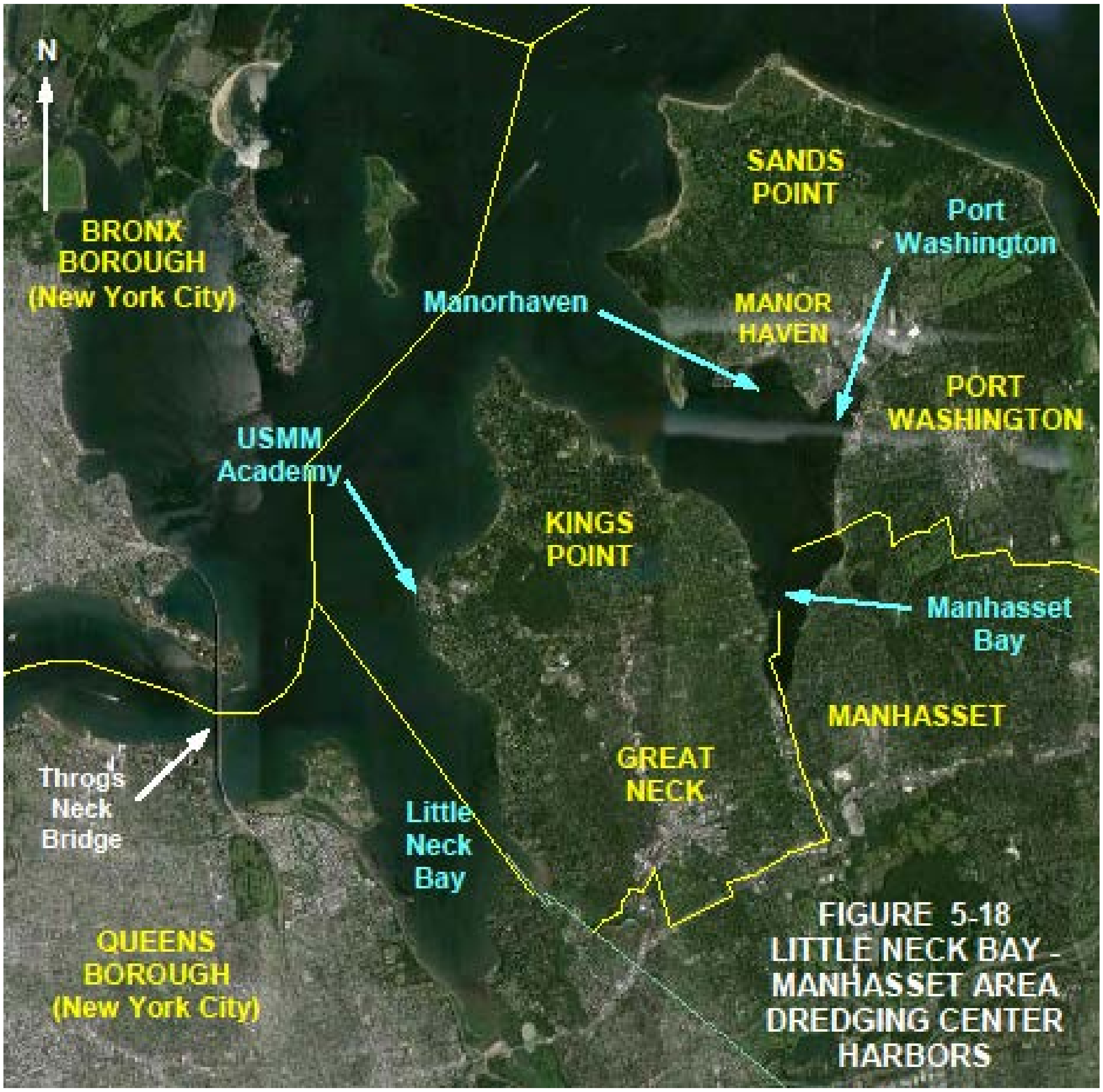
Alternatives to the Federal Base Plan: For the unsuitable material from Eastchester Creek FNP in the next maintenance operation, the material must be contained, and may not be placed in open water. The base plan is placement in the Morris Cove CAD cell or in a CAD cell constructed in Eastchester Bay or Creek, or one constructed in Greenwich for that harbor and others in Connecticut or New York in far western LIS. Placement in CDF sites in Hempstead (at a 70 percent increase), at Captain Harbor (85 percent increase), or at CDFs in Norwalk or Stamford (both a 90 percent increase) would not be cost-effective.

The Federal base plan for the potentially suitable fine-grained material from the second maintenance operation at Eastchester Creek is open water placement at the Western Long Island Sound site. The least costly non-open water alternative is placement at the Sherwood Island COW site would only require an increase in cost of 21 percent, but would also require the site be available at the time that Eastchester Creek is dredged that second time. Placement in the Morris Cove CAD cell, or use in a habitat restoration site in Flushing would be 2.3 times the cost of the WLDS, would also require that site to still be available at the time Eastchester creek is later dredged and would not be cost-effective. Upland placement and CDF placement would be 2.6 times the cost of the base plan and not cost-effective.

5.18 Manhasset and Little Neck Bays Area Dredging Center

The Manhasset and Little Neck Bays Area Dredging Center consists of most of the shore areas of the Queens Borough of New York City (Queens County) east of the Throgs Neck Bridge, and the shore of Western Nassau County east to Sands Point on Manhasset Neck. In Nassau County the dredging center includes all or portions of the township of Hempstead and the villages of Kings Point, Great Neck, Manhasset, Plandome, Port Washington, Manorhaven, and Sands Point. The area includes the Federal Navigation Project for Little Neck Bay. Another FNP for Manhasset Bay was never constructed and later deauthorized. The dredging center also includes the U.S. Merchant Marine Academy on Kings Point, and the heavily developed waterfronts of Manorhaven and Port Washington on Manhasset Neck. The principal waterways in this area are:

Little Neck Bay – Includes FNP
Kings Point (USMMA)
Manhasset Bay
Port Washington and Manorhaven Harbors



The waterways and facilities in this dredging center yield mainly a mix of and sandy and fine-grained materials. It is unlikely that any materials from this dredging center, even entrance channel materials, would be found sandy enough to make them suitable for direct beach placement, though testing for specific projects in the eastern areas of the dredging center may prove suitable for nearshore bar placement.

5.18.1 Federal Navigation Projects - Maintenance

The Little Neck Bay FNP, the only FNP in this dredging center was dredged most recently in 1966-1968 as shown below.

Table 5-174 - Federal Navigation Project Dredging History Manhasset and Little Neck Bays Area Dredging Center				
FNP Activity	Years Dredged	Cubic Yards	Placement Method	Material Type
Little Neck Bay (Improvement Dredging)	1966-1968	2,184,800	Unknown	Suitable Fine

Little Neck Bay: The FNP for Little Neck Bay was constructed in May 1966 to September 1968 with a total of about 2,184,800 CY was dredged over three seasons of work. The project consists of a 7-foot entrance channel to a 350-acre 7-foot anchorage. The project has never been maintained since its initial construction and the southern inner end and margins of the anchorage have shoaled. There is no survey data available for the Little Neck Bay FNP due to the loss of New York District records during Hurricane Sandy in 2012. Based on soundings shown on NOAA Coast Chart #12366, 30th Edition, October 2014, it is estimated that about 683,500 CY of shoal material is within the dredge template of the project, including a one-foot overdepth allowance. This yields an annual shoaling rate of 14,900 CY over the 46 years since it was last dredged. If this project were to be fully maintained in about 2023, some 55 years after its initial construction, then a total of about 817,200 CY of shoal material could be expected. If the project were then to next be maintained on a 20-year frequency then a further 297,200 CY of shoal material could be expected in about 2043.

Manhasset Bay: A FNP for Manhasset Bay was authorized in 1930 calling for an 8-foot channel extending south to the head of the Bay at Manhasset with a turning basin and anchorage at its head. The project was never constructed and was subsequently deauthorized in January 1990 under the sunset provisions of §1001(b)(1) of the 1986 WRDA. There is thus no longer any authority for the USACE to dredge the Manhasset Bay FNP and it is not included in this DMMP.

The dredging activity timeline over the planning horizon for the single FNP in the Manhasset and Little Neck Bays Area Dredging Center is shown below.

Table 5-175 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Manhasset and Little Neck Bays Area Dredging Center						
FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Little Neck Bay FNP		817,200				297,200
Total Suitable Fine		817,200				297,200

5.18.2 Harbor Characterization for Federal Navigation Projects

Little Neck Bay FNP: The FNP at Little Neck Bay has not been maintained since it was initially constructed between 1966 and 1968. Information regarding sediment type and chemistry is not available for that event. However, records of recent permitting actions from non-Federal dredging projects proximal to the Little Neck Bay FNP have demonstrated suitability for upland placement. The USACE does not regulate upland placement of dredged material unless wetlands are impacted, and only limited data was made available by state agencies. As projects in these two areas have not proposed using open water placement, recent testing has not even examined its potential for that placement option. State testing protocols for upland placement are typically more restrictive than for open water placement due to the proximity of upland sites to human habitation, ground water, and other land uses. Also, most harbors immediately across the Sound in Westchester and Fairfield Counties with similar uses and facilities typically test as suitable for open water placement. The USACE believes that testing using the protocols for ocean placement would show most materials from these two bays to be likely suitable for open water placement. We note that future projects could examine the suitability of open water placement through appropriate sampling and testing if they so chose. The assumption for the purposes of the DMMP is that maintenance of the Little Neck Bay FNP is expected to yield a mixed sandy and fine-grained dredged material, which is expected to be suitable for open-water placement.

The material may also prove usable for more beneficial purposes such as marsh restoration, or to create salt marsh in shallow tidelands to replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. These suitable materials could also be placed at available upland sites, or placed at open-water sites, with WLDS, CLDS, and the HARS site being the closest active sites. Testing of the project's materials prior to each dredging operation will be needed to confirm suitability for alternative placement. The material could also be placed upland, with dewatering and re-handling/ transport, if found cost-effective for some public purpose (brownfield remediation, highway landscaping). However, no such purposes were identified by this study. If determined necessary this would require further investigation in the future.

5.18.3 Other Federal (Non-USACE) Dredging Projects

The U.S. Merchant Marine Academy is located at Kings Point on the western shore of Great Neck in Nassau County. The U.S. Coast Guard Station Kings Point, part of USCG Sector New York, is co-located with the Academy. This joint Federal facility has dredged its access channel, deep berth and boat basin area in 1991 (24,200 CY to WLIS), and in 2005-2006 (31,000 to NJ Upland). This yields an annual shoaling rate of about 2,200 CY, for a frequency of about 33,200 CY dredged every fifteen years, with the next maintenance operation due in about 2021.

Table 5-176 - Dredging Activity Timeline – Manhasset and Little Neck Bays Other Federal Activities

	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
U.S. Merchant Marine Academy - Kings Point and U.S. Coast Guard Station King Point (co-located)		33,200	0	0	33,200	0

5.18.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Manhasset and Little Neck Bays Area Dredging Center that periodically generate dredged material. Most of the larger facilities are located along the developed shores of Manhasset Neck at Manorhaven and Port Washington. Smaller facilities exist in Little Neck Bay on the Bay Terrace, Bayside, and Douglaston areas of Queens, and in Nassau County on the Great Neck Estates and Kings Point shores. In Manhasset Bay, smaller facilities are found on the east shore of Great Neck and near the head of Manhasset Bay. These facilities include public and private marinas, yacht club and boat yard operations, and private residential and public access facilities including access.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 269,500 CY of maintenance dredging and 17,500 CY of improvement dredging would be needed by non-Federal facilities. The dredging needs report also projected an additional 76,200 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. This total, distributed over the 30-year DMMP planning horizon is shown in the table below. As Manhasset and Little Neck Bays are in the same dredging center, information on non-Federal projects was aggregated so that individual survey respondents could not be identified, in keeping with the confidentiality requirements of Federal surveys of the general public and private parties.

These non-Federal activities are expected to generate suitable mixed sandy and fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS being the closest approved site, and with HARS and CLDS more distant. These activities could also take advantage of whatever alternative placement methods are used for the one FNP in this dredging center, or possibly in the Eastchester Bay or Hempstead Harbor, New York areas, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open-water placement for otherwise smaller volumes.

Table 5-177 - Dredging Activity Timeline – Manhasset & Little Neck Bays Area Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	113,500	16,500	35,000	35,000	34,700	34,800
Additional Projections	12,700	12,700	12,700	12,700	12,700	12,700
Improvement (Permits)	2,500	5,000	2,500	2,500	2,500	2,500
Total Non-Federal	13,800	1,800	7,100	7,200	900	900

5.18.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating more than 800,000 CY are anticipated. Most dredged materials from this dredging center over at least the past half century have been placed at open-water sites, including CLDS, WLDS and HARS, though more recently upland placement has been most often used. Port/upland fill for specific purposes was also likely used at all of these harbors in earlier times. Several investigations of dredged material management alternatives identified the following as opportunities for placement for projects from this dredging center.

No sandy materials are projected to be dredged from the Manhasset and Little Neck Bays Area dredging center. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-178 - Manhasset & Little Neck Bays Area Dredging Center Available/Potential Placement Alternatives

Alternative	Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Historic Area Remediation Site	Open Water	10,000,000	All	Suitable Fine
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Norwalk Outer Harbor CDF	Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	554,000	All Once Built	Suitable Fine
- Cap		376,000		
Captain Harbor CDF Greenwich - Fill	Island CDF	498,200	Once Built	All
- Cap		331,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Hempstead Harbor NY CDF - Fill	Shore CDF	2,787,700	All Once Built	All
- Cap		712,300		All Suitable
Stamford Harbor CDF - Fill	Island CDF	1,700,000	Once Built	All

Alternative	Site Type	CY Capacity	Years Available	Material Accepted
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Manchester City Landfill, CT	Upland	1,200,000	All	All
Flushing Airport Wetlands Restoration Project	Brownfield & Wetlands	140,000	All	All

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Some projects from nearby dredging centers in New York have been taken to the Historic Area Remediation Site (HARS) off the northern New Jersey coast. While use of that site has not been evaluated in this DMMP, costs for that site are provided for some dredging centers and projects for comparison.

Table 5-179 - Scow Haul Distances to Active and Historic In-Water Placement Sites

Project (Distances in Statute Miles)	HARS	Greenwich Captain Harbor CDF	Hempstead Harbor CDF	Stamford Harbor CDF/CAD	Western LIS DS	Eatons Neck East DS	Norwalk Islands CDF	Sherwood Island CAD	Bridgeport East	Central LIS DS	New Haven Breakwaters CDF	Morris Cove CAD
Little Neck Bay	45.1	17.6	13.7	22.2	23.3	26.8	29.0	35.8	40.8	56.5	56.9	59.9
Kings Point – US Merchant Marine Academy	43.9	14.9	10.9	19.5	20.7	24.2	26.5	33.1	38.2	53.8	54.6	57.2
Manhasset Bay	50.3	16.1	12.0	20.4	21.7	25.2	27.5	33.7	39.2	54.4	55.4	58.2
Port Washington	49.5	15.3	11.2	19.6	20.7	24.2	26.6	32.9	38.2	53.7	54.5	57.3

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut, and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island (COW) could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor (New York), Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, and New Haven Breakwaters. A CDF facility at Hempstead Harbor along the southwest shoreline has been proposed at a former sand mining company site that could accommodate the needs of other harbors in the western sound with its 2.8 million CY capacity.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands. Another habitat project site is a component of the Flushing Airport Brownfield and wetlands project in Queens, New York.

5.18.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Manhasset and Little Neck Bays Area Dredging Center analysis matched projects are as follows.

Little Neck Bay: Future maintenance of the Little Neck Bay FNP is expected to yield fine grained dredged material over the DMMP planning horizon. This material is expected to be found suitable for unconfined open water placement. Fine-grained materials could be placed at open water sites, or in containment facilities (CDFs). Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically. The top-scoring alternatives from the site screening process for Little Neck Bay are shown below.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Little Neck Bay FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 21 percent. Placement at either the Central Long Island Sound site or at the HARS ocean site off the NJ coast would also be a 21 percent increase over the WLDS. The next least costly alternative would be placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at 1.8 times the cost of the least costly alternative. Upland placement at a landfill in New York, or use in a Flushing Airport Brownfield and wetland restoration project would each cost about 2.1 times the cost of using the WLDS. Use in continued marsh restoration efforts in the Jamaica Bay vicinity would be 2.5 times the cost of the WLDS. Placement at various CDF sites in the western LIS area would cost between 3 to 4 times the costs of using the WLDS.

Table 5-180 - Little Neck Bay FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	111,500	2036-2040	Hempstead Harbor CDF – Fill	$111
			110 Sand Co., Melville, NY	$80
			Captain Harbor CDF – Fill	$119
			Manchester City Landfill	$121
			Western Long Island Sound DS	$38
			Falkner Island CDF – Fill	$143
			Duck Island Roads CDF – Fill	$143
			Twotree Island CDF – Fill	$143
			New Haven Breakwaters CDF – Fill	$143
			Groton Black Ledge CDF – Fill	$143
			Norwalk Islands Marsh – Fill	$125
			Norwalk Islands CDF Fill	$125
			Jamaica Bay Marsh Islands	$96
			Morris Cove Pit CAD – Fill	$67
			Central Long Island Sound DS	$50
			Flushing Wetlands Project	$80
			Sherwood Island Pit CAD – Fill	$50
			Sherwood Island Pit CAD – Cap	$50
			Historic Area Remediation Site	$50
			Stamford Harbor CDF – Fill	$125

U.S. Merchant Marine Academy at Kings Point: Future maintenance of the U.S. Merchant Marine Academy is expected to yield fine grained dredged material over the DMMP planning horizon. This material is expected to be found suitable for unconfined open water placement. Fine-grained materials could be placed at open water sites, or in containment facilities (CDFs). Silty material may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically. The top-scoring alternatives from the site screening process for U.S. Merchant Marine Academy are shown below.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the boat basin at the U.S. Merchant Marine Academy at Kings Point, New York is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 19 percent. Use in a Flushing Airport brownfield and marsh restoration project, or placement upland at a landfill in New York, would each cost about 1.6 times the cost of using the WLDS. Use in continued marsh restoration efforts in the Jamaica Bay vicinity, or placement in open water at either the Central Long Island Sound site or the HARS site would cost 1.7 times the cost of the WLDS.

Table 5-181 U.S. Merchant Marine Academy and U.S. Coast Guard Station Kings Point Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	33,200	2021-2045	Western Long Island Sound DS	$47
	33,200	2036-2040	Captain Harbor CDF – Fill	$142
			Captain Harbor CDF – Cap	$142
			Hempstead Harbor CDF – Fill	$123
			Hempstead Harbor CDF – Cap	$123
			Flushing Wetlands Project	$75
			Sherwood Island Pit CAD – Fill	$56
			Sherwood Island Pit CAD – Cap	$56
			110 Sand Co., Melville, NY	$75
			Norwalk Islands CDF – Fill	$144
			Norwalk Islands Marsh – Fill	$144
			Jamaica Bay Marsh Islands	$79
			Morris Cove Pit CAD – Fill	$92
			Brookhaven Town Landfill	$114
			Central Long Island Sound DS	$79
			New Haven Breakwaters CDF – Fill	$173
			Historic Area Remediation Site	$79
			Stamford Harbor CDF – Fill	$142

This project has used the HARS site in the recent past. The next least costly alternative would be placement in the Morris Cove borrow pit CAD cell in New Haven Harbor at twice the cost of the least costly alternative. Placement at various CDF sites in the western LIS area would cost between 2.5 to 4 times the cost of using the WLDS.

5.18.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for USACE and other Federal agency projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-182 - Federal Navigation Project and Other Federal Agency Project Base Plans – Manhasset & Little Neck Bays Area Dredging Center Projects		
Project and Segment	Material Type	Federal Base Plan
Little Neck Bay FNP	Suitable Fines	Western Long Island Sound DS
U.S. Merchant Marine Academy – Kings Point	Suitable Fines	Western Long Island Sound DS

Alternatives to the Federal Base Plan: The Federal base plan for the suitable fine-grained material from both the Little Neck Bay FNP and the U.S. Merchant Marine Academy at Kings Point is open water placement at the Western Long Island Sound site. For both projects, the Sherwood Island COW site would be the least costly non open water alternative at about a 20 percent increase. Use in continued habitat restoration in Jamaica Bay or at Flushing would be 70 to 80 percent more costly than the base plan but elements of that effort might be eligible for Federal participation under other USACE authorities with non-Federal cost-sharing or full non-Federal funding if no USACE authority was warranted.

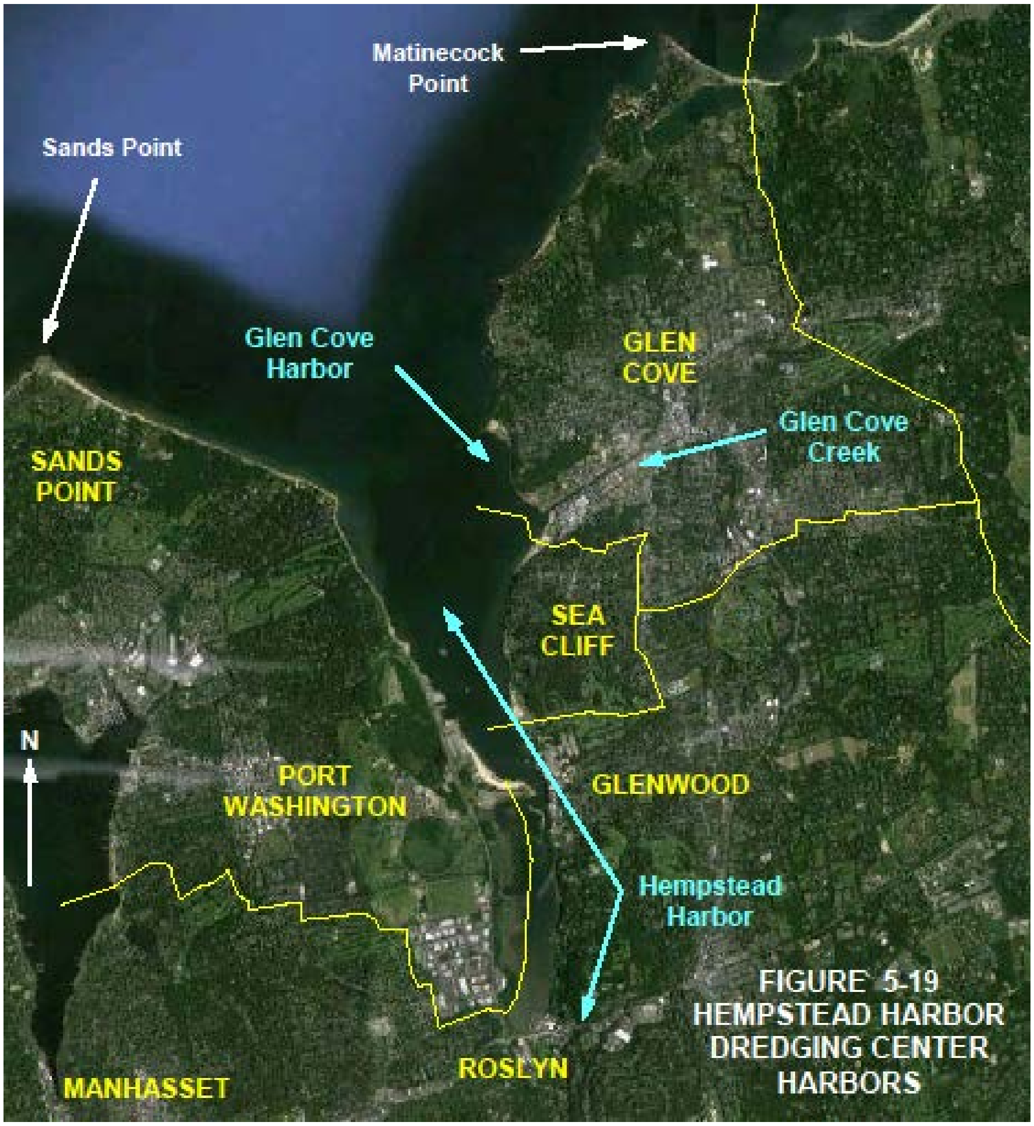
5.19 Hempstead Harbor Area Dredging Center

The Hempstead Harbor Area Dredging Center consists of the Long Island shoreline in the Townships of North Hempstead and Oyster Bay in Nassau County, from Sands Point on Manhasset Neck in the west, to Matinecock Point (East Island) in the East. It includes the east shores of the villages of Sands Point and Port Washington as well as the shore areas of Roslyn, Roslyn Harbor, Glenwood, Sea Cliff, and Glen Cove. The area includes the Federal Navigation Projects for Hempstead Harbor, Glen Cove Harbor (breakwater only – no dredged features), and Glen Cove Creek.

The principal waterways in this area are:

Hempstead Harbor – Includes FNP
Glen Cove Harbor – Includes FNP (Breakwater Only – No Dredged Features)
Glen Cove Creek – Includes FNP

The waterways and facilities in this dredging center yield mainly a mix of and sandy and fine-grained materials. It is unlikely that any materials from the FNPs in this dredging center, even entrance channel materials, would be found sandy enough to make them suitable for direct beach placement, though testing for specific projects may prove suitable for nearshore bar placement. Other non-Federal projects in the dredging center may however produce some amount of dredged material suitable for beach nourishment. Contaminant levels in Glen Cove Creek shoal materials encountered in the 2001 and 2004 maintenance of that waterway required special handling and containment upland, though later marina maintenance in the same waterway was determined suitable for open-water placement.



5.19.1 Federal Navigation Projects - Maintenance

The most recent dredging events for the two FNPs in this dredging center are shown below.

Table 5-183 - Federal Navigation Project Dredging History Hempstead Harbor Area Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Hempstead Harbor	1950	31,600	Unknown	Fines
	1936	19,800	Unknown	Unknown
	1928	69,900	Unknown	Unknown
Glen Cove Creek	2007	28,750	Diked Upland	Unsuitable
	2001	30,500	Upland	Unsuitable
	1996	11,600	Unknown	Unknown
	1965	6,300	Unknown	Unknown
	1960	27,100	Unknown	Unknown
	1948	26,500	Unknown	Unknown
Improvement	1934	195,500	Unknown	Unknown

Hempstead Harbor: The FNP for Hempstead Harbor as adopted in 1910 consists of a 6-foot channel from deep water north of Bar Beach up-harbor 2.3 miles to just below Old Northern Boulevard in Roslyn. A later project modification authorized in 1968 to deepen the channel below Route 25A to 13 feet and add a turning basin was never constructed and was deauthorized in 1990. The 6-foot channel has been maintained three times, in 1928, 1936 and 1950, with a total of 121,300 CY removed in those operations. The 1936 and 1950 maintenance volumes yield an annual shoaling rate of about 2,300 CY for that 22 year period. At that rate, the project should have accumulated about 149,500 CY through 2014. There are no current surveys or shoal volumes available for this project. If this project were to be next maintained in 2030 (80 years since its last dredging) then about 186,900 CY of shoal could be expected at that time. This project is expected to be maintained no more than once during the DMMP planning horizon.

Glen Cove Creek: A FNP for Glen Cove Creek was adopted in 1925 and consists of an 8-foot channel from deep water in Hempstead Harbor upstream to below Charles Street in Glen Cove. Since its completion in 1935 the project has been maintained seven times, six times by the USACE and once partially by the municipality in 2004. During private facility berth maintenance, permitted in 1998, and later channel maintenance by the USACE in 2001, work was terminated when radiological contamination was discovered in dredged materials placed at an upland site. Remediation of that upland site was carried out and dredging was completed by the city with the material transported to upland containment. The next USACE maintenance operation in 2006-2007 placed the dredged material (28,750 CY) at a diked upland site. Recent dredged material from this project has been classified as sandy silt. The total volume of maintenance material removed from the project by the USACE since project completion in 1935 through 2007 was about 130,800 CY, yielding an annual shoaling rate of about 1,800 CY for that 72-year period. More recently, a condition survey in 2014 (Survey #4148 – soundings from June 2014) indicates that about 6,200 CY of shoal have accumulated in the project since the 2007 maintenance operation. When this volume and time is added to the record, the annual shoaling rate is reduced to about 1,700 CY. Over its life, the maintenance frequency for this project has ranged from five to twelve years. Using the longer twelve-year frequency, the project would be maintained in 2019, 2031 and 2043 during the DMMP planning horizon. Using the 2014 shoal volume and the 1,700 CY annual rate yields projected maintenance volumes for those three operations of 14,300, 19,600 and 19,600 CY, respectively.

Whether or not future maintenance materials from Glen Cove Creek would prove suitable for open-water placement would depend on sediment testing conducted at those times for each specific action. The past three operations, two by the USACE and one by the community, placed those materials in confined upland sites due to contaminant levels. For the purposes of this analysis it is assumed that condition will continue at this project.

The dredging activity timeline over the DMMP planning horizon for the two FNPs in the Hempstead Harbor Area Dredging Center is shown below.

Table 5-184 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Hempstead Harbor Area Dredging Center

FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Hempstead Harbor FNP			186,900			
Glen Cove Creek FNP	14,300			19,600		19,600
Total Suitable Fine			186,900			
Total Unsuitable	14,300			19,600		19,600

5.19.2 Harbor Characterization for Federal Navigation Projects

Until the end of the 20th century the two FNPs in this dredging center were managed similar to other projects in the western sound, with open water placement and upland fill for port development as the preferred placement methods. More recently sediments from Glen Cove Creek have been found unsuitable for any use other than containment and treatment due to contamination.

Hempstead Harbor FNP: There is no recent shoal sediment test data available from the FNP. The most recent chemical testing of Hempstead Harbor's sediments occurred in 1976, with two sites (both near the town wharf) tested for metals. All metals tested were relatively low or undetected in both samples (U.S. Testing Company, 1976). Grain size analysis from 1982 showed that harbor sediments were mostly sand (78.6%) with silt (16.7%) and clay (5.1%) (NY Testing Lab, 1982). These results, showing more than 20 percent fine-grained material, are typically greater than what is suitable for direct beach placement. However, this material may be suitable for nearshore feeder bar/berm placement. Only future testing of specific projects will show which material types are present and what placement alternatives may be suitable.

Permit activities also provide data on harbor sediment characterization. Chemistry data from 1971 indicated that two samples from the Town Wharf and Glenwood Landing in Hempstead Harbor exceeded criteria limits then in place for oil and grease. In recent years (1999 and 2004), permits from non-Federal projects next to the Hempstead Harbor FNP have shown suitability for upland placement for the purposes of beach nourishment and marsh restoration.

Taken as a whole, this information yields mixed results as to whether harbor sediments are typically coarse or fine grained. For purposes of this DMMP, it is unlikely that any shoal materials from the FNPs in this dredging center, even entrance channel materials, would be found sandy enough to make them suitable for direct beach placement. Future testing for specific projects may prove suitable for nearshore bar placement, or otherwise suitable for open water placement in LIS, or for use in marsh restoration or upland placement.

<u>Glen Cove Creek FNP</u>: Glen Cove Creek dredged materials have been extensively tested since the late 1990s in association with maintenance dredging operations and Superfund clean-up activities. Materials in this period have been found unsuitable for open water placement and have been disposed upland, most recently at facilities licensed to receive and process heavily contaminated materials, including radiological contamination. Beginning in November 1996, sediment samples were taken for proposed maintenance dredging of the Glen Cove Creek FNP. Those samples showed that Glen Cove Creek consisted mainly of silt and clay (ranging from 4-99 percent fines) with a few core samples that showed a higher sand content (ranging from 2-88 percent sand). Work began in 1996 to maintain the outer portion of the channel. Maintenance dredging of the remaining portion of the creek began in 2001. Work included dredging of approximately 30,500 CY of material with upland placement. Dredging was suspended in April 2001 due to the discovery of an oil layer in the creek sediment. In May 2001, radiation was found in the dredged material placed at the upland dewatering site. Subsequent investigations revealed that the radiological contamination was caused by discrete pieces of ore or slag, varying in size from pea gravel to cobbles. The work site was immediately secured by the USACE and EPA, and converted to a Superfund cleanup site. Additional sampling of the creek sediment for radiological and oil contamination was completed and the report was submitted by the contractor (Cabrera) in the first week of March 2002. The report concluded that significant thorium contamination was present in the creek sediments. The radiological contaminated material in the dewatering site was segregated by USEPA in the summer of 2002 and stored in the Dixon Warehouse for eventual placement. The City of Glen Cove moved the remaining non-radioactive dredged material from the dewatering site in November/December 2002 to the North Hempstead Landfill. USACE was not able to complete the dredging of the creek due to the fact it was incorporated into the ongoing Superfund cleanup project in the adjacent upland areas. Dredging of the remaining portions of the creek was performed by USACE for the EPA under the Superfund program. The project was completed in March 2007 with the removal of an estimated 28,800 CY of dredged material.

<u>The Hempstead Area Dredging Center in General</u>: Maintenance of the two FNPs in this dredging center is expected to yield a mixed sandy and fine-grained dredged material (sandy-silt to silty-sand). The material from projects in the harbor and bay is expected to be suitable for open-water placement, while the material from projects in Glen Cove Creek is not anticipated to be found suitable. The suitable fine material may also prove usable for more beneficial purposes such as marsh restoration, or to create salt marsh in shallow tidelands to

replace marsh lost to past fill actions, or pumped onto existing marsh areas as adaptive management in response to sea level rise. These suitable materials could also be placed at available upland sites, or placed at open-water sites, with WLDS and CLDS being the closest sites. Testing of the shoal materials prior to each dredging operation will be needed to confirm suitability for alternative placement. The material could also be placed upland, with dewatering and re-handling/transport, if found cost-effective for some public purpose (brownfields, highway landscaping). However, no such purposes were identified by this study. If determined necessary this would require further investigation in the future.

The unsuitable material that Glen Cove Creek is expected to produce could be placed in a confined facility upland, as done in recent operations, or in confined aquatic placement cells constructed in the harbor or elsewhere. Confined placement facilities constructed elsewhere in the LIS region could also be used for this material. Depending on the contaminants present and concentration, treatment of the material prior to ultimate placement or use for other purposes may be found appropriate.

5.19.3 Other Federal (Non-USACE) Dredging Projects

There are no non-USACE Federal facilities or projects requiring dredging in the Hempstead Harbor Area dredging center.

5.19.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in both Hempstead Harbor and Glen Cove Creek. Small marinas, public access facilities, public anchorage areas, yacht clubs and private residential access points are located around the harbor's shores. A large commercial sand and soils processing and shipment facility is located on the Port Washington shoreline of the harbor. Larger marina and boat yard facilities and commercial wharves are located on Glen Cove Creek, along with public access facilities.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 65,000 CY of maintenance dredging would be needed by non-Federal facilities. The dredging needs report also projected an additional 25,700 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

These activities are expected to generate suitable mixed sandy and fine-grained dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS being the closest approved site, and CLDS more distant. These activities could also take advantage of whatever alternative placement methods are used for the two FNPs in this dredging center, or possibly in the adjacent Manhasset or Oyster Bay, New York areas, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open-water placement for otherwise smaller volumes.

Based on more recent permit data for non-Federal projects, and information provided by the Town of North Hempstead in their letter of October 16, 2015, some amount of the material dredged from non-Federal projects may be sandy material suitable for beach or bar placement.

For purposes of this DMMP it is assumed that 50 percent of the future non-Federal material may meet these requirements.

Table 5-185 - Dredging Activity Timeline – Hempstead Harbor Area Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	35,000	10,000	5,000	5,000	5,000	5,000
Additional Projections	4,300	4,300	4,300	4,300	4,300	4,200
Total All Materials	39,300	14,300	9,300	9,300	9,300	9,200
Total Suitable Fine (50%)	19,700	7,200	4,700	4,700	4,700	4,600
Total Sand (50%)	19,600	7,100	4,600	4,600	4,600	4,600

5.19.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating less than 200,000 CY are anticipated. Most dredged materials from this dredging center over at least the past 70 years have been placed at open-water sites in the western Sound, though since 1990 upland placement has been most often used. Port/upland fill for specific purposes was also likely used at both of the Federal projects in earlier times, as evidenced from the developed filled shorelines on both the western side of Hempstead Harbor and along Glen Cove Creek. Several investigations of dredged material management alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-186 - Hempstead Harbor Area Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	Al l Suitable
Historic Area Remediation Site	Open Water	10,000,000	All	Suitable Fine
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Norwalk Outer Harbor Islands Marsh Creation - Fill	Island CDF	242,600	All Once Built	Suitable Fine
- Cap		157,400		
Captain Harbor CDF - Fill	Island CDF	498,200	Once Built	All
Greenwich - Cap		331,800		All Suitable

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Falkner Island CDF - Fill	Island CDF	16,010,200	Once Built	All
Guilford - Cap		1,169,800		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Hempstead Harbor NY - Fill	Shore CDF	2,787,700	All Once Built	All
CDF - Cap		712,300		All Suitable
Bridgeport Yellow Mill - Fill	Shore CDF	197,900	All Until Filled	All
Channel CDF - Cap		102,100		All Suitable
Twotree Island CDF, CT - Fill	Island CDF	2,966,200	Once Built	All
Greenwich Harbor Specific CAD Cell – Fill and Cap	Harbor CAD	To Design	Once Built	All
Stamford Harbor CDF – Fill	Island CDF	1,700,000	Once Built	All
Groton Black Ledge CDF – Fill	Island CDF	6,930,000	Once Built	All
Duck Island Road CDF – Fill	Island CDF	1,376,100	Once Built	All
Stratford Point CDF – Fill	Shore CDF	33,666,900	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Manchester City Landfill, CT	Upland	1,200,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All
Placement Options for Sandy Material for Non-Federal Projects				
Sherwood Island Borrow Pit	COW Cap	484,000	Until Filled	Sand
Bayville Beach	Nearshore	96,200	Recurring	Sand
Asharoken Beach	Nearshore	248,300	Recurring	Sand

While some materials dredged from Hempstead Harbor may in the future be found coarse enough for placement on area beaches or nearshore bar/berm systems as nourishment, chemical testing from recent projects indicates that some of the material may not be suitable for such uses. Placement alternatives for suitable materials for FNPs in this dredging center will be limited to those associated with fine-grained materials, including open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. Placement alternatives available for unsuitable materials from Glen Cove Creek include containment in CDFs and CAD cells, or in upland landfills approved to receive such materials.

Placement alternatives for non-Federal projects would also include those suitable for sandy materials (a few representative alternatives are shown in the table above), as recommended by the Town of North Hempstead in their letter of October 16, 2015. Smaller-scale non-Federal projects will likely find more local nourishment opportunities.
Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. Some projects from nearby dredging centers in New York have been taken to the Historic Area Remediation Site off the northern New Jersey coast. While use of that site has not been evaluated in this DMMP, costs for that site are provided for some dredging centers and projects for comparison.

Table 5-187 - Scow Haul Distances to In-Water Placement Sites

Project (Distances in Statute Miles)	HARS	Hempstead Harbor CDF	Greenwich Harbor CDF or CAD cell	Stamford CDF	WLIS DS	Norwalk Island CDF or Marsh	Sherwood Island COW Site	Penfield Reef CDF	Yellow Mill Channel CDF	Stratford Point CDF	CLDS	New Haven Breakwaters CDF	Morris Cove CAD
Hempstead Harbor	54.8	0.3	11.4	15.2	16.5	22.4	28.6	33.8	38.5	37.9	49.2	50.8	54.7
Glen Cove Creek	54.1	2.4	10.6	14.4	15.7	21.6	27.8	33.0	37.3	38.7	48.4	50.0	53.9

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Manchester, Connecticut, and Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island (COW) could receive materials from this and other dredging centers, as either fill or cap material. Sherwood Island borrow pit fill materials are limited to those found suitable for open water placement.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The eleven CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor (New York), Captain Harbor (Greenwich), Stamford Outer Harbor, Norwalk Harbor Islands, Penfield Reef, Bridgeport-Yellow Mill Channel, Stratford Point, New Haven Breakwaters, Falkner Island, Duck Island Roads, and Twotree Island (Waterford). A CDF facility at Hempstead Harbor along the southwest shoreline has been proposed at a former sand mining company site that could accommodate the needs of other harbors in the western sound with its 2.8 million CY capacity.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at the Norwalk Outer Harbor Islands.

5.19.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the Hempstead Harbor Area Dredging Center, the analysis matched projects with placement alternatives as follows.

Hempstead Harbor: Future maintenance of the Hempstead Harbor FNP is expected to yield mixed grained dredged materials too fine grained for direct beach placement, but likely suitable for open water placement in LIS over the DMMP planning horizon. These suitable mixed materials could be placed at open water sites, or in containment facilities (CDFs). Mixed grain materials may also be suitable for use as marsh fill or cap, placed either hydraulically or mechanically.

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Hempstead Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of 19 percent. The next least costly alternatives would be placement in open water at either the Central Long Island Sound site or at the HARS site, both at 1.8 times the cost of using the WLDS. The next least costly alternatives would be placement upland at a landfill in New York, or placement in the Morris Cove borrow pit CAD cell in New Haven Harbor, both at 2.1 times the cost of the least costly alternative. Placement in a CDF at Hempstead Harbor would be 2.9 times the cost of using the WLDS. Placement at other various CDF sites in the western LIS area would cost between roughly four and five times the cost of using the WLDS.

Table 5-188 - Hempstead Harbor FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Mixed Grain	186,900	2026-2030	110 Sand Co., Melville, NY	$67
			Western Long Island Sound DS	$32
			Captain Harbor CDF – Cap	$124
			Captain Harbor CDF – Fill	$124
			Hempstead Harbor CDF – Cap	$94
			Hempstead Harbor CDF – Fill	$94
			Norwalk Islands Marsh – Fill	$124
			Norwalk Islands Marsh – Cap	$124
			Sherwood Island Pit CAD – Fill	$38
			Sherwood Island Pit CAD – Cap	$38
			Brookhaven Town Landfill	$125
			Norwalk Islands CDF – Fill	$129
			Morris Cove Pit CAD – Fill	$68
			Central Long Island Sound DS	$57
			Yellow Mill Channel CDF – Fill	$158
			New Haven Breakwaters CDF – Fill	$158
			Historic Area Remediation Site	$57
			Stamford Harbor CDF – Fill	$124

Glen Cove Creek: Future maintenance of the Glen Cove Creek FNP is expected to yield fine grained dredged material over the DMMP planning horizon. This material has been and is expected to continue to be found unsuitable for unconfined open water placement. It is assumed that the Superfund dredging operations successfully removed the material contaminated by radioisotopes, but that sufficient concentrations of other contaminants will persist in shoal materials for the foreseeable future. For this DMMP analysis, these unsuitable materials must be either contained or treated before placement or use. This limits the potential placement and use alternatives to CAD cells, interior cells of CDFs, and landfill facilities upland (potentially also requiring treatment or augmentation to reduce contaminant levels).

The least cost placement alternative for the maintenance dredging of unsuitable fine-grained material from the Glen Cove Creek FNP would be placement in a CAD cell dredged specifically for that project, or one dredged for another small project such as Greenwich Harbor, that could be sized to accommodate material from nearby harbors in western Connecticut and New York.

Table 5-189 - Glen Cove Creek FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Unsuitable Fine	14,300	2015-2020	Norwalk Islands CDF – Fill	$160
	19,600	2031-2035	Captain Harbor CDF – Fill	$141
	19,600	2041-2045	Hempstead Harbor CDF – Fill	$141
			Norwalk Islands Marsh – Fill	$160
			Penfield Reef CDF – Fill	$167
			Morris Cove Pit CAD – Fill	$112
			Falkner Island CDF – Fill	$201
			Duck Island Roads CDF – Fill	$201
			Twotree Island CDF – Fill	$201
			Yellow Mill Channel CDF – Fill	$201
			New Haven Breakwaters CDF – Fill	$201
			Stratford Point CDF – Fill	$201
			Upland with Treatment	$181
			Glen Cove/Hempstead or Greenwich In-Harbor CAD – Fill	$68
			Stamford Harbor CDF – Fill	$113

Combining a few harbors needs with one cell could help spread the cost of such features. Beyond small CAD cell development, the next least costly alternatives are either placement in the Morris Cove borrow pit CAD cell in New Haven Harbor, or placement in a sub-regional CDF constructed in outer Stamford Harbor, at an increase of 65 percent over a CAD cell. The next least costly alternatives are placement as fill in a CDF developed at Captain Harbor in Greenwich, or in the Hempstead Harbor CDF site, both at a cost about twice that of a CAD cell. Placement in the Norwalk Islands CDFs would cost 2.4 times the least cost alternative. Upland placement with chemical treatment and processing to remove contaminants would cost about 2.7 times the cost of a CAD cell. Placement in more distant CDF sites in central and eastern Connecticut would cost 2.5 to 3 times the cost of a CAD cell.

5.19.7 Identification of Federal Navigation Project Base Plans

<u>Federal Base Plans</u>: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-190 - Federal Navigation Project Base Plans Hempstead Harbor Area Dredging Center Projects		
FNP Project and Segment	Material Type	Federal Base Plan
Hempstead Harbor	Suitable Fines	Western Long Island Sound DS
Glen Cove Creek	Unsuitable	Glen Cove/Hempstead In-Harbor CAD - Fill

Alternatives to the Federal Base Plan: The Federal base plan for the suitable fine-grained material from the Hempstead Harbor FNP is open water placement at the Western Long Island Sound site. The least costly non open-water alternative is placement at the Sherwood Island COW site would only require an increase in cost of 19 percent, but would also require the site be available at the time that Eastchester Creek is dredged that second time. Placement at the HARS site would be 78 percent more than the base plan, provided the material could meet the requirements for HARS placement, but would not be cost-effective. Placement upland at a New York landfill, in the Morris Cove CAD cell, or a Hempstead Harbor CAD cell would be more than twice the cost of the base plan, and would not be cost-effective.

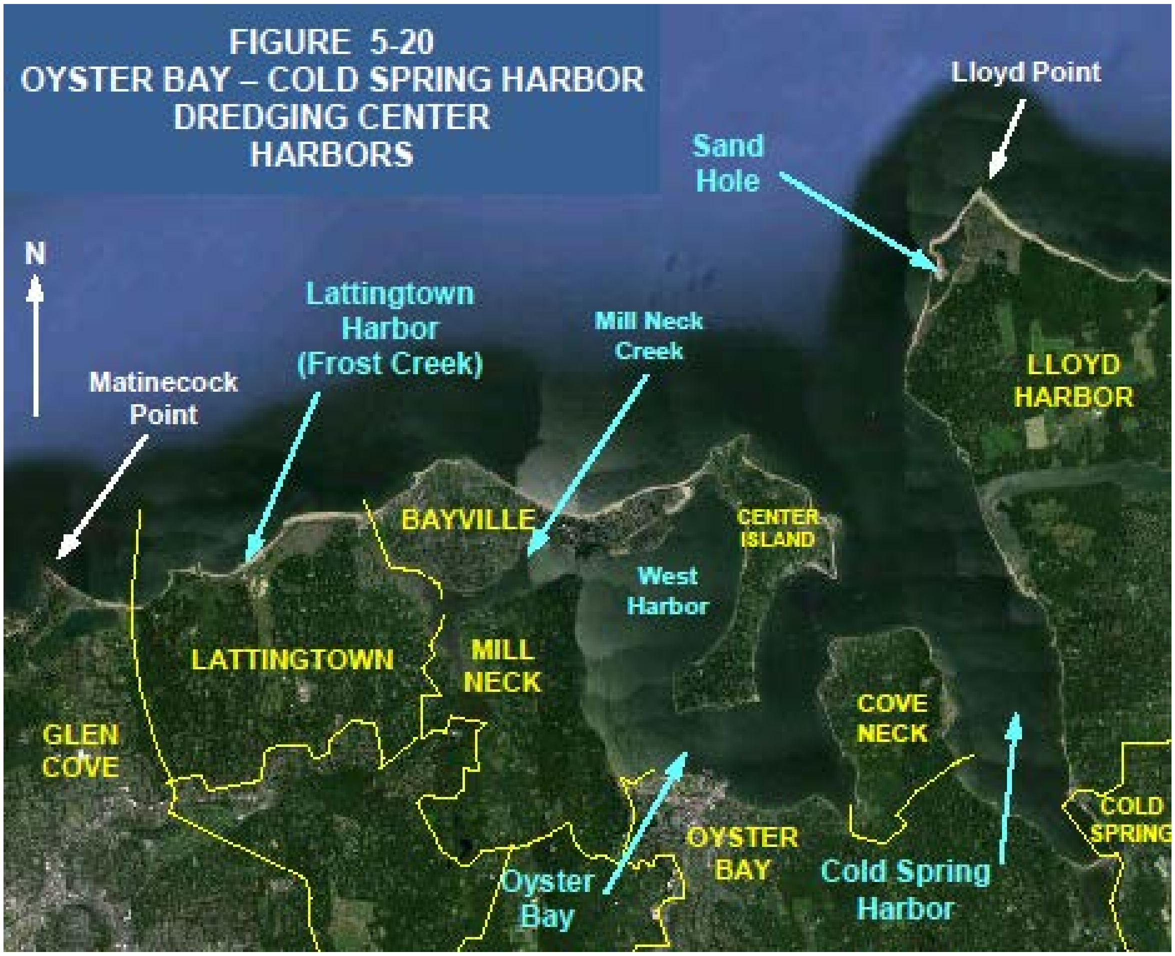
For the unsuitable material from the next several maintenance operations at the Glen Cove Creek FNP, the base plan is placement in a CAD cell constructed specifically for that project, or in a another small CAD cell constructed for a site such as Greenwich Harbor. Placement in the Morris Cove CAD cell or at a small CDF constructed at Stamford or Greenwich would be 65 percent more costly, and not cost-effective. Other options, including placement in a CAD cell constructed at Hempstead Harbor are at least twice the cost of the base plan and are therefore not cost-effective.

5.20 Oyster Bay – Cold Spring Harbor Area Dredging Center

The Oyster Bay – Cold Spring Harbor Area Dredging Center consists of the Long Island shoreline in the Townships of Oyster Bay in Nassau County and Huntington in Suffolk County. The dredging center area extends from Matinecock Point in the west to Lloyd Point in the east. It includes rivers and harbors in the communities of Lattingtown, Bayville, Center Island, Mill Neck, Oyster Bay, Cove Neck, Oyster Bay Cove, Laurel Hollow, Cold Spring Harbor, and Lloyd Harbor. There are no Federal Navigation Projects in this dredging center, nor are there any non-USACE other Federal agency facilities requiring navigation access.

The principal waterways in this area are:

Lattingtown Harbor (Frost Creek)
Oyster Bay and its tributary bays and creeks
(Mill Neck Creek, West Harbor, Centre Island Harbor)
Cold Spring Harbor
Sand Hole (Lloyd Point)



The waterways and facilities in this dredging center yield predominantly sandy materials suitable for beach or nearshore bar nourishment and a variety of other applications requiring coarse permeable fill. Such material would also likely be suitable for open-water placement in the event no beneficial use could be found.

5.20.1 Federal Navigation Projects - Maintenance

There are no FNPs in the Oyster Bay – Cold Spring Harbor dredging center. Both harbors were studied for navigation project development by the USACE more than a century ago with no improvement recommended.

5.20.2 Other Federal (Non-USACE) Dredging Projects

There are no non-USACE Federal facilities or projects requiring dredging in the Oyster Bay – Cold Spring Harbor dredging center.

5.20.3 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Oyster Bay – Cold Spring Harbor area. Large and small marinas, public access facilities, public anchorage areas, yacht clubs and private residential access points are located along the area's shores. There is one commercial fuel terminal located at Oyster Bay.

The 2009 Dredging Needs Update report projected, based on facility surveys, that 39,500 CY of maintenance dredging would be needed by non-Federal facilities. The dredging needs report also projected an additional 23,500 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. Also, one facility indicated a need for 2,000 CY of improvement dredging. These totals, distributed over the 30-year DMMP planning horizon is shown in the table below.

Table 5-191 - Dredging Activity Timeline – Oyster Bay – Cold Spring Harbor Area Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	7,500	20,000			6,000	6,000
Additional Projections	3,900	3,900	3,900	3,900	3,900	4,000
Improvements		2,000				
Total All Material	11,400	25,900	3,900	3,900	9,900	10,000
Sand Fraction (40%)	4,600	10,400	1,600	1,600	4,000	4,000
Silty Fraction (60%)	6,800	15,500	2,300	2,300	5,900	6,000

These non-Federal permit activities are expected to generate mainly suitable sandy dredged material. For DMMP planning purposes it was assumed that the majority of the material (40 percent) would be clean sand, and the remaining material (60 percent) would be suitable fine-grained material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS and CLDS being the closest approved sites. However, the sandy nature of most of these materials makes them valued for beach nourishment and nearshore bar placement, as well as other upland fill applications. Major coastal storms have occasionally resulted in significant coastal erosion and property damage in this area, and these materials could be used to address such losses and provide resiliency against future storm events and sea level rise.

5.20.4 Harbor Characterization for Non-Federal Harbors

There are no FNPs in this dredging center; however, there are a number of small and large non-Federal harbors that have a history of public and private permit dredging that can be discussed based on regulatory records.

Lattingtown Harbor and Frost Creek: In 2005 approximately 5,500 CY were dredged from this waterway by the local property owners association. This material was sand and was placed on the adjacent beach. Future dredging of this waterway is expected to also yield clean sand.

Oyster Bay: In 1991, the Town of Oyster Bay dredged about 8,500 CY from this harbor which was placed at the WLDS. In 1998, the Town of Oyster Bay dredged about 3,000 CY from

Centre Island Harbor and placed that material on the adjacent beach as nourishment. In 2006 the NY DEC dredged about 300 CY from a local boat ramp which was placed upland. Based on this history, material dredged from Oyster Bay can be expected to be a mix of sand and fine-grained material.

Cold Spring Harbor: Between 2001 and 2008, dredging by the Village of Lloyd Harbor and local property owners associations removed a total of 6,800 CY of material. Three of these projects were placed upland, while a fourth was used as beach nourishment. Based on this history, material dredged from Cold Spring Harbor can be expected to be a mix of sand and fine-grained material.

Overall, the Oyster Bay-Cold Spring Harbor dredging center is expected to produce both sand and suitable fine-grained material. For purposes of this DMMP, 40 percent of the material is assumed to be sand, and the remaining 60 percent fine-grained.

5.20.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce mainly sandy material suitable for beach or nearshore bar placement. The Town of Oyster Bay, Village of Lloyds Harbor, the New York DEC, and number of private entities have all done dredging in this area. There are extensive beaches, public and private, in Lattingtown, Bayville, and Center Island, and the west shore of Lloyd Neck. The private and public facility dredging under permit projected for the DMMP planning horizon in this dredging center would range from small-scale marina and residential projects of a few hundred cubic yards up to small to mid-scale public facility or anchorage maintenance operations generating up to 10,000 CY.

Over the past 25 years, dredged materials from this dredging center has been placed in a variety of locations: in open water at the WLDS, at upland sites or stockpiled for future nourishment use, and used for beach nourishment. Port fill for waterfront development was also likely accomplished historically. The several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center. While only two beaches were identified by the survey for nearshore placement, there are other beaches in the dredging center which may, upon detailed investigation, prove to be candidates for placement, such as Frost Creek and Lloyd Harbor Beaches.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-192 - Oyster Bay – Cold Spring Harbor Area Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Bayville Beach	Nearshore	96,200	Recurring	Sand
Asharoken Beach	Nearshore	248,300	Recurring	Sand
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Norwalk Outer Harbor CDF	Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	242,600	All Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Cap	Marsh Shore CDF	157,400	All Once Built	All Suitable
Hempstead Harbor NY CDF - Fill	Shore CDF	2,787,700	All Once Built	All
Hempstead Harbor NY CDF - Cap	Shore CDF	712,300	All Once Built	All Suitable
Stamford Harbor CDF - Fill	Island CDF	1,700,000	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such an alternative carries a high cost compared to other options.

Beach and Nearshore Nourishment Sites: The coastline of the Oyster Bay – Cold Spring Harbor Area dredging center is a mix of large and small beaches and Stony headlands, with small coastal plain river inlets and bays. There are many large public beaches and a few large private beach fronts. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from the Oyster Bay – Cold Spring Harbor area. The two beaches listed above were identified by the screening process.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. The distances by tug/scow from selected harbor dredge sites to area beaches are shown below.

Table 5-193 - Scow Haul Distances to In-Water and Nearshore Placement Sites										
Project (Distances in Statute Miles)	Frost Creek Beach	Bayville Beach	Asharoken Beach	WLIS DS	CLDS	Stamford CDF	Hempstead Harbor CDF	Norwalk Island CDF	New Haven Breakwaters CDF	HARS
Lattingtown Harbor (Frost Creek)	0.6	3.5	16.1	9.5	42.7	9.0	7.7	15.6	43.9	51.7
Oyster Bay Harbor	10.2	6.2	14.6	8.9	41.2	11.0	17.0	14.9	42.3	65.6
Cold Springs Harbor	10.7	6.7	15.1	9.4	41.7	11.5	17.5	15.4	42.8	66.1

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The three CDFs sites located near this dredging center or identified in the screening process include Hempstead Harbor, Stamford Harbor, and Norwalk Harbor.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Norwalk Outer Harbor Islands.

5.20.6 Alternatives Screening for the Dredging Center

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. For the Oyster Bay – Cold Spring Harbor Area Dredging Center analysis there were no FNPs to match with the screened sites. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

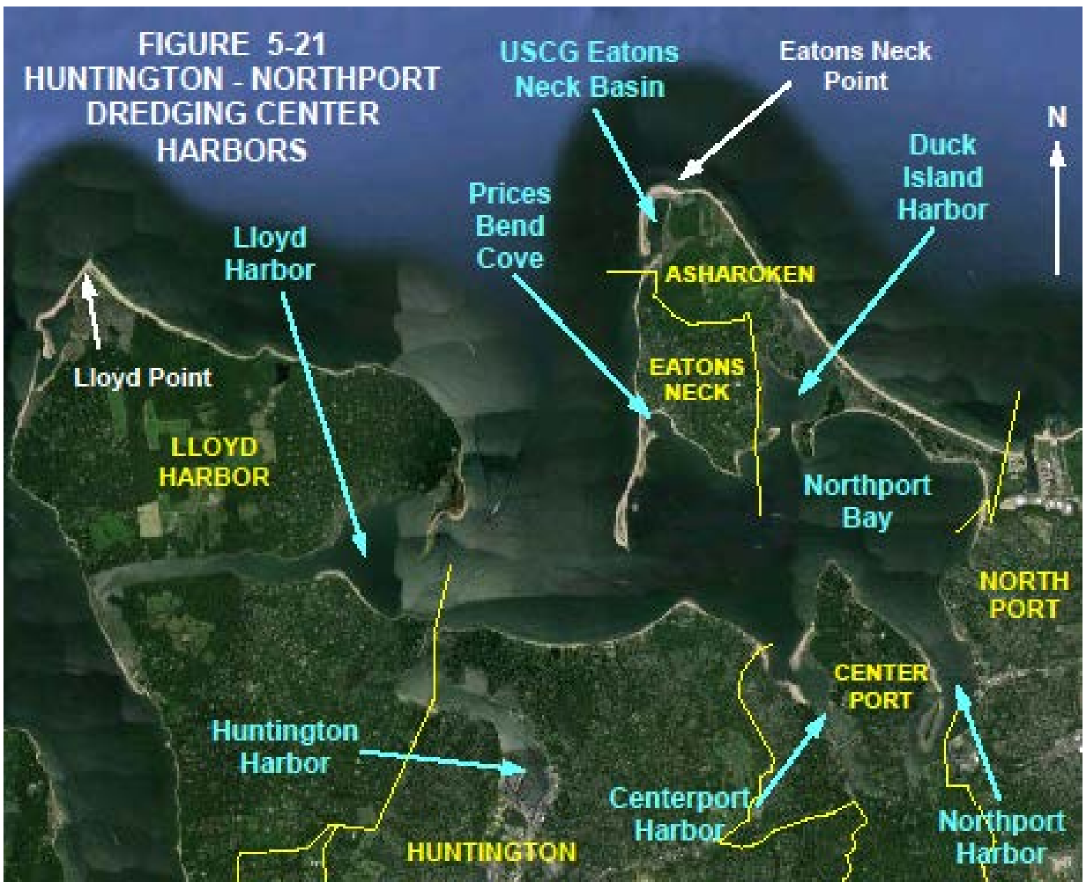
Lattingtown Harbor (Frost Creek) and most areas of Oyster Bay and Cold Spring Harbor are expected to yield clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment. Other beneficial uses such as upland fill, and waterfront structural backfill should also be considered. The inner harbor and upper bay areas of Oyster Bay and Cold Spring Harbor are expected to generate the most material, and will yield fine-grained materials that may also have beneficial uses, such as marsh creation, or containment site cap.

5.21 Huntington and Northport Bay Area Dredging Center

The Huntington and Northport Bay Area Dredging Center consists of the shoreline areas of Huntington Township from Lloyd Point in the west to Eaton's Neck Point in the east. The area includes Huntington and Northport Bays and their tributaries and the Federal Navigation Projects for Huntington Harbor and Northport Harbor. The area includes the communities of Lloyd Harbor, Huntington, Centerport, Northport, Asharoken, and Eaton's Neck. The dredging center also includes the U.S. Coast Guard facility at Eaton's Neck, and many small private and public navigation access facilities. The principal waterways in this area are:

Lloyd Harbor	Northport Bay
Huntington Harbor – Includes FNP	Duck Island Harbor
Centerport Harbor	Prices Bend Cove
Northport Harbor – Includes FNP	Eaton's Neck Basin – Includes USCG

The waterways and facilities in this dredging center yield mainly sand, and mixed silty sand dredged material. These materials are typically suitable for direct beach placement or nearshore bar placement. Materials are also occasionally stockpiled upland for transport to more distant beaches or held for emergency shoreline projects after major storms. Testing for specific projects is required to confirm suitability for various uses. In rare instances, dredging from inner areas of marinas, yacht clubs and small terminals can yield sandy silts not suitable for beach nourishment.



5.21.1 Federal Navigation Projects - Maintenance

The most recent dredging operations for the two FNPs in this dredging center are shown below. In both cases this was improvement dredging. Neither project has been maintained by the USACE since that improvement.

Table 5-194 - Federal Navigation Project Dredging History Huntington and Northport Bay Area Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Type of Material
Huntington Harbor Improvement	1941	220,900	Unknown	Sand
Maintenance	1935	21,400	Unknown	Unknown
Northport Harbor Improvement Dredging	1956	86,300	Unknown	Sand

<u>Huntington Harbor</u>: The FNP for Huntington Harbor consists of an 8-foot channel from Hunting Bay to the old Town Dock adopted in 1890 and constructed in 1904, and a 6-foot channel extension above that point to below the Mill Dam Road causeway, with a 6-foot anchorage west of the channels, both adopted in 1938 and constructed in 1941. The 8-foot project was maintained in 1935 when about 21,400 CY was removed. The 1941 improvement project removed about 217,800 CY and 3,100 CY of maintenance material. The placement method used for both actions is not recorded. There are no current hydrographic surveys of this project to demonstrate present shoal volumes and rates. U.S. Coast Chart #13265, 28th Edition, updated October 2014, indicates that shoaling in the project features has been limited. About 2,500 linear feet of the 8-foot channel between the vicinity of buoys #7 and #11 has shoaled to a depth of about seven feet, yielding and estimated shoal volume of 22,200 CY. The entrance and upper reaches of the project appear at or below the authorized depths. The annual shoaling rates for the five-year period between 1936 and 1941, and for the 73-year period from 1941 to 2014, were about 620 and 300 CY, respectively. Using the average of those two rates, and an assumed next maintenance event for this project in about 2026 would yield a total shoal volume of 27,800 CY at that time.

<u>Northport Harbor</u>: The FNP for Northport Harbor was authorized in 1945 and calls for an 8-foot channel extending south along the Northport shore to a point above the Northport Yacht Club, with a 15-acre 6-foot anchorage to the west of the channel. The project was constructed in 1956 when 86,300 CY of material was dredged, and it has never been maintained by the USACE. The placement method used for both actions is not recorded. There are no current hydrographic surveys of this project to demonstrate present shoal volumes and rates. U.S. Coast Chart #13265, 28th Edition, updated October 2014, indicates shoaling in the up-harbor (south) half of the channel and anchorage. The middle portion of the channel is shoaled to a depth of about 6.5 feet while the upper channel and anchorage are shoaled to about five feet. This equates to about 43,300 CY of shoal material. Over the 58 years since the project was last dredged this yields an annual shoaling rate of about 750 CY. Using the 2014 estimated shoal volume and that rate, if the harbor were maintained in about 2024, then restoring the project's authorized dimensions would require the removal of about 50,800 CY at that time.

The dredging activity timeline over the planning horizon for the two FNPs in this dredging center is shown below.

Table 5-195 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Huntington and Northport Bay Area Dredging Center

FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Huntington Harbor FNP			13,900			13,900
			13,900			13,900
Northport Harbor FNP		25,400				25,400
		25,400				25,400
Total Suitable Sand		25,400	13,900			39,300
Total Suitable Fine		25,400	13,900			39,300

5.21.2 Harbor Characterization for Federal Navigation Projects

The two FNPs in this dredging center were managed similar to other projects in the western sound, with open water placement and upland fill for port development as the preferred placement method.

Huntington Harbor: The existing project at Huntington Harbor was originally constructed in 1872 and has had improvements over the years, but information regarding the amount and type of sediment removed for those improvement dredging events is not obtainable nor was a placement site specified. The most recent sediment testing information available for the Huntington Harbor FNP was from 1971 when four samples were taken. Test results for these samples showed elevated levels of oil and grease and some metals, including mercury, lead, and zinc.

County records show that 441,700 CY of "sand and mud" was dredged from Huntington Harbor in 1962. More recent regulatory permit records show three dredging events from 1999 to 2005 totaling 12,500 CY. This material was placed at the WLDS, used as beach nourishment, and placed upland. The available data on sediment characterization is inconclusive as to what material might be expected in the future, other than that it would likely be suitable for open water placement. The volume for purposes of this DMMP will be evenly split between sand and suitable fine-grained material.

Centerport Harbor: There is no FNP for Centerport Harbor. Federal permit records and county records show that Suffolk County dredged this harbor four times between 1958 and 2008, removing a total of 335,000 CY, all of which was characterized as sand. The one instance where placement is recorded cites it as beach nourishment. No test results were located, but this harbor is expected to generate clean sand in the future.

<u>Northport Harbor</u>: The most recent dredging of the Northport Harbor FNP was when it was constructed in 1956. At that time it was estimated that approximately 32,800 CY of material would be removed to create a channel -8-foot MLLW deep with a -6-foot MLLW anchorage adjacent to the channel. Sediment characterization and placement site information was not available for that event. Test results of one sample taken from Northport Harbor in 1971 showed that the material had elevated levels of oil and grease, and some metals (mercury, lead, and zinc).

County records for Northport Harbor show two dredging events, in 1963 and 1996, both characterized as "sand and mud". Regulatory permit records show five instances of dredging by the same property owners association at Northport between 1993 and 2007. These materials were placed at WLDS twice, CLDS once, and upland twice. The available data on sediment characterization is inconclusive as to what material might be expected in the future, other than that it would likely be suitable for open water placement. The volume for purposes of this DMMP will be evenly split between sand and suitable fine-grained material.

<u>The Huntington and Northport Bay Area Dredging Center in General</u>: Any future maintenance of the FNPs for Huntington Harbor and Northport Harbor is expected to yield sandy dredged material suitable for direct beach or nearshore bar nourishment. The material is therefore also expected to be suitable for open-water placement with WLDS and CLDS being the closest sites. The material may also prove usable for upland placement for purposes such as in construction, port or other structural fill, highway projects or other applications requiring sand. The material could also be stockpiled for use in emergency response to shore stabilization needs after major storms. Testing of the project's materials prior to each dredging operation will be needed to confirm suitability for alternative placement.

5.21.3 Other Federal (Non-USACE) Dredging Projects

The U.S. Coast Guard operates a station at Eaton's Neck Basin. The Coast Guard indicated a need for maintenance dredging of about 8,000 CY of material in the near term, expected to be sand. There was no information provided by the Coast Guard as to how often the basin requires maintenance dredging at this station, but a review of regulatory records shows that the basin has been dredged annually over the past five years as follows, for an average of about 6,200 CY annually.

2011	6,700 CY	2012	5,800 CY
2013	4,675 CY	2014	5,165 CY
2015	8,770 CY		

The regulatory records indicate that this dredging was accomplished by mechanical means (barge mounted excavator) with the material being placed on the adjacent beach above the mean high water elevation, and is then spread and graded using a bulldozer. The work is accomplished by a contractor working for the Coast Guard under a general permit issued by the USACE NAN (NAN-2008-00971-EYO).

Given this recent activity, and the shallow sandy nature of the basin and its exposure, it will likely be dredged frequently during the 30-year DMMP planning horizon. An estimate of 31,000 CY for each five-year period was used

Table 5-196 - Dredging Activity Timeline – Huntington and Northport Bay Other Federal Activities						
	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
USCG Eaton's Neck	31,000	31,000	31,000	31,000	31,000	31,000

A comment was received from the public during the draft report review to the effect that the US Coast Guard maintenance of the basin at Eaton's Neck was having an adverse impact on adjacent oyster beds, with a report that after the most recent dredging many oysters and shells were seen on the nourished beach area.

As the Coast Guard maintenance dredging was not performed by the Corps of Engineers, a Corps inspector was not present at the site, and we have no first-hand observations or reports concerning the work other than what was provided in the comments. Some limited impact to the benthic community is fully expected during projects such as this at the immediate dredging site and where the material is placed, but without further detail about the project we cannot speculate on a cause for any oyster mortality. The commenter was advised that should a similar situation arise in the future, they should notify the Corps of Engineers, the USEPA, the NY DEC, or the USCG, who could then follow up on the specific cause of the issue.

5.21.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Huntington and Northport Harbor Bay Area Dredging Center that periodically generate dredged material. Most of the larger facilities are located at the two harbors with FNPs, though marinas, boat yards and yacht clubs also exist at Centerport and other smaller public and private access facilities and residential docks are found throughout the dredging center's coves, bays, and coastal rivers.

Suffolk County Department of Public Works (SC-DPW) and USACE permit records for dredging activity under permit for this dredging center are provided below. The county dredging records indicate that about 15 percent of the dredged volume was sand, while 85 percent was classified as "sand and mud".

USACE regulatory records for 12 permits issued for projects in this dredging center from 1994 to 2008 show 164,000 CY dredged, of which three projects comprising 20 percent of the total yardage were placed as beach nourishment. Of the remaining projects five went to the WLDS or CLDS open water sites, while four were placed upland.

Table 5-197 - Suffolk County Dredging Project History Huntington and Northport Bays Dredging Center				
Suffolk County DPW Permit Activity	Dredged	Cubic Yards	Placement Method	Material Recorded
Huntington Harbor	1962	441,700	Unknown	Sand and Mud
Centerport Harbor	2008	30,000	Beach	Sand
	1997	20,000	Unknown	Sand
	1981	70,600	Unknown	Sand
	1958	214,500	Unknown	Sand
Northport Harbor	1996	75,000	CLDS	Sand and Mud
	1963	1,354,500	Unknown	Sand and Mud
Prices Bend Cove	1958	169,200	Unknown	Sand and Mud

The 2009 Dredging Needs Update report projected, based on facility surveys, that 41,000 CY of maintenance dredging and 3,007,500 CY of improvement dredging would be needed by non-Federal facilities. The dredging needs report also projected an additional 59,000 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. Further, about 70,000 CY was projected for Suffolk County maintenance dredging projects over the DMMP planning horizon. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

Non-Federal maintenance activities are expected to generate both sand suitable for direct beach or nearshore bar placement and fine grained materials. Based on the county and USACE regulatory records, 20 percent will be classified as sand, and 80 percent will be classified as fine-grained suitable material. Materials from marina basins or other areas in inner harbor areas may prove to be silty sands and sandy silts not suitable for beach or bar placement, but otherwise likely suitable for open-water placement or other uses upland. Ocean placement can be an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS and CLDS being the closest approved sites. These activities could also take advantage of whatever alternative placement methods are used for the two FNPs in this dredging center, or possibly in the adjacent Oyster Bay and Smithtown, New York areas, if undertaken concurrently, as economies of scale may increase cost-effectiveness relative to open-water placement for otherwise smaller volumes. Non-Federal improvement dredging projects are expected to generate clean sandy materials.

Table 5-198 - Dredging Activity Timeline – Huntington and Northport Bays Area Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	19,500	5,000	6,500	6,500	1,700	1,800
Permit Projections	9,800	9,800	9,800	9,800	9,900	9,900
Suffolk County Projections	11,700	11,700	11,700	11,700	11,600	11,600
Improvement Projects	3,001,000	2,500	1,000	1,000	1,000	1,000
Total Non-Federal	3,042,000	29,000	29,000	29,000	24,200	24,300
Sand Volume	3,009,200	7,800	6,600	6,600	5,600	5,700
Fine-Grained Volume	32,800	21,200	22,400	22,400	18,600	18,600

5.21.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to large-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating more than 50,000 CY, to large-scale non-Federal improvements generating about three million CY are anticipated. Most dredged materials from this dredging center in recent decades have been beneficially used for beach and other shoreline projects, or placed upland for various purposes. There is little evidence of past port-fill activities, though as elsewhere that practice likely occurred on some scale. The several investigations of management alternatives identified the following as opportunities for placement for projects from this dredging center.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-199 - Huntington and Northport Bay Area Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Bayville Beach	Nearshore	96,200	Recurring	Sand
Asharoken Beach	Nearshore	248,300	Recurring	Sand
Crescent Beach (Huntington)	Beach	4,800	Recurring	Sand
Gold Star Beach (Huntington)	Beach	3,200	Recurring	Sand
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Morris Cove Borrow Pit CAD	CAD Cap	466,100	Until Filled	All Suitable
Captain Harbor CDF – Cap	Island CDF	331,800	Until Filled	All Suitable
Falkner Island CDF – Cap	Island CDF	1,169,800	Until Filled	All Suitable
Norwalk Outer Harbor CDF	Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	242,600	All Once Built	Suitable Fine
Norwalk Outer Harbor Islands Marsh Creation - Cap	Marsh Shore CDF	157,400	All Once Built	Suitable Fine
New Haven Breakwaters – Cap	Island CDF	5,554,400	Until Filled	All Suitable
Hempstead Harbor CDF – Cap	Shore CDF	712,300	Until Filled	All Suitable
Yellow Mill Channel CDF Cap	Shore CDF	102,100	Until Filled	All Suitable
Stratford Point CDF – Fill	Shore CDF	33,666,900	Once Built	All

Beach and Nearshore Nourishment Sites: The coastline of the Huntington and Northport Bay Area Dredging Center is a mix of large and small beaches and stony headlands, with small coastal plain river inlets and bays. There are many large public beaches and a few large private beach fronts. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from the Huntington and Northport Bay area. The beaches listed above were identified by the screening process.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The three CDFs sites located near this dredging center or identified in the screening process include Hempstead Harbor, Stamford Harbor and Norwalk Harbor.

Table 5-200 - Scow Haul Distances to Selected Placement Sites

Project (Distances in Statute Miles)	HARS	Hempstead Harbor CDF	Greenwich Harbor CDF or CAD Cell	Stamford CDF	WLIS DS	Norwalk Island CDF or Marsh	Sherwood Island COW Site	Penfield Reef CDF	Yellow Mill Channel CDF	Stratford Point CDF	CLDS	New Haven Breakwaters CDF	Morris Cove CAD
Lloyd Harbor	70.2	22.2	14.7	12.5	8.4	12.6	16.4	21.0	25.3	25.5	35.9	36.4	40.4
Huntington Harbor	70.8	22.8	15.3	13.1	9.0	13.2	17.0	21.6	25.9	26.1	36.5	37.0	41.0
Centerport Harbor	71.2	23.2	15.7	13.5	9.4	13.6	17.4	22.0	26.3	26.5	36.9	37.4	41.4
Northport Harbor	72.7	24.7	17.2	15.0	10.9	15.1	18.9	23.5	27.8	28.0	38.4	38.9	42.9
Price's Bend Cove	71.2	23.2	15.7	13.5	9.4	13.6	17.4	22.0	26.3	26.5	36.9	37.4	41.4
Eaton's Neck Basin	67.8	19.8	12.5	9.8	5.7	9.5	13.0	17.6	21.9	22.3	32.4	33.0	37.0

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Norwalk Outer Harbor Islands.

5.21.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the FNPs in the Huntington and Northport Bay Area Dredging Center, the analysis matched projects with placement alternatives as shown below. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification, and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

Huntington Harbor: Future maintenance of the Huntington Harbor FNP will yield sandy dredged materials suitable for open water placement in LIS over the DMMP planning horizon. These suitable sandy materials are available for beach or nearshore bar placement or other uses. They could be placed at open water sites, or in containment facilities (CDFs) as cap material.

The least-cost placement alternative for the maintenance dredging of suitable fine-grained material from the Huntington Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of four percent. The next least costly alternatives would be placement upland at landfills in New York, at 1.5 to 1.7 times the cost of the least costly alternative. The next least costly alternative would be placement in open water at the Central Long Island Sound site at 1.7 times the cost of using the WDLS, followed by ocean placement at the HARS (if found suitable) at 2.2 times the cost of using the WLDS. Placement in a CDF constructed in Connecticut or New York in western LIS would be 2.4 to 3.1 times the cost of using the WLDS.

Table 5-201 - Huntington Harbor FNP - Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fines	13,900	2026-2030	Norwalk Islands CDF – Fill	$170
	13,900	2041-2045	Captain Harbor CDF – Fill	$170
			Hempstead Harbor CDF – Fill	$170
			Norwalk Islands Marsh – Fill	$170
			Penfield Reef CDF – Fill	$170
			Sherwood Island Pit CAD – Fill	$75
			Sherwood Island Pit CAD – Cap	$75
			110 Sand Co., Melville, NY	$107
			Brookhaven Town Landfill	$119
			Western Long Island Sound DS	$72
			Yellow Mill Channel CDF – Fill	$184
			Milford Harbor CDF – Fill	$184
			New Haven Breakwaters CDF – Fill	$222
			Central Long Island Sound DS	$124
			Historic Area Remediation Site	$156
			Stamford Harbor CDF – Fill	$170

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	13,900	2026-2030	Norwalk Islands CDF – Cap	$170
	13,900	2041-2045	Captain Harbor CDF – Cap	$170
			Hempstead Harbor CDF – Cap	$170
			Norwalk Islands Marsh – Cap	$170
			Penfield Reef CDF – Cap	$170
			Sherwood Island Pit CAD – Fill	$75
			Sherwood Island Pit CAD – Cap	$75
			Asharoken Beach – Nearshore	$92
			Sunken Meadow State Park – NS	$104
			Bayville Beach – Nearshore	$104
			Western Long Island Sound DS	$72
			Crescent Beach (Huntington) – NS	$71
			Gold Star Battalion Beach	$61

The least cost placement alternative for the maintenance dredging of suitable sandy material from the Huntington Harbor FNP is direct beach placement at Crescent and Gold Star Beaches adjacent to the harbor. However, these beaches do not have the capacity to receive the entire anticipated volume of sand from a single maintenance operation. They therefore must be used together and in combination with other alternatives. Open water placement at the WLDS is about 3 percent more costly than the combined placement at the two beaches. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of ten percent over the beaches. The third least costly alternative would be nearshore placement at Asharoken Beach to the east of Eaton's Neck at an increase of 28 percent over the cost of using the WLDS. The next least costly would be nearshore placement at either Bayville or at Sunken Meadow State Park at 1.4 times the cost of using the WLDS. Placement as cap material in a CDF constructed in Connecticut or New York in western LIS would be 2.4 times the cost of using the WLDS or more.

<u>Northport Harbor</u>: Future maintenance of the Northport Harbor FNP is expected to yield sandy dredged materials suitable for open water placement in LIS over the DMMP planning horizon. These suitable sandy materials are available for beach or nearshore bar placement or other uses. They could be placed at open water sites, or in containment facilities (CDFs) as cap material.

Table 5-202 - Northport Harbor FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Fines	25,400	2021-2035	Norwalk Islands CDF – Fill	$149
	25,400	2041-2045	Captain Harbor CDF – Fill	$149
			Hempstead Harbor CDF – Fill	$149
			Norwalk Islands Marsh – Fill	$149
			Stratford Point CDF – Fill	$149
			Penfield Reef CDF – Fill	$149
			Sherwood Island Pit CAD – Fill	$50
			Sherwood Island Pit CAD – Cap	$50
			Western Long Island Sound DS	$48
			Yellow Mill Channel CDF – Fill	$149
			110 Sand Co., Melville, NY	$70
			Brookhaven Town Landfill	$83
			Morris Cove Pit CAD – Fill	$100
			Central Long Island Sound DS	$87
			Historic Area Remediation Site	$155
			New Haven Breakwaters CDF – Fill	$180
			Stamford Harbor CDF – Fill	$149
Suitable Sand	25,400	2021-2035	Norwalk Islands CDF – Cap	$149
	25,400	2041-2045	Captain Harbor CDF – Cap	$149
			Hempstead Harbor CDF – Cap	$149
			Norwalk Islands Marsh – Cap	$149
			Stratford Point CDF – Cap	$149
			Penfield Reef CDF – Cap	$149
			Sherwood Island Pit CAD – Fill	$50
			Sherwood Island Pit CAD – Cap	$50
			Asharoken Beach – Nearshore	$61
			Sunken Meadow State Park – NS	$73
			Western Long Island Sound DS	$48

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Northport Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of four percent. The next least costly alternatives would be placement upland at landfills in New York, at 1.5 to 1.7 times the cost of the least costly alternative. The next least costly alternative would be placement in open water at the CLDS at 1.8 times the cost of using the WLDS. Placement in a CDF constructed in Connecticut or New York in western LIS would be 2.1 to 3.2 times the cost of using the WLDS.

The least cost placement alternative for the maintenance dredging of suitable sandy material from the Northport Harbor FNP is open water placement at the Western Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of four percent. The third least costly alternative would be nearshore placement at Asharoken Beach to the east of Eaton's Neck at an increase of 27 percent over the cost of using the WLDS. The next least costly would be nearshore placement at Sunken Meadow State Park at 1.5 times the cost of using the WLDS. Placement as cap material in a CDF constructed in Connecticut or New York in western LIS would be more than three times the cost of using the WLDS.

U.S. Coast Guard Station Eaton's Neck: Future maintenance of the U.S. Coast Guard Station at Eaton's Neck is expected to yield sandy dredged materials suitable for open water placement in LIS over the DMMP planning horizon. These suitable sandy materials are available for beach or nearshore bar placement or other uses. They could be placed at open water sites, or in containment facilities (CDFs) as cap material.

Table 5-203 - U.S. Coast Guard Station Eaton's Neck
Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	31,000	2015-2020	Sherwood Island Pit CAD – Cap	$110
	31,000	2021-2025	Sherwood Island Pit CAD – Fill	$110
	31,000	2026-2030	Western Long Island Sound DS	$106
	31,000	2031-2035	Hobart Beach – On-Beach	$111
	31,000	2036-2040	Yellow Mill Channel CDF – Fill	$212
	31,000	2041-2045	Yellow Mill Channel CDF – Cap	$212
			Norwalk Islands CDF – Fill	$194
			Norwalk Islands CDF – Cap	$194
			Captain Harbor CDF – Cap	$212
			Captain Harbor CDF – Fill	$212
			Hempstead Harbor CDF – Fill	$212
			Hempstead Harbor CDF – Cap	$212
			Central Long Island Sound DS	$176
			Stamford Harbor CDF – Cap	$194

The least cost placement alternative for the maintenance dredging of suitable sandy material from the U.S. Coast Guard's Eaton's Neck facility is open water placement at the Western

Long Island Sound site. The second least costly alternative is use as either fill or cap material at the Sherwood Island offshore borrow pit COW site at an increase in cost of four percent. The third least costly alternative would be direct beach placement on Hobart Beach Park on Eaton's Neck at an increase of five percent over the cost of using the WLDS. The next least costly alternative would be placement in open water at the Central Long Island Sound site at 1.7 times the cost of using the WLDS. Placement as cap material in a CDF constructed in Connecticut or New York in western LIS would be 1.8 times the cost of using the WLDS or more.

5.21.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for FNPs and other Federal agency projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-204 - Federal Navigation Project Base Plans Huntington and Northport Bay Area Dredging Center		
FNP Project and Segment	Material Type	Federal Base Plan
Huntington Harbor	Suitable Sand	Crescent and Gold Star Beach in combination with the Western Long Island Sound DS, or Sherwood Island COW Site Cap
	Suitable Fines	Western Long Island Sound DS, or Sherwood Island COW Site Fill
Northport Harbor	Suitable Sand	Western Long Island Sound DS, or Sherwood Island COW Site Cap
	Suitable Fines	Western Long Island Sound DS, or Sherwood Island COW Site Fill
US Coast Guard Station - Eaton's Neck Basin	Suitable Sand	Western Long Island Sound DS, or Sherwood Island COW Site Cap, or Hobart Beach

Alternatives to the Federal Base Plan: The Federal base plan for placement of sand from the Huntington Harbor FNP is direct placement on adjacent beaches. For this and the Northport Harbor FNP, the Western LIS site, and placement at the Sherwood Island COW site as either base or cap material, are the base plans (WLDS is within a ten percent range of the least cost alternative). Silt from both FNPs also has placement at the WLDS as the Federal base plan with the Sherwood Island COW site at a four percent increase in cost. For the U.S. Coast Guard's Eaton's Neck facility the Western LIS site is the base plan, while Sherwood Island and direct placement on Hobart Beach (which has been used in the past) are within five percent of the least cost. For the two FNPs nearshore placement at Asharoken Beach is about 27 percent more expensive and would require non-Federal funding, or cost-sharing if Section 204 applies. More distant nearshore placement sites at least 40 percent more costly, while use of landfills or as cap for CDF sites at 1.4 to 3.2 times the base plan, would all be not cost effective.

5.22 Smithtown Bay and Stony Brook Harbor Area Dredging Center

The Smithtown Bay and Stony Brook Harbor Area Dredging Center consists of the Long Island shoreline in the Townships of Huntington, Smithtown and Brookhaven, from Eaton's Neck Point in the west to Old Field Point in the east. It includes rivers and harbors in the communities of Fort Salonga, Kings Park, Nissequogue, Smithtown, Head of the Harbor, Stony Brook, and Old Field, and the Long Island Sound beaches of Asharoken. There are no Federal Navigation Projects in this dredging center, nor are there any non-USACE Federal facilities requiring navigation access.

The principal waterways in this area are:

Asharoken Basin
Nissequogue River
Stony Brook Harbor

The waterways and facilities in this dredging center yield predominantly sandy materials suitable for beach or nearshore bar nourishment and a variety of other applications requiring coarse permeable fill. Such material would also likely be suitable for open-water placement in the event no better practicable option or beneficial use could be found.

5.22.1 Federal Navigation Projects - Maintenance

There are no FNPs in the Smithtown Bay and Stony Brook Harbor Area dredging center. Both Smithtown Bay and Stony Brook Harbor have been the subject of USACE studies for navigation improvements in the past, Smithtown in 1896 and the 1950s, and Stony Brook in 1884 and 1909; however, no improvements were ever recommended or authorized.

5.22.2 Other Federal (Non-USACE) Dredging Projects (Permit Activities)

There are no non-USACE Federal facilities or projects requiring dredging in the Smithtown Bay and Stony Brook Harbor Area dredging center.

5.22.3 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Smithtown Bay and Stony Brook Harbor area. Small marinas and yacht clubs, public access facilities, public anchorage areas, and private residential access points are located along the area's shores.

Suffolk County Department of Public Works (SC-DPW) records for dredging activity under permit for this dredging center are shown below. Most recent county dredging of sand from Nissequogue River and Stony Brook Harbor, including the Porpoise Channel, placed the material by hydraulic pipeline as direct beach nourishment. The Town of Smithtown has also dredged the Kings Park landing on the Nissequogue River in the 1996 using upland placement for a small amount of material.

There is no record of dredging for the Asharoken Basin. However this appears to be an improved harbor with two stone jetties, a public boat ramp and pier, and was likely originally constructed to facilitate the building of the adjacent power plant. Without any dredging record or surveys it is not possible to develop projections for needed future dredging.

The county dredging records show that 2,505,700 CY were dredged between 1953 and 2009 from Stonybrook Harbor, the Nissequogue River and their tributaries. For those events where a sediment type was recorded, 21 percent were fine-grained material and 79 percent were sand and gravel. This is primarily due to the improvement dredging of the Long Beach Boat Basin in the 1950s generating mixed sandy-silty material, while future maintenance of that facility is expected to involve dredging of sand carried into the basin from the beach. USACE regulatory records for this dredging center show four permits issued between 1993 and 1996 for a total of 195,100 CY of which all but less than one percent was placed as beach nourishment. Based on the county and permit data, it will be assumed for this DMMP that 85 percent of the non-Federal dredged material generated from this area in the future will be clean sand, and 15 percent will be fine-grained material.

Table 5-205 - Suffolk County Dredging Project History Smithtown Bay and Stony Brook Harbor Area Dredging Center				
Suffolk County DPW Permit Activity	Year Dredged	Cubic Yards	Placement Method	Material Recorded
Long Beach Boat Basin, Smithtown	1958	484,800	Unknown	Sand and Mud
	1953	44,100	Unknown	Sand and Mud
Porpoise Channel, Smithtown	2005	2,900	Unknown	Sand & Gravel
	2001	49,000	Unknown	Sand
	1994	33,600	Beach	Sand & Gravel
Nissequogue River	2013	Unknown	Beach	Sand & Gravel
	2009	38,000	Unknown	Sand & Gravel
	2008	46,500	Unknown	Sand & Gravel
	2001	80,900	Unknown	Sand
	1996	82,000	Beach	Sand
	1987	96,600	Unknown	Sand
	1980	56,000	Unknown	Sand
	1966	140,700	Unknown	Unrecorded
	1962	765,900	Unknown	Unrecorded
Stony Brook Harbor	2013	Unknown	Beach	Sand & Gravel
	2005	25,100	Unknown	Sand & Gravel
	2001	49,000	Unknown	Sand & Gravel
	1997	20,000	Unknown	Sand & Gravel
	1994	80,000	Beach	Sand & Gravel
	1980	16,000	Unknown	Sand
	1965	207,100	Unknown	Sand
	1958	187,500	Unknown	Sand
Note: 2013 data provided by Town of Smithtown, NY				

The 2009 Dredging Needs Update report projected, based on facility surveys, that 675,700 CY of maintenance dredging would be needed by Suffolk County projects, and 183,000 CY by other non-Federal facilities (the 5 responding facilities to the 2008 dredging needs survey). The dredging needs report also projected an additional 100 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. Also non-Federal facilities indicated a need for 203,800 CY of improvement dredging. These totals, distributed over the 30-year DMMP planning horizon are shown in the table below.

Table 5-206 - Dredging Activity Timeline – Smithtown Bay and Stony Brook Harbor Area Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Suffolk County Maintenance	112,600	112,600	112,600	112,600	112,600	112,700
Other NF Maintenance	151,500	11,500	5,000	5,000	5,000	5,000
Additional Projections						100
Improvements	200,000				3,800	
Total All Material	464,100	124,100	117,600	117,600	121,400	117,800
Sand Fraction	393,800	121,800	116,600	116,600	119,600	116,800
Fine-Grained	70,300	2,300	1,000	1,000	1,800	1,000

These activities are expected to generate 1,062,600 CY of suitable dredged material over the 30-year period of analysis. Suffolk County maintenance is expected to be all sandy material, as it has been since 1980. No information is available on sediment classification of the non-County maintenance and improvement work. Sampling and testing of those materials would occur in the future as proponents initiated the regulatory process for those projects. The draft DMMP used an assumption of 85% sand and 15% fine-grained applied to the total non-Federal dredging volume including the county work. The Town of Smithtown in their letter of October 2, 2015 took issue with this approach, believing it overestimated the volume of fine-grained materials that would be produced by this dredging center. The assumption has been modified to apply a split percentage to only the non-County work using a split of 80% sand and 20% fines, similar to the long-term County dredging records, and assuming that all material classified as "sand and mud" from those records would be unsuitable for nourishment purposes.

Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the WLDS and CLDS being the closest approved sites. However, the sandy nature of most of these materials makes them valued for beach nourishment and nearshore bar placement, as well as other upland fill applications. Major coastal storms have occasionally resulted in coastal erosion and property damage in this area, and such materials could be used to address such losses and provide resiliency against future storm events and sea level rise.

5.22.4 Harbor Characterization for Non-Federal Harbors

There are no FNPs in this dredging center; however, there are a number of small non-Federal harbors that have a history of public and private permit dredging that can be discussed based on regulatory records.

Nissequogue River: County dredging of 400,000 CY between 1980 and 2009 was classified as sand, or sand and gravel, as was the unknown volume from 2013. Where a placement method is listed, dredging and placement was accomplished by hydraulic pipeline dredging with beach nourishment. Future dredged material from the Nissequogue River is expected to also be sand suitable for nourishment purposes.

Stony Brook Harbor, including the Porpoise Channel and Long Beach Boat Basin: Except for the Long Beach Boat Basin, which was characterized as sand and mud during its construction in the 1950s, the 275,000 CY of material dredged from this harbor by the county since 1980 and the 2013 maintenance project were characterized as sand, with beach nourishment being the only placement method recorded. For the future, dredged materials from this waterway, including the Porpoise Channel and maintenance of the boat basin, are expected to be clean sand suitable for nourishment purposes.

5.22.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce mainly sandy material suitable for beach or nearshore bar placement. There are several large public beaches on Smithtown Bay that could benefit for nourishment through either direct placement or nearshore bar placement. The private and public facility dredging under permit projected for the DMMP planning horizon in this dredging center would range from small-scale marina and residential projects of a few hundred cubic yards to mid-scale private marina and public landing and anchorage maintenance and improvement projects generating up to 200,000 CY.

Over the past few decades dredged materials from this dredging center have been placed as nourishment on area beaches, and upland as fill for waterfront and public park development. The several investigations of placement alternatives identified the following alternatives listed in Table 5-207 as opportunities for placement for projects from this dredging center. While only three beaches were identified by the survey for nearshore placement, there are other beaches in the dredging center which have been used, or may upon detailed investigation, prove to be candidates for placement.

Table 5-207 - Smithtown Bay and Stony Brook Harbor Area Dredging Center Available Placement Alternatives

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Bayville Beach	Nearshore	96,200	Recurring	Sand
Asharoken Beach	Nearshore	248,300	Recurring	Sand
Sunken Meadow State Park	Nearshore	242,800	Recurring	Sand
	On-Beach	216,800	Recurring	Sand
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	All
Brookhaven Town Landfill	Upland	700,000	All	All

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or upland placement. No unsuitable materials or more than minimal volumes of fine-grained materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Beach and Nearshore Nourishment Sites: The coastline of the Smithtown Bay and Stony Brook Harbor Area Dredging Center is a mix of large and small beaches and stony headlands, with small coastal plain river inlets and bays. There are a few large public beaches and a few large private beach fronts. County and municipal dredging projects in recent decades have used hydraulic pipeline dredges for direct placement of these materials on adjacent beaches and are expected to continue to do so in the future. Placement nearshore by scow or hopper dredge at area beaches too distant for direct pumping could be accomplished if needed. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from the Smithtown Bay and Stony Brook Harbor area. The three beaches listed above were identified by the screening process. The distances by tug/scow from selected harbor dredge sites to area beaches are shown below for nearshore placement purposes.

The Town of Smithtown, in their letter of October 2, 2015, listed a few additional beaches not included in the DMMP surveys which have received dredged sands from this dredging center for nourishment in the past. These include Long Beach, Schubert Beach, and Short Beach in the Town of Smithtown, and West Meadow Beach in the Town of Brookhaven. Future dredging projects could consider these beaches for placement of sandy dredged materials in addition to those cited in the DMMP survey.

The nearshore feeder bar/berm placement site off of Sunken Meadow State Park in Kings Park, NY was located in an area likely to provide material to the state beach over time. However, as described in detail in the 2012 Technical Supporting Document #8 (Nearshore Berm Site Report), the east end of the proposed berm site is within a mile of the Nissequogue entrance channel. While the creation of a berm at this location should reduce wave energy in the location of the channel, storm events could result in berm sands migrating toward the channel. If a nearshore feeder berm is ever proposed for Sunken Meadow State Park, it may be necessary to move the location further west, beyond the Golf Course, so that material is more likely to reach the beach and not increase channel shoaling. Specific studies would need to be conducted if this site were ever considered to determine if an appropriate nearshore placement location can be identified for this beach or other beaches in Smithtown Bay.

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Central Long Island Sound site. These sites could receive any suitable material, either sandy or fine-grained. There are also two historic inactive open water sites located closer to this dredging center, the Smithtown Bay and Port Jefferson Disposal Sites, though these are unlikely to approved by the state for further use.

Table 5-208 - Scow Haul Distances to Nearshore and Open Water Placement Sites											
Project (Distances in Statute Miles)	Bayville Beach	Asharoken Beach	Sunken Meadow State Park	Short Beach	Long Beach	West Meadow Beach	Old Field Beach	East Beach (McAllister Park)	Cedar Beach	Smithtown Bay DS	Port Jefferson DS
Nissequogue River	20.6	8.6	2.2	1.5	4.0	6.0	10.2	11.5	14.0	7.0	10.6
Stony Brook Harbor	24.2	12.3	7.0	5.6	3.1	2.0	7.9	9.2	11.6	6.8	8.3

<u>Upland Landfills</u>: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options, and is not the best use of clean sandy material.

5.22.6 Alternatives Screening for the Dredging Center

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. For the Smithtown Bay and Stony Brook Harbor Area Dredging Center analysis there were no FNPs to match with the screened sites. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

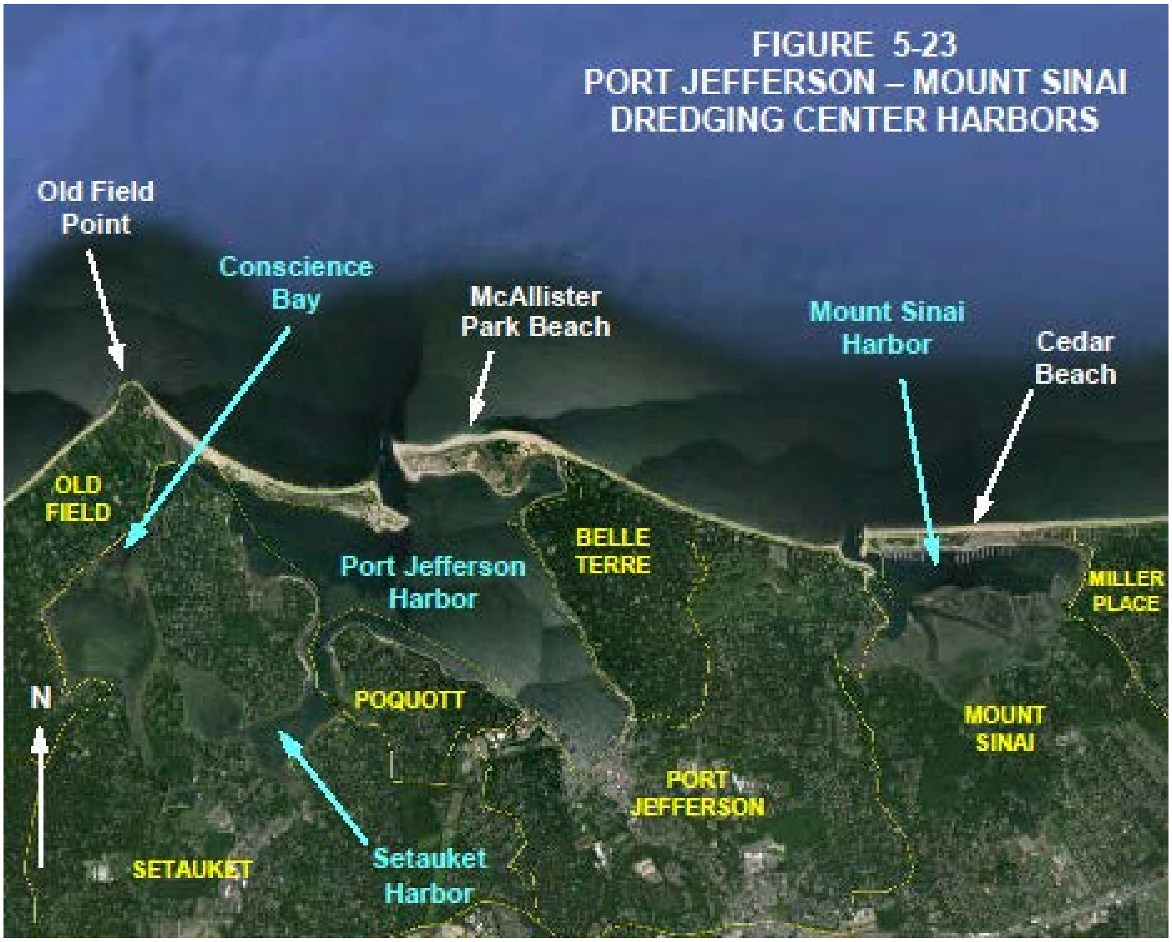
The Nissequogue River and Stony Brook Harbor and their tributary channels are expected to yield mainly clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment. Other beneficial uses such as upland fill, and waterfront structural backfill should also be considered. As there are no FNPs n this dredging center, no Federal base plans were identified.

5.23 Port Jefferson – Mount Sinai Dredging Center

The Port Jefferson-Mount Sinai Dredging Center consists of the western LIS coastal areas of the township of Brookhaven, and the communities of Old Field, Setauket and East Setauket, Poquott, Port Jefferson, Belle Terre, and Mount Sinai. The dredging center extends from Old

Field Point in the west easterly to the east end of Cedar Beach in Mount Sinai. The area includes the Federal Navigation Project for Port Jefferson Harbor, which is locally maintained. Port Jefferson Harbor includes several tributaries of which Setauket Harbor and Conscience Bay have the most navigation access. The principal waterways in this area are:

Port Jefferson – Includes FNP (Maintained by Non-Federal Interests)
Mount Sinai Harbor



The waterways and facilities in this dredging center yield sand generally suitable for direct beach or nearshore bar placement, though testing for specific projects is required to confirm suitability.

5.23.1 Federal Navigation Projects - Maintenance

Port Jefferson Harbor: The Port Jefferson Harbor FNP, the only FNP in this dredging center has not been dredged by the Federal Government since completion of the authorized 12-foot channel in 1903 and a single instance of maintenance dredging to that depth in 1906. Subsequent authorizations calling for deepening the project to 16 feet (1930), and later 40 feet (1968), were never constructed by the USACE, and were instead pursued by local interests, and deauthorized in 1990. Local interests dredged the channel to 16 feet in 1931, to 26 feet in 1957, and to 40 feet sometime after 1968. The USACE is only authorized to maintain the two jetties at the harbor entrance and a 12-foot channel depth, far less than that actually maintained by others. The last maintenance dredging in the spring of 1906 removed about 16,500 CY as shown below.

Table 5-209 - Federal Navigation Project Dredging History Port Jefferson-Mount Sinai Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material
Port Jefferson Harbor	1906	16,500	Unknown	Suitable Sand

There is no projected Federal dredging activity projected during the DMMP planning horizon as non-Federal interests maintain the Port Jefferson Harbor project to a depth greater than authorized for Federal maintenance.

5.23.2 Harbor Characterization for the Dredging Center

Port Jefferson Harbor FNP: Information on Port Jefferson Harbor's sediment composition consists of chemical testing of the harbor's sediments in 1971. The one sample taken from the outer harbor exceeded EPA criteria at that time for zinc, and oil and grease. The two samples taken from the inner harbor within the turning basin exceeded EPA criteria for oil and grease, and some metals (mercury, lead, and zinc). The channel has been dredged since that time. No grain size data is available from the FNP, though earlier records reference placement on "East Beach". No Federal maintenance dredging is anticipated during the DMMP planning horizon.

Port Jefferson Harbor – Non-Federal Dredging Activities: Permitting records from non-Federal projects show that dredged material from within Port Jefferson Harbor is typically placed upland. Regulatory permit records show that harbor facilities were dredged six times between 1991 and 2008 for a total of 11,400 CY. Two of these events were dredging by the Town of Brookhaven which placed the material upland, most recently at the Brookhaven town landfill in 1999. The Long Island Lighting Company has performed maintenance of the berth at the power plant in 1995, and harbor marinas periodically maintain their slip and dock space.

Setauket Harbor: There is no FNP for Setauket Harbor. Suffolk County dredged the harbor twice in the 1950s, but there are no available records of more recent work. The county dredging records list the material removed as "sand and gravel", and future dredging is assumed to yield similar material.

Mount Sinai Harbor: There is no FNP for Mount Sinai Harbor. USACE regulatory permit records show one instance of dredging in this harbor by Suffolk County in 1993, with 8,000 CY removed and the material placed as beach nourishment. Suffolk County records shown below list four dredging operations characterized as coarse material used for beach nourishment. Future dredging of this harbor is expected to yield clean sandy material suitable for beach or nearshore nourishment purposes.

5.23.3 Other Federal (Non-USACE) Dredging Projects

There are no non-USACE other Federal agency facilities or projects requiring dredging in the Port Jefferson – Mount Sinai Harbor Area dredging center.

5.23.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Port Jefferson – Mount Sinai Harbor Area Dredging Center that periodically generate dredged material. The deep-draft channel and turning basin at Port Jefferson Harbor are maintained by the power plant operators (Long Island Lighting Company). Suffolk County and the Town of Brookhaven dredge public access facilities in both harbors. Smaller public and private facilities exist in Setauket Harbor which has also been dredged by the County. Mount Sinai Harbor includes private and public marinas and a large public anchorage. Port Jefferson Harbor includes public and private marinas, yacht clubs and boat yard operations. Private residential access facilities are located throughout the dredging center

Suffolk County Department of Public Works (SC-DPW) records for dredging activity under permit for this dredging center are shown below. The Town of Brookhaven has dredged both Port Jefferson Harbor (with upland placement), and Mount Sinai Harbor (with beach placement).

Table 5-210 - Suffolk County Dredging Project History
Port Jefferson – Mount Sinai Harbor Area Dredging Center

Suffolk County DPW Permit Activity	Year Dredged	Cubic Yards	Placement Method	Material Recorded
Setauket Harbor	1959	138,400	Unknown	Sand & Gravel
	1953	42,300	Unknown	Sand & Gravel
Mount Sinai Harbor	2006	60,300	Unknown	Sand, Gravel & Cobble
	1995	81,000	Unknown	Sand, Gravel & Cobble
	1994	30,000	Beach	Sand, Gravel & Cobble
	1977	54,000	Unknown	Sand, Gravel & Cobble

The 2009 Dredging Needs Update report projected, based on facility surveys, that 181,200 CY of maintenance dredging would be needed by non-Federal facilities, including 171,300 CY of dredging by Suffolk County. The dredging needs report also projected an additional 19,400 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

Table 5-211 - Dredging Activity Timeline – Port Jefferson – Mount Sinai Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance (Permits)	9,900					
Additional Projections	3,200	3,200	3,300	3,200	3,200	3,300
Suffolk County Maintenance Dredging	28,500	28,600	28,500	28,600	28,500	28,600
Total Non-Federal	41,600	31,800	31,800	31,800	31,700	31,900
Sand Fraction (50%)	20,800	15,900	15,900	15,900	15,800	15,900
Fines Fraction (50%)	20.800	15,900	15,900	15,900	15,900	16,000

These activities are expected to generate suitable sand and gravel dredged material. Ocean placement is an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CLDS being the closest approved site. However, the sandy nature of these materials makes them valued for beach nourishment and nearshore bar placement, as well as other upland fill applications. Major coastal storms have occasionally resulted in coastal erosion and property damage in this area, and such materials could be used to address such losses and provide resiliency against future storm events and sea level rise.

5.23.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce mainly sandy material suitable for beach or nearshore bar placement. There are several large public beaches east of Port Jefferson Inlet (East Beach and Cedar Beach) that could benefit from nourishment through either direct placement or nearshore bar placement. There are smaller public and private beaches and shorelines around Port Jefferson Harbor and west of the inlet to Old Field Point that could also benefit from such beneficial placement. The private and public facility dredging under permit projected for the DMMP planning horizon in this dredging center would range from small-scale marina and residential projects of a few hundred cubic yards to mid-scale private marina and public landing and anchorage maintenance projects generating up to 20,000 CY. Dredged material from the berth and basin at the power plant has gone to an upland location on-site in recent years. The several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Table 5-212 - Port Jefferson – Mount Sinai Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Bayville Beach	Nearshore	96,200	Recurring	Sand
Asharoken Beach	Nearshore	248,300	Recurring	Sand
Sunken Meadow State Park	Nearshore	242,800	Recurring	Sand
Western Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Historic Area Remediation Site	Open Water	10,000,000	All	Suitable Fine
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
Sherwood Island Borrow Pit	COW Fill	266,000	All Until Filled	All Suitable
	COW Cap	484,000		
Norwalk Outer Harbor CDF	Island CDF	242,600	Once Built	All
Norwalk Outer Harbor Islands Marsh Creation - Fill	Marsh Shore CDF	242,600	All Once Built	Suitable Fine
- Cap		157,400		
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Hempstead Harbor NY CDF - Fill	Shore CDF	2,787,700	All Once Built	All
- Cap		712,300		All Suitable
Bridgeport Yellow Mill Channel CDF - Fill	Shore CDF	197,900	All Until Filled	All
- Cap		102,100		All Suitable
Penfield Reef CDF – Fill	Shore CDF	33,539,300	Once Built	All
Milford Harbor CDF – Fill	Shore CDF	219,100	Once Built	All
Stratford Point CDF – Fill	Shore CDF	33,666,900	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Brookhaven Town Landfill	Upland	700,000	All	All

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Beach and Nearshore Nourishment Sites: The coastline of the Port Jefferson-Mount Sinai Dredging Center is a mix of large beaches and stony headlands, with large bays and small coastal plain river inlets. There are many large public beaches and a few large private beach fronts. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from Port Jefferson-Mount Sinai area. The two beaches listed above were identified by the screening process.

Table 5-213 - Scow Haul Distances to Nearshore Placement Sites

Project (Distances in Statute Miles)	Bayville Beach	Asharoken Beach	Sunken Meadow State Park	Long Beach	Old Field Point West Beach	East Beach (McAllister Park)	Cedar Beach (Mount Sinai)	Wading River Town Beach	Wildwood State Park	Bailie Beach (Mattituck)
Setauket Harbor	28.4	17.2	13.1	10.4	5.2	3.6	6.5	15.5	18.9	31.4
Port Jefferson Harbor	28.2	17.0	12.9	10.2	5.0	3.4	6.3	15.3	18.7	31.2
Mount Sinai Harbor	29.7	18.5	14.2	11.6	6.5	3.0	1.7	11.3	14.8	27.4

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Western Long Island Sound site located offshore of Norwalk Harbor. The Central Long Island Sound site is more distant. These sites could receive any suitable material, either sandy or fine-grained. The historic Port Jefferson site is located a short distance north of that harbor's entrance but has been inactive since the 1970s and is unlikely to be approved for further use by the state of New York.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options for all expect the smallest dredging projects.

Confined Aquatic and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS, nearly all in Connecticut, have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The six CDF sites located near this dredging center or identified in the screening process include Hempstead Harbor, Norwalk Harbor, Penfield Reef, Bridgeport's upper Yellow Mill Channel, Stratford Point, and the New Haven Breakwaters site.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Norwalk Outer Harbor Islands.

Table 5-214 - Scow Haul Distances to In-Water and CDF Sites

Project (Distances in Statute Miles)	WLIS DS	Port Jefferson DS	CLDS	Hempstead Harbor CDF	Norwalk Island CDF	Sherwood Island COW Site	Penfield Reef CDF Site	Yellow Mill Channel CDF	Stratford Point CDF Site	New Haven Breakwaters CDF	Falkner Island CDF
Setauket Harbor	23.3	5.2	18.9	38.8	21.2	17.5	15.2	17.5	14.4	22.6	31.1
Port Jefferson Harbor	23.1	5.0	18.7	38.6	21.0	17.3	15.0	17.3	14.2	22.4	30.9
Mount Sinai Harbor	24.5	5.6	16.1	40.0	22.2	18.8	15.7	17.7	13.7	20.4	27.5

5.23.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. For the Port Jefferson-Mount Sinai Dredging Center analysis, the only FNP in the dredging center was not projected to require Federal maintenance during the DMMP planning horizon as local interests maintain the harbor to a deeper depth than that authorized for the FNP.

Port Jefferson Harbor FNP: To provide a list of likely placement alternatives should maintenance of the FNP at Port Jefferson be required, the screening tool was run for both and sand and fine-grained material, for a minimal 5,000 CY volume. The results are provided below.

The least cost placement alternative for the maintenance dredging of suitable sandy material from the Port Jefferson Harbor FNP is either open water placement at the Central Long Island Sound site, or use as either fill or cap material at the Sherwood Island offshore borrow pit COW site. The second least costly alternative is direct placement on the beach east of the harbor inlet at McAllister Park, at an increase of nine percent over the least cost alternatives. The third least costly alternative is placement in open water at the Western Long Island Sound site at an increase of 22 percent over the least cost alternative. The next least costly alternative is placement as cap material at the Morris Cove borrow pit CAD cell site in New Haven Harbor at about 35 percent more costly than the least cost alternative. Next is nearshore placement at either Cedar Beach at Mount Sinai Harbor, or at Sunken Meadow State Park, both at about 1.4 times the cost of the least cost alternative. Nearshore placement at Asharoken Beach or at Long Beach in Stratford would cost 1.9 times the last cost alternative.

Table 5-215 - Port Jefferson Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	None Identified But 5,000 CY Used as Example	None Identified	Yellow Mill Channel CDF – Cap	$283
			New Haven Breakwaters CDF – Cap	$283
			Norwalk Harbor Islands CDF – Cap	$283
			Milford Harbor CDF – Cap	$283
			Norwalk Harbor Islands Marsh – Cap	$283
			Stratford Point CDF – Cap	$283
			Penfield Reef CDF – Cap	$283
			Sherwood Island COW – Cap	$150
			Sherwood Island COW – Fill	$150
			Morris Cove Pit CAD Cell – Cap	$202
			East Beach (McAllister Park)	$163
			Cedar Beach (Mt Sinai) – Nearshore	$213
			Sunken Meadow State Park – NS	$213
			Central Long Island Sound DS	$150
			Asharoken Beach – Nearshore	$280
			Long Beach (Stratford) – Nearshore	$280
			Western Long Island Sound DS	$183
Suitable Fine	None Identified But 5,000 CY Used as Example	None Identified	Yellow Mill Channel CDF – Fill	$283
			New Haven Breakwaters CDF – Fill	$283
			Norwalk Harbor Islands CDF – Fill	$283
			Milford Harbor CDF – Fill	$283
			Norwalk Harbor Islands Marsh – Fill	$283
			Stratford Point CDF – Fill	$283
			Penfield Reef CDF – Fill	$283
			Sherwood Island COW – Cap	$150
			Sherwood Island COW – Fill	$150
			Morris Cove Pit CAD Cell – Fill	$202
			Brookhaven Town Landfill	$237
			Central Long Island Sound DS	$150
			Falkner Island CDF – Fill	$283
			110 Sand Company Site, NY	$283
			Western Long Island Sound DS	$183
			Hempstead Harbor CDF – Fill	$341
			Sandy Point West Haven Marsh	$219

The least cost placement alternative for the maintenance dredging of suitable fine-grained material from the Port Jefferson Harbor FNP is either open water placement at the Central Long Island Sound site, or use as either fill or cap material at the Sherwood Island offshore borrow pit COW site. The second least costly alternative is placement at the Western Long Island Sound site at an increase in cost of 22 percent. The third least costly alternative is placement as fill in the Morris Cove borrow pit CAD cell site in New Haven Harbor at about 35 percent more costly than the least cost alternative. Beneficial use in a marsh creation project at Sandy Point in West Haven would cost about 46 percent more than the least cost alternatives. Placement upland at landfills in New York would cost 1.6 to 1.9 times the cost of the least costly alternative.

Non-Federal public and private projects from the harbors in this dredging center are expected to yield both clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment and fine-grained materials that would require other placement options. Other beneficial uses such as upland fill, and waterfront structural backfill, marsh creation, or containment site cap, should also be considered. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

5.23.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The single FNP in this dredging is not projected to require maintenance within the 30-year DMMP planning horizon. However, in the event some minimal maintenance does prove necessary at Port Jefferson Harbor, base plans were identified for both sandy and fine-grained material as follows:

Table 5-216 - Federal Navigation Project Base Plans
Port Jefferson Harbor

FNP Project and Segment	Material Type	Federal Base Plan
Port Jefferson Harbor	Suitable Sand	Central Long Island Sound DS or Sherwood Island Borrow Pit COW
	Suitable Fines	Central Long Island Sound DS or use as fill or cap at the Sherwood Island COW

Alternatives to the Federal Base Plan: The Federal base plan for placement of both sand and fine-grained material from any required maintenance dredging at the Port Jefferson FNP would be placement at either the Central LIS site, or use as cap or fill material at the Sherwood Island COW site. For the sandy material, a beneficial use as direct placement nourishment on the beach at McAllister Park east of the inlet would be a nine percent increase over the base plan. Placement of sandy material nearshore at more distant beaches (42 to 90 percent increase) would require non-Federal funding or cost-sharing under another eligible Federal authority. For fine-grained material, alternatives to the CLDS or Sherwood Island are CAD cell placement at Morris Cove (35 percent), or use in a marsh creation project at Sandy Point in West Haven (46 percent), which would all require some level of non-Federal funding.

5.24 Suffolk County Northeast Shore Area Dredging Center

The Suffolk County Northeast Shore Area Dredging Center consists of the Long Island Sound shoreline areas of Brookhaven, Riverhead and Southold Townships from the East end of Cedar Beach in Mount Sinai in the west to Orient Point, Plum Island and the Gull Islands in the east. The area includes the Federal Navigation Project for Mattituck Harbor. The area includes the communities (from west to east) of Miller Place, Sound Beach, Rocky Point, Shoreham, East Shoreham, Wading River, Wildwood, Baiting Hollow, Riverhead (LIS shore), Northville, Mattituck, Peconic, Southold, Greenport, East Marion, and Orient. The dredging center also includes the Department of Homeland Security's waterfront facilities at Orient Point and Plum Island, the Cross Sound Ferry terminal at Orient Point, and many small private and public navigation access facilities. While this is the largest dredging center in the study area by size, it has the least dredging activity. The principal waterways in this area are:

Mattituck Harbor – Includes FNP
Goldsmith Inlet

The waterways and facilities in this dredging center yield mainly sandy dredged material. These materials are typically suitable for direct beach placement or nearshore bar placement. In rare instances dredging from inner areas of marinas, yacht clubs and small terminals can yield silty sands and sandy silts not suitable for beach nourishment that are typically placed upland. Sandy materials are also occasionally stockpiled upland for transport to more distant beaches or held for emergency shoreline projects after major storms. Testing for specific projects is required to confirm suitability for various uses.

5.24.1 Federal Navigation Projects - Maintenance

The only FNP in this dredging center is Mattituck Harbor. The most recent dredging operation for this project was the 2014 maintenance dredging conducted in association with a Section 111 shore damage mitigation project for the easterly beaches adjacent to the inlet, upon which the dredged sand was placed for shore damage reduction purposes.

Table 5-217 - Federal Navigation Project Dredging History
Suffolk County Northeast Shore Area Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Mattituck Harbor	2014	124,000	Beach	Suitable Sand
	2004	13,800	Beach	Suitable Sand
	1990	13,200	Beach	Suitable Sand
	1980	24,100	Beach	Suitable Sand
Improvement	1966	41,000	Unknown	Unknown
Maintenance	1966	6,300	Unknown	Unknown
	1962	43,600	Unknown	Unknown
	1956	31,600	Unknown	Unknown
	1951	22,900	Unknown	Unknown
	1947	53,900	Unknown	Unknown

Mattituck Harbor: The FNP for Mattituck Harbor was adopted in 1896 and modified in 1935 and 1964. The project consists of two stone jetties at the inlet to LIS, with a 7-foot channel extending about 2.1 miles up-harbor to a 6-acre anchorage of the same depth at Mattituck. Since 1920, maintenance dredging of the project has been conducted thirteen times, most recently in 2014. Since the last dredging improvement in 1966 which extended the channel up-harbor and added the anchorage, the project has been maintained four times (1980, 1990, 2004 and 2014), at a frequency of 10 to 14 years, with a total of 186,100 CY removed. This yields an annual shoaling rate over that 48-year period of about 3,900 CY. The most recent (after-dredge) survey from 2014 (Survey #4123 with sounding from May 2014) shows that 4,650 CY of pay yardage remains in the project limits. If the Mattituck Harbor FNP were to be maintained at a 14-year interval, then the next maintenance operation in 2028 could expect about 58,900 CY of shoal available, and in 2042 about 54,300 CY available.

Table 5-218 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Suffolk County Northeast Shore Area Dredging Center						
FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Mattituck Harbor FNP			58,900			54,300
Total Sandy Material			58,900			54,300

5.24.2 Harbor Characterization for Federal Navigation Projects

Mattituck Harbor FNP: Recent maintenance dredging of Mattituck Harbor in 2014, involved the removal of approximately 124,000 CY of sandy material that was placed on Bailie's Beach by pipeline dredge. Previous dredging events of the FNP have all placed dredged material on a beach for the purpose of beach nourishment. Sediment samples taken from the FNP in May of 2003 showed that approximately half of the cores collected were predominantly sand and gravel (ranging from 50-94% coarse), while the other half of the samples collected were mainly silt and clay (ranging from 69-97% fines).

Sediment samples collected from the beaches adjacent to the inlet were taken along two profile lines, one up-drift and one down-drift of the inlet. The samples were taken at the backshore area, at high water, mid-tide, and low water levels. The up-drift samples were collected from an area approximately 500 feet west of the west jetty, and down-drift samples were collected from a location approximately 2,000 feet east of the east jetty. Median grain size of the beach material varied from 0.07 mm (fine sand) to 25.4 mm (pebble), with no one size being dominant.

Any future maintenance of the FNP at Mattituck Harbor is expected to yield sandy dredged material suitable for direct beach or nearshore bar nourishment. The material is therefore also expected to be suitable for open-water placement with the CSDS being the closest. The historic Mattituck Disposal Site is also located nearshore off the beach sites. The material may also prove usable for upland placement for purposes such as in construction, port or other structural fill, highway projects, or other applications requiring sand. The material could also be stockpiled for use in emergency response to shore stabilization needs after major storms. Testing of the project's materials prior to each dredging operation will be needed to confirm suitability for alternative placement.

5.24.3 Other Federal (Non-USACE) Dredging Projects

There are no non-USACE Federal facilities or projects requiring dredging in the Suffolk County Northeast Shore Area Dredging Center.

5.24.4 Non-Federal Dredging Projects (Permit Activities)

There are a small number of maritime interests in the Suffolk County Northeast Shore Area Dredging Center that periodically generate dredged material. Most of these are located at Mattituck Harbor and consist of marinas, boat yards and yacht clubs. Smaller public access facilities (docks and boat ramps) are located at Goldsmith Inlet (Southold) and Wading River. A major fuel terminal is located offshore of Riverhead and connected to the shore by submerged pipeline. There are a small number of residential docks and piers located around Mattituck Harbor and Goldsmith Inlet.

There are a number of state, county, and municipal beach access facilities located along this section of coast, some with small craft launch ramps. In general none of these appear to require any dredging, though occasionally ramp or pier maintenance requires some small-scale excavation or dredging, such as when the town of Riverhead performed maintenance of the boat ramp and pier at Iron Pier Beach in 1999 and placed a few hundred CY of dredge material upland on site. All three of the non-Federal dredging projects listed in the USACE regulatory permit record for Mattituck Harbor for 1998-1999 were placed upland.

Suffolk County Department of Public Works and USACE permit records for dredging activity under permit at Goldsmith Inlet, as listed below, show that the county dredged the inlet ten times between 1977 and 2005, removing a total of 65,000 CY of sand in those operations. The town of Southold also dredged 5,000 CY from Goldsmiths Inlet in 1998 and stockpiled it upland at the town highway department yard.

Table 5-219 - Suffolk County Dredging Projects History Suffolk County Northeast Shore Area Dredging Center				
Suffolk County DPW Permit Activity	Year Dredged	Cubic Yards	Placement Method	Material Recorded
Goldsmith Inlet	2005	22,400	Unknown	Sand
	2004	5,000	Unknown	Sand
	2002	5,000	Unknown	Sand
	1990	7,200	Unknown	Sand
	1989	4,300	Unknown	Sand
	1987	4,800	Unknown	Sand
	1985	2,600	Unknown	Sand
	1982	6,000	Unknown	Sand
	1980	3,700	Unknown	Sand
	1977	4,000	Unknown	Sand

The 2009 Dredging Needs Update report projected, based on facility surveys, that 61,000 CY of maintenance dredging would be needed by non-Federal facilities, all from Suffolk County projects including Goldsmith Inlet. The dredging needs report also projected an additional 350 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

These activities are expected to generate mainly sand suitable for direct beach or nearshore bar placement. Occasionally materials from marina basins or other areas in inner harbor areas may prove to be silty sands and sandy silts not suitable for beach or bar placement, but otherwise likely suitable for open-water placement or other uses upland. Ocean placement can be an environmentally acceptable and cost effective alternative when other uses are not practicable, with the CSDS being the closest approved site for that type of material. However, open-water placement is not the best use of sandy material, and nourishment and coastal resiliency focused projects and opportunities are found throughout this dredging center in areas adjacent to most dredging locations.

Table 5-220 - Dredging Activity Timeline – Non-Federal Permit Activities Suffolk County Northeast Shore Area Dredging Center						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Permit Projections		100		100		200
Suffolk County Projections	10,100	10,200	10,100	10,200	10,100	10,200
Total Non-Federal	10,100	10,300	10,100	10,300	10,100	10,400

5.24.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities generating a few hundred cubic yards, up to FNP maintenance activities generating more than 50,000 CY, to large-scale non-Federal improvements generating about three million CY are anticipated. Most dredged materials from this dredging center in recent decades have been beneficially used for beach and other shoreline projects, or placed upland for various purposes. There is little evidence of past port-fill activities, though as elsewhere that practice likely occurred on some scale. The several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-221 - Suffolk County Northeast Shore Area Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Asharoken Beach	Nearshore	248,300	Recurring	Sand
Sunken Meadow State Park	Nearshore	242,800	Recurring	Sand
Wildwood State Park	Nearshore	197,800	Recurring	Sand
Bailie's Beach - Mattituck	On-Beach	100,000	Recurring	Sand
	Nearshore	35,100	Recurring	Sand
Jamesport (Hallock) State Park	Nearshore	129,600	Recurring	Sand
Jamesport (Hallock) State Park	On-Beach	161,900	Recurring	Sand
Hashamomuck Cove – Cty Rd 48	Nearshore	155,100	Recurring	Sand
Kenney's Beach - Southold	Nearshore	72,800	Recurring	Sand
Cornfield Shoals Disposal Site	Open Water	200,000,000	All	All Suitable
New London Disposal Site	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Stratford Point CDF - Fill	Shore CDF	33,666,900	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Brookhaven Town Landfill	Upland	700,000	All	All

<u>Beach and Nearshore Nourishment Sites</u>: The coastline of the Suffolk County Northeast Shore Area Dredging Center is on nearly continuous narrow beach backed by a mix of dunes, small coastal marshes, and stony bluffs, with a few small coastal plain river inlets and salt ponds. There are several large and small public beaches and lengthy private beach fronts. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from Suffolk County Northeast Shore area. The beaches listed above and below were identified by the screening process for this and adjacent dredging centers. Haul distances for nearshore placement off area beaches for the two dredged harbors in this center are shown below.

Table 5-222 - Scow Haul Distances to Nearshore Placement Sites										
Project (Distances in Statute Miles)	Asharoken Beach	Sunken Meadow State Park	Cedar Beach (Mount Sinai)	Wading River Town Beach	Wildwood State Park	Bailie Beach (Mattituck)	Jamestown State Park (Hallock)	Kenneys Beach	Hashamomuck Cove	Orient Beach State Park
Mattituck Harbor	45.0	40.6	27.4	18.5	15.2	2.7	5.0	9.2	12.1	27.6
Goldsmith Inlet	48.3	43.9	30.7	21.8	18.5	5.6	8.3	2.4	5.3	20.8

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Cornfield Shoals site located offshore of the mouth of the Connecticut River. The Central Long Island Sound site and the New London site are more distant. These sites could receive any suitable material, either sandy or fine-grained. The historic Mattituck Disposal Site is located a short distance north of that harbor's entrance but has been inactive since the 1970s and is unlikely to be approved for further use by the state of New York.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options for all expect the smallest dredging projects.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS, nearly all in Connecticut, have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The four CDF sites located near this dredging center or identified in the screening process include the Falkner Island, Clinton Harbor, Duck Island Roads, and New Haven Breakwaters sites.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in Little Narragansett Bay. Haul distances for various open water and alternative placement sites for this dredging center are shown below.

Table 5-223 - Scow Haul Distances to In-Water and CDF Sites											
Project (Distances in Statute Miles)	Morris Cove CAD Cell – New Haven	New Haven Breakwaters CDF	Central LIS DS	Falkner Island CDF Site	Clinton Harbor CDF Site	Duck Island Roads CDF Site	Cornfield Shoals Site	Mattituck DS	Orient DS	New London DS	Sandy Point Marsh Site
Mattituck Harbor	28.3	27.3	19.3	17.8	19.1	19.7	17.4	5.8	24.0	31.6	45.5
Goldsmith Inlet	28.8	27.7	22.6	15.6	14.7	14.6	12.9	5.9	17.2	27.0	38.7

5.24.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the one FNP in the Suffolk County Northeast Shore Area Dredging Center, the analysis matched that FNP with placement alternatives as shown below. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

Mattituck Harbor: Future maintenance of the Mattituck Harbor FNP will yield mainly sandy dredged materials over the DMMP planning horizon. These sandy materials would be suitable for beach or nearshore bar placement, open water placement in LIS, or other uses. Some fine-grained material from upper harbor areas may also be produced. These suitable silty materials could be placed at open water sites, upland, in CDFs as fill or cap material, or beneficially used in marsh creation projects. The entire projected volume of material from future dredging of the Mattituck Harbor FNP has been characterized as sandy material. However, as there is the potential for silty material to be encountered in the upper project reaches the alternatives screening was also run for a minor amount (7,000 CY) of fine-grained material to see what placement alternatives may be available in the event such material was encountered.

The least cost placement alternative for the maintenance dredging of sand from the Mattituck Harbor FNP is placement at Bailie’s Beach east of the inlet, either direct by pipeline or nearshore. The second least costly alternatives are open water placement at either the Cornfield Shoals site or the Central Long Island Sound site, at a 50 percent increase over placement on Bailie’s Beach. The third least costly alternative is placement at Jamesport State Park (Hallock Park), either nearshore or on the beach, at 1.6 times the cost of Bailie’s Beach. Nearshore placement at Hashamomuck Cove (CR-48) is about 2.1 times the cost of the least cost alternative. Placement as cap at the Sherwood Island offshore borrow pit site, or in open water at the New London site is about 2.4 times the cost of the least cost alternative. Placement nearshore off Orient Beach State Park would be about 2.5 times the cost of placement at Bailie’s Beach.

Table 5-224 - Mattituck Harbor – FNP Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	58,900	2026-2030	Falkner Island CDF – Cap	$130
	54,300	2041-2045	Duck Island Roads CDF – Cap	$130
			Bailie's Beach – On-Beach	$28
			Clinton Harbor CDF – Cap	$130
			Morris Cove Pit CAD – Cap	$82
			Hashamomuck Cove CR-48 – NS	$58
			Jamesport State Park – Nearshore	$46
			Central Long Island Sound DS	$42
			Jamesport State Park – On-Beach	$46
			Cornfield Shoals Disposal Site	$42
			Bailie's Beach – Nearshore	$28
			Hashamomuck Cove CR-48 – Beach	$58
			Orient Beach State Park – Nearshore	$71
			Sherwood Island COW – Cap	$68
			New London Disposal Site	$68
Suitable Fine	7,000	2026-2030	Falkner Island CDF – Fill	$229
		2041-2045	Duck Island Roads CDF– Fill	$229
			Clinton Harbor CDF – Fill	$229
			Morris Cove Pit CAD Cell – Fill	$167
			Central Long Island Sound DS	$120
			Cornfield Shoals Disposal Site	$120
			Twotree Island CDF – Fill	$243
			New Haven Breakwaters CDF – Fill	$243
			Milford Harbor CDF – Fill	$243
			Yellow Mill Channel CDF – Fill	$294
			Norwalk Harbor Islands CDF – Fill	$294
			Norwalk Harbor Islands Marsh – Fill	$294
			Stratford Point CDF – Fill	$294
			Penfield Reef CDF – Fill	$294
			Sherwood Island COW – Cap	$191
			Sherwood Island COW – Fill	$191
			Brookhaven Town Landfill	$187
			110 Sand Company Site, NY	$214
			Western Long Island Sound DS	$191
			Hempstead Harbor CDF – Fill	$294
			Sandy Point West Haven Marsh	$183

The least cost placement alternative for the future maintenance dredging of potentially suitable fine-grained material from the Mattituck Harbor FNP is open water placement either at the Central Long Island Sound or Cornfield Shoals sites. The second least costly alternative is use in a marsh creation project at Sandy Point in West Haven, at a 53 percent increase over open water placement. Placement upland at a landfill in New York would cost between 1.6 and 1.8 times the least cost alternative. Placement as either fill or cap material at the Sherwood Island offshore borrow pit COW, or in open water at the Western Long Island Sound site would both cost 1.6 times the least cost alternative. Placement at various CDF sites in the western LIS area would cost at least twice the cost of using the CLDS or CSDS.

Non-Federal public and private project from the harbors in this dredging center are expected to yield both clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment and fine-grained materials that would require other placement options. Other beneficial uses such as upland fill, and waterfront structural backfill, marsh creation, or containment site cap, should also be considered.

5.24.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-225 - Federal Navigation Project Base Plans
Mattituck Harbor

FNP Project and Segment	Material Type	Federal Base Plan
Mattituck Harbor	Suitable Sand	Bailie's Beach
	Suitable Fines	Central Long Island Sound DS or Cornfield Shoals DS

Alternatives to the Federal Base Plan: The Federal base plan for placement of sand from the Mattituck Harbor FNP is direct beach placement on the adjacent Bailie's Beach. Open water placement at the Cornfield Shoals or Central LIS sites, at a 50 percent increase, would be not cost-effective. Placement nearshore at more distant public beaches such as Hallock State Park in Jamesport (60 percent increase), or Hashamomuck Cove at County Road 48, would be 60 to 110 percent more costly and would require non-Federal funding or cost-sharing (if Section 204 was applicable).

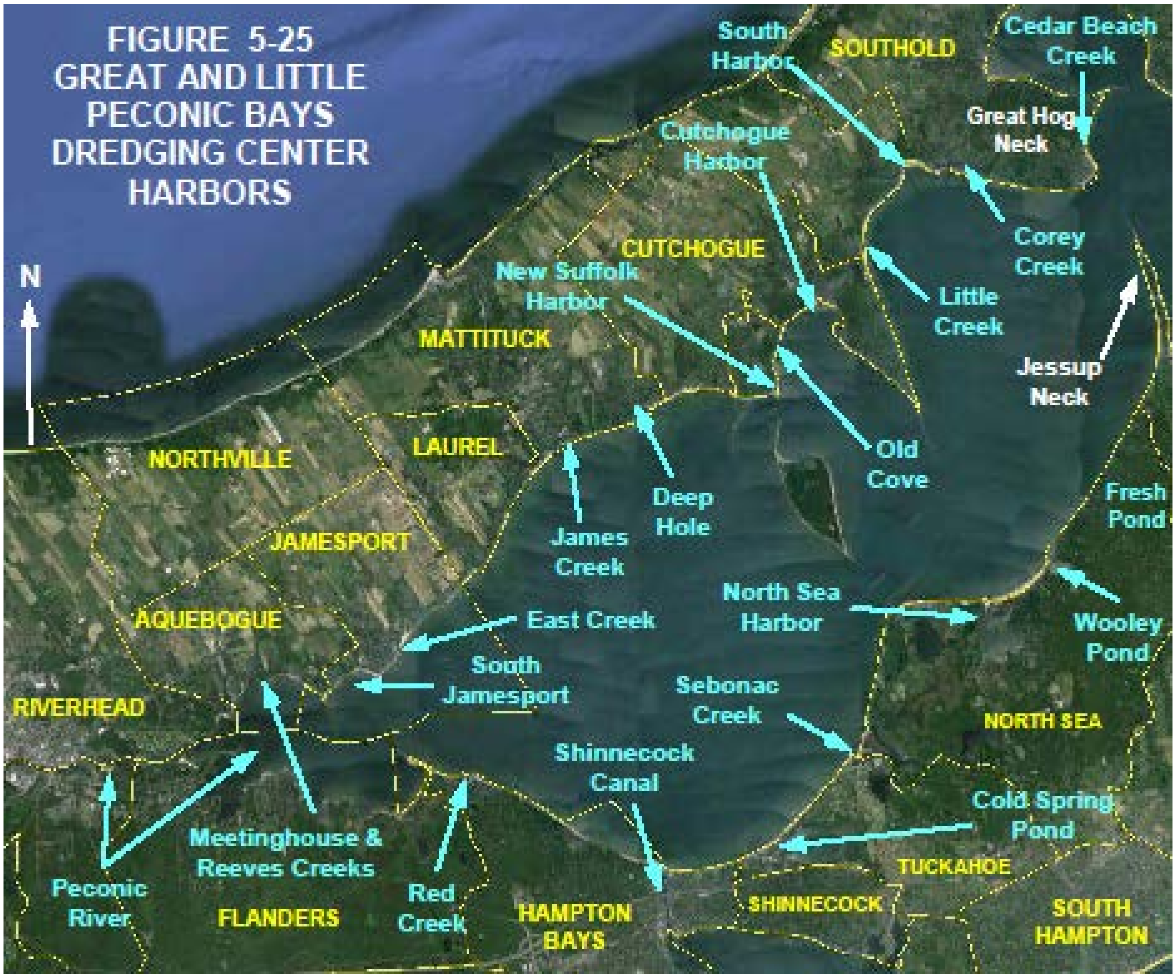
For any fine grained material required to be removed from the Mattituck Harbor FNP, open water placement at either the Cornfield Shoals or Central LIS sites would be the Federal base plan. Use as fill material in a marsh creation project at West Haven would be at least 50 percent more costly and would require non-Federal funding or cost-sharing. Placement upland at landfills on Long Island, at a 60 to 80 percent increase would not be cost-effective.

5.25 Great and Little Peconic Bays Dredging Center

The Great and Little Peconic Bays Dredging Center is the largest dredging center in the study area in terms of number of dredging actions, and consists of these two water bodies lying between the North and South Forks of outer Long Island. The dredging center consists of all areas west of a line from Cedar Beach Point on Great Hog Neck in Southold across to Jessup Neck in South Hampton, including the Peconic River west up to the head of navigation at Riverhead. The area includes the Federal Navigation Project for the Peconic River. The area includes the communities (counter-clockwise from the northeast) of Southold, Cutchogue, New Suffolk, Mattituck, Laurel, Jamesport, Aquebogue, Riverhead, Riverside, Flanders, Hampton Bays, Tuckahoe, North Sea, and Noyack. The dredging center also includes many small private and public navigation access facilities in these communities. The principal waterways in this area are:

Cedar Beach Creek
Corey Creek
Richmond Creek (South Harbor)
Little Creek (Cutchogue)
Wunneweta Pond (Cutchogue)
Cutchogue Harbor (including Broadwater Cove, Mud (Halls), East and Wickham Creeks)
West Creek (Cutchogue)
Deep Hole
James Creek (Mattituck)
Brushs Creek (Laurel)
East Creek (Jamesport)
South Jamesport
Miamogue Lagoon (Jamesport)
Acquebogue Harbor (Includes Reeves, Meetinghouse and Terrys Creeks)
Peconic River (Including Sawmill Creek) – Includes FNP
Reeves Bay (Flanders)
Red Creek (Hampton Bays)
Shinnecock Canal
Cold Spring Pond (Tuckahoe)
Sebonac Creek (Includes Bullhead Bay)
North Sea Harbor
Wolley Pond (North Sea)
Fresh Pond (North Sea)

The waterways and facilities in this dredging center yield mainly sandy dredged material. These materials are typically suitable for direct beach placement or nearshore bar placement. In rare instances, dredging from inner areas of rivers, marinas, and small coves can yield silty sands and sandy silts not suitable for beach nourishment that are typically placed upland. Sandy materials are also occasionally stockpiled upland for transport to more distant beaches or held for emergency shoreline projects after major storms. Testing for specific projects is required to confirm suitability for various uses.



5.25.1 Federal Navigation Projects - Maintenance

The only FNP in this dredging center is the Peconic River. The most recent dredging operation for this project was maintenance dredging of the 6-foot channel conducted in 1948. There is no record of the type of material encountered or the placement method used, except for a requirement that local interests furnish a placement site, which for that period would typically indicate that upland placement or port/marsh fill was used.

Table 5-226 - Federal Navigation Project Dredging History
Great and Little Peconic Bays Dredging Center

FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Peconic River FNP	1948	83,900	Unknown	Unknown
	1942	59,800	Unknown	Unknown
	1936	76,400	Unknown	Unknown

<u>Peconic River</u>: The FNP for the Peconic River was adopted in 1871 and modified in 1945. The project consists of a 6-foot channel extending westerly from Great Peconic Bay through Flanders Bay and upriver a total of 4.6 miles to a point below Peconic Avenue at Riverhead and Riverside. Since 1936, maintenance dredging of the project has been conducted three times (1936, 1942 and 1948). Over the twelve years between 1936 and 1948, a total of 143,700 CY were removed giving an annual shoaling rate of about 12,000 CY. The most recent condition survey from 2013 (Survey #4016 with Soundings from July 2013) indicates that about 8,200 CY of shoal material is in the project. For the period of 1948 to 2013 this represents an annual shoaling rate of just 130 CY. However, Suffolk County dredging records indicate that the county dredged the Peconic River Channel in 1960 and again in 1970 with a total of 776,500 CY removed under permit in those two operations. If that event and volume is added to the USACE maintenance history, then a 1936 to 2013 annual shoaling rate of 12,100 CY results (nearly the same as the 1936-1948 record), or 190 CY annually from 1970 to 2013. This indicates the difficulty in trying to predict future shoal volumes from a limited historical record or small number of dredging events. Controlling depths at the upper end of the channel and in a few small places along the outside channel quarters are less than 4 feet, though the center quarters carry 6 to 9 feet of depth. This indicates that either the lesser annual rate is more characteristic of present conditions, or that dredging by other parties not reflected in available records has been carried out since 1970. Using the lesser annual shoaling rate and starting from the 2013 survey volume, if the project were not maintained until 2040 only 13,300 CY would be available as pay yardage at that time.

Table 5-227 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Great and Little Peconic Bays Dredging Center

FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Peconic River FNP					13,300	
Total Suitable Fine					13,300	

5.25.2 Harbor Characterization for Federal Navigation Projects

<u>Peconic River FNP</u>: The Peconic River FNP has not been dredged by the USACE since 1948 when the last maintenance was accomplished. No data regarding dredging method, placement site, or sediment type or chemistry from that event is available. Sediment samples were taken from the channel in 1971. No grain size data or sample locations for that effort are available other than that the samples were taken from the upstream half of the project. The limited chemistry data available from that effort is presented in the Harbor Characterization Appendix, and the results are indicative of that expected from fine-grained material.

Suffolk County records for 1948 through 2009 list more than 440 individual county-funded dredging events in this dredging center (see table below). Among these include two instances listed for the Peconic River in 1960 and 1970 totaling 776,500 CY and recorded as “sand and mud”. There is no record of where this material was placed. However, aerial images appear to show two fill areas on the river’s south bank upstream and downstream of the Cross River Drive Bridge (County Route 105).

For the purposes of this DMMP it is inferred from the limited Federal and county data that material to be dredged from the Peconic River FNP in the future will be a mix of sandy and fine-grained material. This material would be unlikely to be suitable for beach or nearshore placement. While this material could be suitable for open-water placement, the nearest active site is the NLDS, and the nearest historic placement site, Orient, is a dispersal site. Upland placement would likely be the more suitable and least costly means, as it has been used in the past. The two areas along the river's south shore that appear to have been used previously are sufficient in size to accommodate additional placement, especially given the low volume of shoal (13,300 CY) anticipated for this waterway. These sites would need to be surveyed and studied, ownership determined, and regulatory approvals received before they could be used for any future dredging project placement.

The material may also prove usable for upland purposes such as non-load-bearing fill, other upland placement, in CDFs, or for beneficial uses such as marsh creation/augmentation. Testing of the project's materials prior to any dredging operation will be needed to confirm suitability for alternative placement.

Other Non-Federal Projects in the Dredging Center: The more than 8 million CY of dredging in the 1948 to 2009 period listed in the Suffolk County records was from 34 different locations (or an average of 131,300 CY/Year), with 59 percent was described as sand and 41 percent as "sand and mud". USACE regulatory permit records for the 1991 to 2009 period list 47 dredging events in this dredging center (totaling 142,500 CY, or an average of 7,500 CY/year), of which 30 placed material as beach nourishment (64 percent), one to an unidentified open water site, and 16 upland. For purposes of this DMMP non-Federal dredging under Federal and or state permit will be classified as 60 percent sand and 40 percent suitable fine-grained.

5.25.3 Other Federal (Non-USACE) Dredging Projects

There are no non-USACE Federal facilities or projects requiring dredging in the Great and Little Peconic Bays Dredging Center.

5.25.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests, both public and private, in the Great and Little Peconic Bays Dredging Center that periodically generate dredged material. These consist of county maintained channels and anchorage areas, municipal and private marinas and boat landings, boat yards, and yacht clubs. There are also a large number of residential docks and piers with dredged access, for homeowner's and neighborhood associations and individual residences.

Suffolk County Department of Public Works and USACE permit records for County sponsored dredging activity done under permit in this dredging center are shown below. Municipalities also occasionally conduct dredging for their own facilities and residents, such as the Town of Riverhead's minor dredging of the Peconic River in 1994, with placement of about 1,500 CY upland.

Table 5-228 - Suffolk County Dredging Projects History Great and Little Peconic Bays Dredging Center				
Suffolk County DPW Permit Activity	Dredged	Cubic Yards	Placement Method	Material Recorded
Dreamers Cove (Cases Creek – 7 Events)	1985-2006	30,000	Beach when Noted	Sand
East Creek (Jamesport)	1960	305,900	Unknown	Sand
(4 Events)	1961-1975	183,200	Unknown	Sand
(22 Events)	1985-2008	104,500	Unknown	Sand
Hawks Creek (Jamesport)	1966	30,800	Unknown	Sand
(19 Events)	1975-2007	33,700	Beach when Noted	Sand
Meetinghouse Creek (Aquebogue) (3 Events)	1948-1975	404,200	Unknown	Sand & Mud
Miamogue Lagoon (Jamesport)	1966-2008	84,500	Beach when Noted	Sand
Peconic River (Riverhead)	1960	160,200	Unknown	Sand & Mud
	1970	616,300	Unknown	Sand & Mud
Reeves Creek (Aquebogue) Sawmill Creek (Riverhead) Terrys Creek (Riverehead)	1965	708,600	Unknown	Sand & Mud
Cold Spring Creek	1964	124,80	Unknown	Sand
(17 Events)	1967-2006	269,500	Unknown	Sand
Fresh Pond (North Sea) (25 Events)	1975-2008	101,000	Unknown	Sand & Gravel
North Sea Harbor	1961	108,100	Unknown	Sand
(32 Events)	1964-2008	407,100	Unknown	Sand
Staff (Payne) Creek	1960	221,300	Unknown	Sand & Mud
Red Creek Pond	1964	93,200	Unknown	Sand & Gravel
(18 Events)	1971-2009	106,700	Unknown	
	2008	5,000	Beach	Sand
Reeves Bay	1967	135,300	Unknown	Sand & Mud
Sebonac Creek (Inner)	1958	110,200	Unknown	Sand & Mud
(4 Events)	1967-1997	242,000	Unknown	Sand & Mud
Sebonac Creek (Outer)	2007	7,500	Unknown	Sand & Gravel
	2008	20,400	Unknown	
(7 Events)	1981-2004	58,100	Unknown	Sand

Suffolk County DPW Permit Activity	Dredged	Cubic Yards	Placement Method	Material Recorded
Shinnecock Canal	1966	132,200	Unknown	Sand & Mud
Wooley Pond	1964	210,800	Unknown	Sand
(16 Events)	1967-2008	115,900	Unknown	Sand
Sylvan (Royal) Canal	1967	13,000	Unknown	Sand & Silt
(Flanders)	2007	600	Beach	Sand
Cutchogue Harbor (Broadwater Cove)	1966	434,400	Unknown	Sand & Silt
Brushes Creek (Laurel)	1966	88,400	Unknown	Sand
(24 Events)	1970-2007	78,400	Beach when Noted	Sand
(8 Events)	1972-2006	24,400	Unknown	Sand & Mud
Cedar Beach Harbor (Southold) (18 Events)	1971-2007	80,300	Beach when Noted	Sand
Corey Creek (Southold)	1963-64	345,600	Unknown	Sand
(12 Events)	1967-2007	102,700	Unknown	Sand
Deep Hole Creek	1964-65	243,500	Unknown	Sand
(Mattituck) (25 Events)	1972-2008	159,000	Unknown	Sand
Cutchcogue Harbor (Mud Creek) (18 Events)	1976-2008	131,800	Beach when Noted	Sand
James Creek (Mattituck)	1964-1965	272,500	Unknown	Sand & Mud
(2 Events)	1979-1983	5,100	Unknown	Sand & Mud
(13 Events)	1980-2008	48,500	Unknown	Sand
Little Creek (Cutchogue)	1967	51,000	Unknown	Sand
(39 Events)	1968-2008	188,100	Beach when Noted	Sand
Budds Pond (Mill Creek)	1964	65,600	Unknown	Unknown
(2 Events)	2000-2006	8,600	Unknown	Sand & Mud
(9 Events)	1968-2007	29,000	Unknown	Sand
New Suffolk Landing (16 Events)	1977-1994	30,900	Unknown	Sand
Richmond Creek	1959	123,000	Unknown	Sand
(12 Events)	1964-2007	185,200	Unknown	Sand

Suffolk County DPW Permit Activity	Dredged	Cubic Yards	Placement Method	Material Recorded
Schoolhouse Creek (New Suffolk – 2 Events)	1976 & 2008	13,200	Unknown	Sand
West Creek (New Suffolk)	1966	92,500	Unknown	Sand
(10 Events)	1976-2007	64,900	Unknown	Sand
Cutchogue Harbor (Wickham Creek)	1966	38,300	Unknown	Sand
(26 Events)	1972-2008	86,200	Unknown	Sand
TOTAL County Work	1991-2009	8,010,900	59% Sand, 41% Fines	

The 2009 Dredging Needs Update report projected, based on a survey of 34 facilities (of which 17 or 50 percent responded), that 69,200 CY of maintenance dredging would be needed by non-Federal facilities other than the county over the DMMP planning horizon. Suffolk County projects were projected to generate about 2,033,200 CY over the same period. The dredging needs report also projected an additional 19,100 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends, and one facility indicated a need for improvement dredging of about 500 CY. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

Table 5-229 - Dredging Activity Timeline
Great and Little Peconic Bays Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance (Permit)	12,100	11,100	9,000	9,000	14,000	14,000
Permit Projections	3,100	3,200	3,200	3,200	3,200	3,200
Suffolk County Projections	338,900	338,900	338,800	338,900	338,900	338,800
Improvement Dredging	500					
Total Non-Federal	354,600	353,200	351,000	351,000	356,100	356,000
Sand Portion (60%)	212,800	211,900	210,600	210,600	213,700	213,600
Fines Portion (40%)	141,800	141,300	140,400	140,400	142,400	142,400

Based on Suffolk County records, which cover the period from 1948 to 2009, about 41 percent of the material dredged in this dredging center is classified as mud and sand, or silt. If it is assumed that all dredging in this center produces similar materials in the same proportion then the 30-year planning horizon would be distributed by material type as shown above. Sand material produced would be suitable for beach or nearshore bar nourishment or for stockpile upland for future use in coastal resiliency projects as are presently done. Occasionally, materials from marina basins or other inner harbor or upper river areas may prove to be silty sands and sandy silts not suitable for beach or bar placement. Such materials could be placed upland as typically done now, or used in marsh restoration projects. Ocean placement can be an environmentally acceptable and cost effective alternative when other uses are not practicable; however, the nearest active open water site (NLDS) is a considerable distance from this dredging center. Open-water placement is not the best use of sandy material. Nourishment and coastal resiliency focused projects and opportunities are found throughout this dredging center in areas adjacent to most dredging locations.

5.25.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities and private residential access dredging generating a few hundred cubic yards, up to county channel maintenance activities generating more than 100,000 CY are anticipated. Most dredged materials from this dredging center in recent decades have been beneficially used for beach and other shoreline projects, or placed upland for various purposes. There are a number of state, county, and municipal beaches located throughout the dredging center that receive dredged sandy material as nourishment. There is little evidence of past port-fill activities, though as elsewhere that practice likely occurred on some scale. The several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Table 5-230 - Great and Little Peconic Bays Dredging Center Available/Potential Placement Alternatives

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Asharoken Beach	Nearshore	248,300	Recurring	Sand
Sunken Meadow State Park	Nearshore	242,800	Recurring	Sand
Wildwood State Park	Nearshore	197,800	Recurring	Sand
Bailie's Beach - Mattituck	On-Beach	100,000	Recurring	Sand
	Nearshore	35,100	Recurring	Sand
Jamesport (Hallock) State Park	Nearshore	129,641	Recurring	Sand
	On-Beach	161,900	Recurring	Sand
Hashamomuck Cove – Cty Rd 48	Nearshore	155,100	Recurring	Sand
Kenney's Beach - Southold	Nearshore	72,800	Recurring	Sand
Orient Point State Park Beach	Nearshore	204,100	Recurring	Sand
Gull Pond Beach, Southold	On-Beach	19,500	Recurring	Sand
Cornfield Shoals Disposal Site	Open Water	200,000,000	All	All Suitable

Alternatives		Site Type	CY Capacity	Years Available	Material Accepted
New London Disposal Site		Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS		Open Water	20,000,000	All	All Suitable
Duck Island Roads CDF	- Fill	Island CDF	1,376,100	All Once Built	All
	- Cap		233,900		All Suitable
Faulkner Island CDF	- Fill	Island CDF	16,010,200	All Once Built	All
	- Cap		1,169,800		All Suitable
Morris Cove Borrow Pit CAD, New Haven Harbor, CT		CAD Fill	466,100	All Until Filled	All
		CAD Cap	143,900		All Suitable
New Haven Breakwaters	- Fill	Island CDF	52,695,600	Once Built	All
	- Cap		5,554,400		All Suitable
Stratford Point CDF – Fill		Shore CDF	33,666,900	Once Built	All
110 Sand Company Site, Melville, NY		Upland	1,000,000	All	Suitable Fine
Brookhaven Town Landfill		Upland	700,000	All	All

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

<u>Beach and Nearshore Nourishment Sites</u>: The coastline of the Great and Little Peconic Bays Dredging Center is on nearly continuous narrow beach backed by a mix of dunes, small coastal marshes, and stony bluffs, with a few small coastal plain river inlets and salt ponds. There are several large and small public beaches and lengthy private beach fronts. Other more distant dredging centers in Connecticut or New York include additional beaches that could receive sandy material from Great and Little Peconic Bays area. The beaches listed above and below were identified by the screening process for this and adjacent dredging centers. Haul distances for nearshore placement off area beaches for the one FNP and a few selected non-Federally dredged harbors in this center are shown below.

Table 5-231 - Scow Haul Distances to Nearshore Placement Sites											
Project (Distances in Statute Miles)	Cedar Beach (Mount Sinai)	Wading River Town Beach	Wildwood State Park	Jamestown State Park (Hallock)	Bailie Beach (Mattituck)	Kenneys Beach	Hashamomuck Cove	Orient Beach State Park	Cedar Point Cty P	Hither Hills SP	Montauk Point SP
Peconic River	79.9	71.9	68.7	59.3	56.8	50.7	47.2	49.0	45.4	60.0	68.1
South Harbor	65.5	57.5	54.3	44.9	42.4	36.3	32.8	34.6	31.0	45.6	53.7
Cutchogue Harbor	69.9	61.9	58.7	49.3	46.8	40.7	37.2	39.0	35.4	50.0	58.1
New Suffolk Landing	69.3	61.3	58.1	48.7	46.2	40.1	36.6	38.4	34.8	49.4	57.5
James Creek	73.4	65.4	62.2	52.8	50.3	44.2	40.7	42.5	38.9	53.5	61.6
South Jamesport	76.1	68.1	64.9	55.5	53.0	46.9	43.4	45.2	41.6	56.2	64.3
Meetinghouse Creek	78.2	70.2	67.0	57.6	55.1	49.0	45.5	47.3	43.7	58.3	66.4
Shinnecock Canal	73.8	65.8	62.6	53.2	50.7	44.6	41.1	42.9	39.3	53.9	62.0
Sebonac Creek	71.8	63.8	60.6	51.2	48.7	42.6	39.1	40.9	37.3	51.9	60.0
North Sea Harbor	68.7	60.7	57.5	48.1	45.6	39.5	36.0	37.8	34.2	48.8	56.9

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Cornfield Shoals site located offshore of the mouth of the Connecticut River. The Central Long Island Sound site and the New London site are more distant. These sites could receive any suitable material, either sandy or fine-grained. The historic Orient Disposal Site is located a short north of Orient Point and west of Plum Gut but has been inactive since the 1970s and is unlike to be approved for further use by the state of New York.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options for all expect the smallest dredging projects.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS, nearly all in Connecticut, have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The CDF sites located near this dredging center or identified in the screening process include the Falkner Island, Clinton Harbor, Duck Island Roads, New Haven Breakwaters< Milford, Stratford, and Twotree Island sites.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in Little Narragansett Bay. Haul distances for placement areas, other than beaches, for the one FNP and a few selected non-Federally dredged harbors in this center are show below.

Table 5-232 - Scow Haul Distances to In-Water and CDF Sites

Project (Distances in Statute Miles)	Morris Cove CAD Cell	New Haven Breakwaters	Central LIS DS	Falkner Island CDF	Clinton Harbor CDF	Duck Island Roads CDF	Cornfield Shoals DS	Orient DS	Mattituck DS	Niantic DS	New London DS	Sandy Point Marsh Site	Rhode Island Sound DS
Peconic River	75.2	74.2	70.2	50.4	45.0	59.1	43.1	36.3	56.0	42.5	46.2	58.0	95.9
South Harbor	60.8	59.8	55.8	36.0	30.6	44.7	28.7	21.9	41.6	28.1	31.8	43.6	81.5
Cutchogue Harbor	65.2	64.2	60.2	40.4	35.0	49.1	33.1	26.3	46.0	32.5	36.2	48.0	85.9
New Suffolk Landing	64.6	63.6	59.6	39.8	34.4	48.5	32.5	25.7	45.4	31.9	35.6	47.4	85.3
James Creek	68.7	67.7	63.7	43.9	38.5	52.6	36.6	29.8	49.5	36.0	39.7	51.5	89.4
South Jamesport	71.4	70.4	66.4	46.6	41.2	55.3	39.3	32.5	52.2	38.7	42.4	54.2	92.1
Meetinghouse Creek	73.5	72.5	68.5	48.7	43.3	57.4	41.4	34.6	54.3	40.8	44.5	56.3	94.2
Shinnecock Canal	69.1	68.1	64.1	44.3	38.9	53.0	37.0	30.2	49.9	36.4	40.1	51.9	89.8
Sebonac Creek	67.1	66.1	62.1	42.3	36.9	51.0	35.0	28.2	47.9	34.4	38.1	49.9	87.8
North Sea Harbor	64.0	63.0	59.0	39.2	33.8	47.9	31.9	25.1	44.8	31.3	35.0	46.8	84.7

5.25.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the one FNP in the Great and Little Peconic Bays Dredging Center, the analysis matched projects with placement alternatives as shown below. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

Peconic River: Future maintenance of the Peconic River FNP will yield mainly fine-grained dredged materials over the DMMP planning horizon. These suitable silty materials could be placed at open water sites, upland, in CDFs as fill or cap material, or beneficially used in marsh creation projects. The entire projected volume of material from future dredging of the Peconic River FNP has been characterized as fine-grained material. However, as there is the potential for sandy material to be encountered in the outer project reaches in the bay, the alternatives screening was also run for a minor amount (7,000 CY) of sandy material to see what placement alternatives may be available in the event such material was encountered.

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Table 5-233 - Peconic River – FNP Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Fine	13,300	2036-2040	Morris Cove CAD – Fill	$124
			Falkner Island CDF – Fill	$187
			Duck Island Roads CDF – Fill	$187
			New Haven Breakwaters CDF – Fill	$187
			Clinton Harbor CDF – Fill	$187
			Milford Harbor CDF – Fill	$187
			Stratford Point CDF – Fill	$187
			Brookhaven Landfill	$122
			Twotree Island CDF – Fill	$226
			Yellow Mill Channel CDF – Fill	$226
			Sherwood Island Borrow Pit – Fill	$128
			110 Sand Co., Melville, NY	$144
			Central Long Island Sound DS	$155
			New London Disposal Site	$128
			Cornfield Shoals Disposal Site	$128
			Flushing Airport Wetlands/Flushing Airport Uplands – Brownfield	$144
			Jamaica Bay Marsh Islands – Habitat	$144
			Plumb Beach – Habitat	$144
			Sandy Point RI Marsh	$183
			Generic Upland along River	$69
			Rhode Island Sound Disposal Site	$156

The least cost placement alternative for the future maintenance dredging of potentially suitable fine-grained material from the Peconic River FNP may be upland placement at a site along the river. There appears to be a previously used site along the south bank of the river, above the Route 105 Bridge and east of the end of Kirk Avenue. Whether or not this site could be used in the future for placement of material dredged from the river would need to be the subject of further investigation.

In the absence of a riverside upland site, the next least cost alternatives are upland placement at the Brookhaven landfill (a 77 percent increase over on-shore placement), or placement as fill in the Morris Cove borrow pit CAD cell at New Haven Harbor (an 80 percent increase over on-shore placement). The next least costly would be placement as fill in at the Sherwood Island offshore borrow pit site, or in open water at either the Cornfield Shoals site or the New London site, all at 86 percent above the least cost alternative. Placement upland in a landfill in Melville, use of other CDF sites, placement at the CLDS, or use in various habitat restoration projects in western Long Island, would all be more than twice the least cost alternative.

Table 5-234 - Peconic River – FNP Placement Alternatives Screening Sand Example

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	7,000	2036-2040	Morris Cove Pit CAD – Cap	$167
			Bailie’s Beach (Nearshore)	$166
			Wildwood State Park (Nearshore)	$166
			Jamesport State Park (Nearshore)	$166
			Falkner Island CDF – Cap	$243
			Duck Island Roads CDF – Cap	$243
			New Haven Breakwaters CDF – Cap	$243
			Clinton Harbor CDF – Cap	$243
			Milford Harbor CDF – Cap	$243
			Stratford Point CDF – Cap	$243
			Shadmoor State Park – Nearshore	$272
			Misquamicut State Beach – Nearshore	$272
			Lake Montauk Harbor – Nearshore	$272
			Hashamomuck Cove – CR-48 – NS	$217
			Kenney's Beach – Nearshore	$217
			Hither Hills State Park – Nearshore	$272
			Sherwood Island COW – Cap	$191
			Central Long Island Sound DS	$191
			Cornfield Shoals Disposal Site	$191
			New London Disposal Site	$191
			Orient Beach State Park – Nearshore	$272
			Generic Beach Placement	$123

The least cost placement alternative for the maintenance dredging of sand from the entrance channel bar shoals in the Peconic River FNP is placement on a beach in the vicinity of the channel. There are several beach fronts in the communities around the mouth of the river and the head of the bay within two to five miles of the upstream end of the channel. Whether or not these beaches could be used in the future for placement of sand material dredged from the river would need to be the subject of further investigation.

In the absence of a nearby beach placement site, the next least costly alternative is nearshore placement at one of three beaches on the LIS shore of eastern Suffolk County (Bailie's Beach, Jamesport (Hallock) State Park, or Wildwood State Park), or placement as cap material at the Morris Cove borrow pit CAD cell site in New Haven harbor, all at an increase in cost of about 35 percent over the least cost alternative. The next least costly alternatives would be placement either in open water at the Central Long Island Sound or Cornfield Shoals sites, or as cap material at the Sherwood Island offshore borrow pit site, all at a 55 percent increase in cost over the least cost alternative. Other more distant nearshore placement sites, or use as CDF cap material would cost between 1.7 and 2.2 times the cost of the least cost alternative, or more.

Non-Federal public and private projects from the harbors in this dredging center are expected to yield both clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment and fine-grained materials that would require other placement options. Other beneficial uses such as upland fill, and waterfront structural backfill, marsh creation, or containment site cap, should also be considered.

5.25.7 Identification of Federal Navigation Project Base Plan

<u>Federal Base Plans</u>: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-235 - Peconic River Federal Navigation Project Base Plans

FNP Project and Segment	Material Type	Federal Base Plan
Peconic River	Suitable Fines	Upland Onshore Along the River or if not available then the Brookhaven Town Landfill
	Suitable Sand	Beaches on Great Peconic Bay or if not available then Nearshore along Suffolk County North Shore Beaches

<u>Alternatives to the Federal Base Plan</u>: The Federal base plan for placement of fine grained material dredged from the maintenance of the Peconic River would be placement at an upland site along the river shore, if that site remained available for such use. Absent an onshore site, placement in the Brookhaven landfill would be the next least cost alternative. Placement as fill at the Morris Cove CAD cell or the Sherwood Island COW site, or in open water at either the Cornfield Shoals or New London sites, would all be within five percent of the cost of upland placement at the Brookhaven landfill.

Should sandy materials be found in the entrance reaches of the Peconic River FNP, then the Federal base plan would be the same upland placement site along the river shore as for the fine-grained material. Direct beach placement as nourishment on beaches nearby in Great Peconic Bay would be about 77 percent more costly, but could be pursued with non-Federal funding or cost-sharing. Absent suitable onshore sites or beaches in the bay, nearshore placement on LIS beaches of the North Fork would be about 35 percent more costly. These would become the base plan if the Peconic Bay beaches were not available.

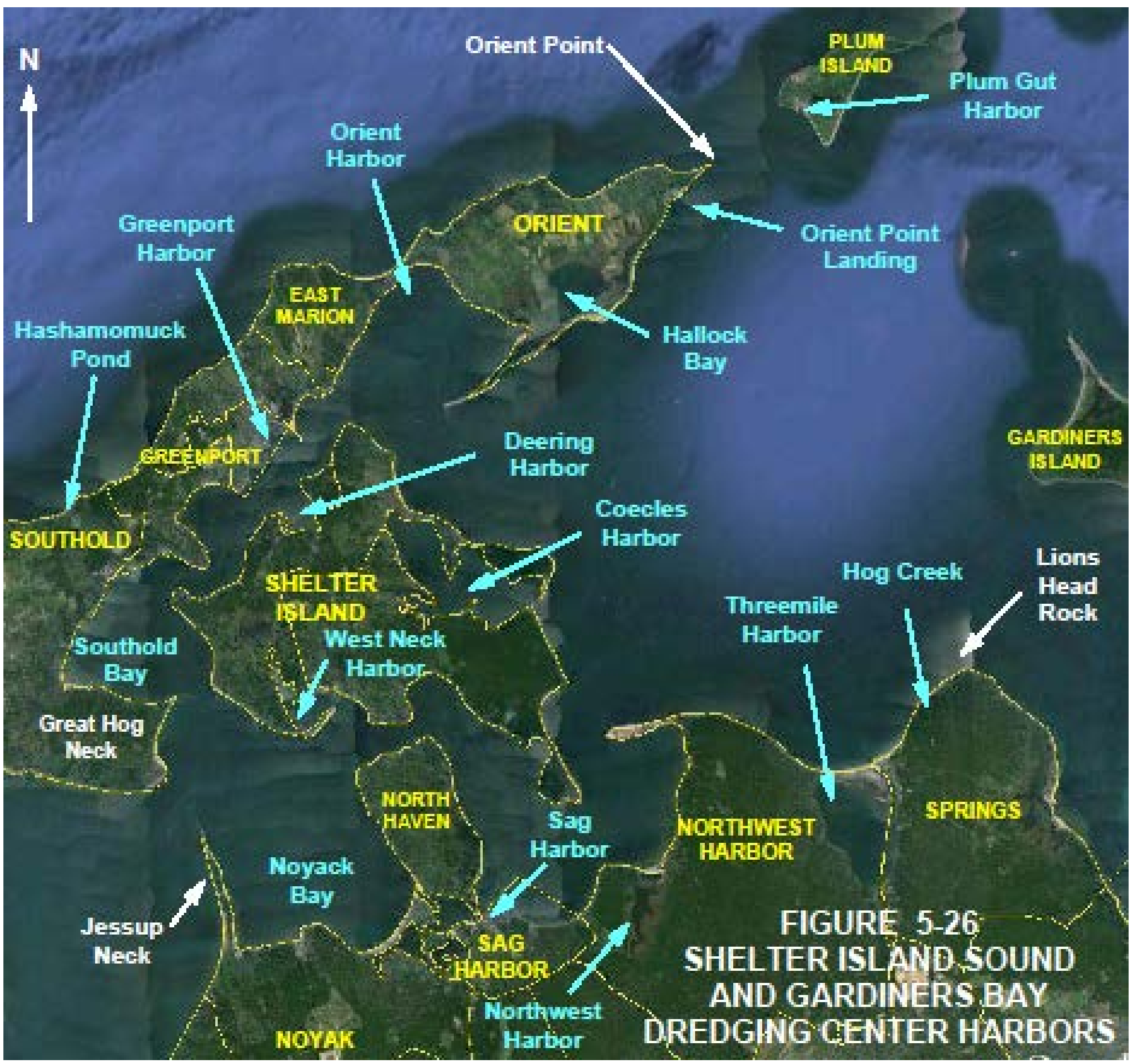
5.26 Shelter Island Sound and Gardiners Bay Dredging Area

The Shelter Island Sound and Gardiners Bay Dredging Center is the second largest dredging center in this study in terms of the number of harbors and waterways it includes. The dredging center consists of all shores and waters east of a line from Cedar Beach Point on Great Hog Neck in Southold across to Jessup Neck in South Hampton, including all of Shelter Island, Noyack Bay, Shelter Island Sound, the southerly and easterly shores of the North Fork east of Cedar Beach Point, and the northerly and easterly shores of South Hampton and East Hampton between Jessup Neck in the west and Lion Head Rock in the east. Also included are Plum Island and the Gull Islands which separate Long Island Sound from Block Island Sound. The dredging center includes the Federal Navigation Projects for Greenport Harbor and Sag Harbor. The area includes the communities (counter-clockwise from the northeast) of Orient, East Marion, Greenport, Southold, Shelter Island, Noyack, North Haven, Sag Harbor, Northwest Harbor, and Springs. The dredging center also includes the Department of Homeland Security’s waterfront facilities at Orient Point and Plum Island, the Cross Sound Ferry terminal at Orient Point, the terminals for the two Shelter Island ferry crossings to Greenport and North Haven, and many small private and public navigation access facilities. The waterways in this area which have dredging records and/or navigation access facilities are:

Plum Gut Harbor – U.S. DHS
Orient Point
Long Beach (Hallock) Bay/Peters Neck Point
Orient Harbor (Including Dam Pond)
Spring Pond (East Marion)
Gull Pond (Greenport)
Greenport Harbor (Including Sterling Basin) – Includes FNP
Pipes Cove
Brick Cove
Hashamomuck Pond (Including Mill Creek and Budds Pond)
Southold Bay and Harbor – Including Town, Jockey and Goose Creeks
Reydon Shores Basin
Paradise Point Basin
Deering Harbor (Shelter Island – Including Chase Creek and Gardiner Creek)
Coecles Harbor (Shelter Island – Including Congdons Creek)
Smith Cove (Shelter Island)
West Neck Harbor (Shelter Island)
    Includes Dickerson Creek, Menantic Creek and Silver Beach Lagoon
Crab Creek (Shelter Island)

Noyack Creek
Mill Creek (Noyack Bay)
Genet Creek (North Haven)
Fresh Pond (North Haven)
Sag Harbor (Including Paynes Creek and Sag Harbor Coves) – Includes FNP
Northwest Harbor and Creek
Threemile Harbor
Hog Creek Inlet

The waterways and facilities in this dredging center yield mainly sandy dredged material. These materials are typically suitable for direct beach placement or nearshore bar placement. In some instances, dredging from inner areas of marinas, yacht clubs and small terminals can yield silty sands and sandy silts not suitable for beach nourishment that are typically placed upland. Sandy materials are also occasionally stockpiled upland for transport to more distant beaches or held for emergency shoreline projects after major storms. Testing for specific projects is required to confirm suitability for various uses.



5.26.1 Federal Navigation Projects - Maintenance

The most recent dredging operations for the two FNPs in this dredging center are shown below. In both cases this was improvement dredging. Neither project has been maintained by the USACE since that improvement.

Table 5-236 - Federal Navigation Project Dredging History Shelter Island Sound and Gardiners Bay Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Greenport Harbor (Stirling Basin - Improvement)	1939	106,900	Unknown	Suitable Sand
Sag Harbor (Improvement)	1937	177,800	Unknown	Suitable Sand

Greenport Harbor: The village of Greenport includes a highly developed commercial waterfront with ferry terminals, boat yards, marinas and marine support facilities. The FNP for Greenport Harbor consists of a rubblestone breakwater at Young's Point east of the Stirling Basin inlet, an 8-foot deep channel into Stirling Basin to an anchorage of the same depth, and a 9-foot anchorage outside the basin. The project was completed in 1937 and has not been maintained by the Federal Government since that time. A 2013 condition survey of the project (Survey #4010, soundings from July 2013) showed minor shoaling in two anchorages, with a small but significant shoal in the entrance where Sandy Beach spit has migrated southwesterly into the channel, narrowing it by about forty percent and giving elevations shallower than MLLW in the easterly outer channel quarter. While the shoal volume is small (2,200 CY in 2013) the impact on navigation will likely need to be addressed during the DMMP planning horizon. If maintenance were to be performed in 2045, then a total shoal volume of about 3,200 CY could be expected. This material will likely be sand suitable for beneficial use as nourishment.

Sag Harbor: The FNP for Sag Harbor was authorized in 1902 and as modified through 1935 consisted of two rubblestone breakwaters in Shelter Island Sound protecting the harbor from the east, a 10-foot deep channel to the wharves, an 8-foot anchorage between the channel and the breakwaters, and a 6-foot anchorage between the channel and the central waterfront. The Water Resources Development Act of 1992 deauthorized the dredged features of the project, leaving only the breakwaters as Federal project features. Therefore, any future maintenance dredging of the former Federal channel and anchorage areas would need to be accomplished by non-Federal interests under permit. A 2013 condition survey of the project (Survey #4017, soundings from July 2013) showed very minor shoaling in the anchorage areas (about 140 CY). While the county has dredged the channels in Sag Harbor Cove upstream of the North Haven Bridge, there is no record of they're having done work downstream in the former Federal project areas. The shoaling rate here is therefore very small and maintenance of these areas is not anticipated in the near future.

The dredging activity timeline over the planning horizon for the one remaining Federal Navigation Projects in this dredging center is shown below.

Table 5-237 - Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Shelter Island Sound and Gardiners Bay Dredging Center						
FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Greenport Harbor FNP						3,200
Total Suitable Sand						3,200

5.26.2 Harbor Characterization for Federal Navigation Projects

Greenport Harbor FNP: The Greenport Harbor FNP has not been maintained since the project's initial construction in 1937. No physical or chemical sediment information was obtained from that event. Chemical analysis of the harbor's sediments was conducted in 1971, but location of the samples is not included in available records. Chemistry data from that investigation was indicative of a sandy material (NY Testing Lab, 1971).

Suffolk County records list four county dredging events for Sterling Basin for the period of 1959 to 1992, totaling 312,600 CY, all characterized as sand. USACE regulatory permit records for Sterling Basin list two dredging events in 1994 and 1999, both of which were very small volumes placed upland or used as bulkhead fill.

Any future maintenance of the Greenport Harbor FNP (Stirling Basin) is expected to yield sandy dredged material suitable for direct beach or nearshore bar nourishment. The material is therefore also expected to be suitable for open-water placement if a cost-effective site were available. The material may also prove usable for upland placement for purposes such as in construction, port or other structural fill, highway projects or other applications requiring sand. The material could also be stockpiled for use in emergency response to shore stabilization needs after major storms or for coastal resiliency projects. Testing of the project's materials prior to each dredging operation will be needed to confirm suitability for alternative placement.

Sag Harbor FNP: The dredged channel and anchorage features of the Sag Harbor FNP have been deauthorized, making their future maintenance a non-Federal responsibility. Suffolk County records list five county dredging operations for Sag Harbor and its inner tributary channels between 1960 and 1987 which removed a total of 604,900 CY, 57 percent of which was characterized as sand, and the rest "sand and mud". Dredging of this harbor will therefore like yield both sand and fine-grained material in the future.

The Shelter Island Sound and Gardiners Bay Dredging Center in General: There are a large number of small harbors, coves, rivers and man-made boat basins in this dredging center. Suffolk County records list 89 county funded dredging events in 23 different harbors between 1955 and 2009, which removed more than 3.9 million CY (see table below). Eighty-five percent of that volume was characterized as sand or "sand and gravel", and 15 percent as mud or "mud and sand".

USACE regulatory permit records list 36 different dredging actions between 1991 and 2008, which removed a total of 356,300 CY. Seventy-five percent of that volume was used as beach nourishment and is therefore assumed to be sand. The remaining 25 percent was placed upland as shore stabilization or taken to a landfill. Overall it is assumed from these records that 80 percent of the non-Federal dredging needs volume over the 30-year DMMP planning horizon will be sandy material, and the remaining 20 percent will be suitable fine-grained material.

5.26.3 Other Federal (Non-USACE) Dredging Projects

The U.S. Department of Homeland Security operates a facility on Plum Island in the Town of Southold which it is planning to close and relocate to another part of the Country. The facility was formerly operated by the U.S. Department of Agriculture as an animal disease laboratory. Access to the facility requires periodic maintenance dredging of Plum Gut Harbor on the south side of Plum Island, and access to a mainland pier at Orient Point. USACE permit records show the following as the recent dredging record:

Table 5-238 – Dredging History
Shelter Island Sound and Gardiners Bay – Other Federal Activities

Other Federal Agency Dredging Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Orient Point	1993	800	Upland	Suitable Sand
	2007	18,000	Upland	Suitable Sand
Plum Gut Harbor, Plum Island	2007	29,000	Beach	Suitable Sand

The 2007 permit records include a notation that for each end of the route (Orient and Plum Island) a maintenance cycle of five years at 5,000 CY per event was anticipated. While it is unknown what future use the island and its facilities will be put to, it is likely that some minimal level of access comparable to that maintained by USDA and USDHS would be continued. The material from both sites is expected to remain clean sandy material suitable for beach or nearshore bar nourishment or some other beneficial use upland as in the past, if only to facilitate access for relocation and abandonment of the facility. Two 5,000 CY maintenance events for each location were included at a 10-year frequency. Anything more would require a better understanding of the future plans for the island.

Table 5-239 – Dredging Activity Timeline
Shelter Island Sound and Gardiners Bay – Other Federal Activities

	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Orient Point	5,000		5,000			
Plum Gut Harbor	5,000		5,000			
Total Sandy Material	10,000		10,000			

As has been discussed elsewhere, it should also be noted that Plum Island has been suggested by some New York state agencies as a potential location for a dredged material containment and processing facility.

5.26.4 Non-Federal Dredging Projects (Permit Activities)

There are a large number of maritime interests in the Shelter Island Sound and Gardiners Bay Dredging Center that periodically generate dredged material. Most of the larger facilities are located at Greenport and Sag Harbor, though marinas, boat yards, yacht clubs and other smaller public and private access facilities and residential docks are found throughout the dredging center's coves, bays, and coastal rivers. The Town of Shelter Island and Village of Deering Harbor have also dredged minor amounts from Deering Harbor in 2003 and 1993 respectively, with the material disposed upland or as bulkhead backfill.

The Suffolk County Department of Public Works and USACE permit records for County dredging activity under permit for this dredging center are shown below and total about 3.9 million CY over the past 60 years. The County is also proposing to dredge the South Ferry between Shelter Island and North Haven in late 2014.

Table 5-240 – Suffolk County Dredging Projects History
Shelter Island Sound and Gardiners Bay Dredging Center

Suffolk County DPW Permit Activity	Year Dredged	Cubic Yards	Placement Method	Material Recorded
Gull Pond (Greenport)	1959	117,200	Unknown	Sand
8 Events	1960-1996	86,200	Unknown	Sand
Greenport - RR Dock	1983	41,700	Unknown	Sand & Gravel
Stirling Basin	1959	163,900	Unknown	Sand
Stirling Basin (3 Events)	1963-1992	148,700	Unknown	Sand
Goose Creek (Cutchogue)	1959 & 1967	121,900	Unknown	Sand
3 Events	1968-1995	20,100	Unknown	Sand
2 Events	2006-2008	20,100	Beach	Sand
Town Creek (Southold)	1959	93,400	Unknown	Sand
1 Event	1976	9,000	Unknown	Sand
Jockey Creek (Southold)	1959	23,200	Unknown	Sand & Mud
1 Event	2006	15,000	Beach	Unknown
Mill Creek (Noyack Bay)	1960	180,700	Unknown	Sand & Gravel
5 Events	1971-2006	63,800	Unknown	Sand & Gravel

Suffolk County DPW Permit Activity	Year Dredged	Cubic Yards	Placement Method	Material Recorded
Noyack Creek	1969	134,900	Unknown	Sand & Gravel
6 Events	1988-2007	34,300	Unknown	Sand
Deering Harbor	1966	18,200	Unknown	Sand & Mud
Gardiners Creek	1979	5,300	Unknown	Unknown
Chase Creek	1980	300	Unknown	Sand
Coecles Harbor (Shelter Island)	1966	143,200	Unknown	Sand
"	1995-1996	28,900	Beach	Sand
"	2000	2,000	Unknown	Sand
Congdons Cove - 2 Events	1965-1966	199,900	Unknown	Mud
Smith Cove (Shelter Island)	1966	35,900	Unknown	Sand & Mud
Dickerson Creek (Shelter Isl)	1996	6,000	Beach	Sand
"	1988	15,000	Unknown	Sand
Menantic Creek (Shelter Island)	1986	9,200	Unknown	Sand
West Neck Harbor (Shelter Isl)	1955-1960	321,500	Unknown	Sand & Gravel
2 Events	1965 & 1976	38,200	Unknown	Sand & Gravel
7 Events	1983-2003	61,300	Unknown	Sand
3 Events	2005-2009	28,700	Beach when Noted	Sand & Gravel
Silver Beach Lagoon (Shelter Isl)	2006	14,000	Upland Site	Unknown
"	2009	9,000	Unknown	Sand & Mud
Crab Creek (Shelter Is) 5 Events	1976-1994	26,700	Unknown	Sand & Gravel
Sag Harbor	1978	39,400	Unknown	Sand & Mud
Paynes Creek	1960	221,300	Unknown	Sand & Mud
Sag Harbor Cove (3 Events)	1960-1987	344,200	Unknown	Sand
Northwest Harbor	1961	356,700	Unknown	Sand
6 Events	1965-2005	103,200	Upland when Noted	Sand
Three Mile Harbor	1958	81,600	Unknown	Sand
4 Events	1961-1975	314,500	Unknown	Sand
1 Event	1993	130,000	Beach	Unknown
1 Event	1995	15,000	Upland Site	Unknown
2 Events	1996-2000	98,300	Unknown	Sand

The 2009 Dredging Needs Update report projected, based on facility surveys, that about 497,200 CY of maintenance dredging and 303,700 CY of improvement dredging would be needed by non-Federal facilities. This report also projected an additional 89,900 CY of non-Federal permit maintenance dredging based on analysis of historical permit trends. Further, about 798,800 CY was projected for Suffolk County maintenance dredging project over the DMMP planning horizon. This total, distributed over the 30-year DMMP planning horizon is shown in the table below.

These activities are expected to generate mainly sand suitable for direct beach or nearshore bar placement. Occasionally materials from marina basins or other areas in inner harbor areas may prove to be silty sands and sandy silts not suitable for beach or bar placement, but otherwise likely suitable for open-water placement or other uses upland.

Table 5-241 – Dredging Activity Timeline – Shelter Island Sound and Gardiners Bay Dredging Center – Non-Federal Permit Activities

Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	70,300	159,200	103,700	103,700	30,100	30,200
Permit Projections	15,000	15,000	15,000	15,000	15,000	14,900
Suffolk County Projections	133,100	133,100	133,200	133,100	133,100	133,200
Improvement Projects	186,600	62,000	22,000	22,100	5,500	5,500
Total Non-Federal	405,000	369,300	273,900	273,900	183,700	183,800
Sand Portion (80%)	324,000	295,400	219,100	219,100	147,000	147,000
Fine Portion (20%)	81,000	73,900	54,800	54,800	36,700	36,800

Based on both Suffolk County records, which cover the period from 1955 to 2009, and USACE regulatory permit records for 1991 to 2009, about 20 percent of the material dredged in this dredging center is classified as “mud and sand”, or silt. If it is assumed that all dredging in this center produces similar materials in the same proportion, then the 30-year planning horizon would be distributed by material type as shown above. Sand material, the remaining 80 percent of the volume produced in this dredging center, would be suitable for beach or nearshore bar nourishment or for stockpile upland for future use in coastal resiliency projects as are presently done. Occasionally materials from marina basins or other inner harbor or upper river areas may prove to be silty sands and sandy silts not suitable for beach or bar placement. Such materials could be placed upland as typically done now, or used in marsh restoration projects. Ocean placement can be an environmentally acceptable and cost effective alternative when other uses are not practicable, however the nearest active open water site (NLDS) is a considerable distance from this dredging center. Additionally, open-water placement is not the best use of sandy material. Nourishment and coastal resiliency focused projects and opportunities are found throughout this dredging center in areas adjacent to most dredging locations.

5.26.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities and private residential access dredging generating a few hundred cubic yards, up to county channel maintenance activities and private improvement projects generating more than 100,000 CY are anticipated. Most dredged materials from this dredging center in recent decades have been beneficially used for beach and other shoreline projects, or placed upland for various purposes. There are a number of state, county, and municipal beaches located throughout the dredging center that receive dredged sandy material as nourishment. There is little evidence of past port-fill activities, though as elsewhere that practice likely occurred on some scale. The several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Table 5-242 – Shelter Island Sound and Gardiners Bay Dredging Center Available Placement Alternatives

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Sunken Meadow State Park	Nearshore	242,800	Recurring	Sand
Wildwood State Park	Nearshore	197,800	Recurring	Sand
Bailie's Beach - Mattituck	On-Beach	100,000	Recurring	Sand
	Nearshore	35,100	Recurring	Sand
Jamesport (Hallock) State Park	Nearshore	129,641	Recurring	Sand
	On-Beach	161,900	Recurring	Sand
Hashamomuck Cove – Cty Rd 48	Nearshore	155,100	Recurring	Sand
Kenney's Beach - Southold	Nearshore	72,800	Recurring	Sand
Orient Point State Park Beach	Nearshore	204,100	Recurring	Sand
Gull Pond Beach, Southold	On-Beach	19,500	Recurring	Sand
Town Beach, Southold	On-Beach	31,300	Recurring	Sand
Cornfield Shoals Disposal Site	Open Water	200,000,000	All	All Suitable
New London Disposal Site	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable

Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Morris Cove Borrow Pit CAD, New Haven Harbor, CT	CAD Fill	466,100	All Until Filled	All
	CAD Cap	143,900		All Suitable
New Haven Breakwaters - Fill	Island CDF	52,695,600	Once Built	All
- Cap		5,554,400		All Suitable
Duck Island Roads CDF - Fill	Island CDF	1,376,100	All Once Built	All
- Cap		233,900		All Suitable
Faulkner Island CDF - Fill	Island CDF	16,010,200	All Once Built	All
- Cap		1,169,800		All Suitable
Stratford Point CDF - Fill	Shore CDF	33,666,900	Once Built	All
110 Sand Company Site, Melville, NY	Upland	1,000,000	All	Suitable Fine
Brookhaven Town Landfill	Upland	700,000	All	All

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

<u>Beach and Nearshore Nourishment Sites</u>: The coastline of the Shelter Island Sound and Gardiners Bay Dredging Center is a mixture of islands, headlands, barrier spits, large and small narrow beaches backed by a mix of dunes, small coastal marshes, and stony bluffs, with a few small coastal plain river inlets and salt ponds. There are several large and small public beaches and lengthy private beach fronts. Other more distant dredging centers in New York include additional beaches that could receive sandy material from Shelter Island Sound and Gardiners Bay area. The beaches listed above and below were identified by the screening process for this and adjacent dredging centers. Haul distances for nearshore placement off area beaches for the one FNP and a few selected non-Federally dredged harbors in this center are shown below.

<u>Open Water Placement Sites</u>: The closest currently active open water placement site to this dredging center is the Cornfield Shoals site located offshore of the mouth of the Connecticut River. The Central Long Island Sound site and the New London site are more distant. These sites could receive any suitable material, either sandy or fine-grained. The historic Orient Disposal Site is located a short distance Orient Point and west of Plum Gut but has been inactive since the 1970s and is unlike to be approved for further use by the state of New York.

Table 5-243 – Scow Haul Distances to Nearshore Placement Sites											
Project (Distances in Statute Miles)	Wildwood State Park	Jamesport State Park (Hallock)	Bailie Beach (Mattituck)	Kenneys Beach	Town Beach - Southold	Hashamomuck Cove	Orient Beach State Park	Gull Pond Beach	Cedar Point Cty P	Hither Hills SP	Montauk Point SP
Plum Gut Harbor	34.9	25.2	22.7	16.7	12.9	11.8	3.5	10.1	9.0	16.2	17.4
Orient Harbor	44.2	34.5	32.0	26.0	22.2	21.1	7.3	3.1	8.1	21.1	28.2
Greenport Harbor	45.1	25.4	32.9	26.9	23.1	22.0	8.2	1.4	9.0	21.8	28.8
Southold Harbor	49.4	39.7	37.2	31.2	27.4	26.3	13.0	6.0	13.1	26.0	33.2
Coecles Harbor	44.4	34.7	32.2	26.2	22.4	21.3	8.0	9.0	4.7	18.5	25.8
Noyak Bay (Mill Ck)	52.6	42.9	40.4	34.4	30.6	29.8	16.5	9.9	11.0	25.4	32.4
Sag Harbor	47.1	37.4	34.9	28.9	25.1	24.0	10.6	11.9	5.2	19.2	26.4
Northwest Harbor	45.8	36.1	33.6	27.6	23.8	22.6	9.4	10.6	4.0	18.2	25.2
Threemile Harbor	44.5	34.8	32.2	26.3	23.6	22.5	9.1	11.5	4.8	13.8	21.0

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options for all expect the smallest dredging projects.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material.

Confined Disposal Facilities: Many locations around LIS, nearly all in Connecticut, have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The three CDFs sites located near this dredging center or identified in the screening process include the Falkner Island, Duck Island Roads, and New Haven Breakwaters sites.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in Little Narragansett Bay. Haul distances for placement areas, other than beaches, for the one FNP and a few selected non-Federally dredged harbors in this center are show below.

Table 5-244 – Scow Haul Distances to In-Water and CDF Sites

Project (Distances in Statute Miles)	Morris Cove CAD Cell	New Haven Breakwaters	Central LIS DS	Falkner Island CDF	Mattituck DS	Clinton Harbor CDF	Duck Island Roads CDF	Cornfield Shoals DS	Twotree Island CDF	Orient DS	Niantic DS	New London DS	Sandy Point Marsh Site	Rhode Island Sound DS
Plum Gut Harbor	41.0	40.3	36.2	24.5	21.7	19.4	16.7	9.1	11.1	2.1	8.5	12.2	24.0	45.1
Orient Harbor	50.5	49.7	45.5	34.3	31.0	28.6	25.9	18.4	20.3	11.6	17.8	21.5	32.0	53.1
Greenport Harbor	51.5	50.8	46.4	35.0	31.9	29.3	26.7	19.3	21.8	12.5	18.7	22.4	32.8	53.9
Southold Harbor	55.9	55.3	50.7	39.2	36.2	33.5	31.1	23.6	26.1	16.8	23.0	26.7	37.1	58.3
Coecles Harbor	50.8	50.0	45.7	34.7	31.2	28.7	26.4	18.6	21.1	11.8	18.0	21.7	31.8	52.9
Noyak Bay	59.1	58.3	53.9	42.7	39.4	37.0	34.5	26.8	29.2	20.0	26.2	29.9	39.9	61.1
Sag Harbor	53.4	52.8	48.4	37.2	33.9	31.2	28.9	21.3	23.7	14.5	20.7	24.4	34.4	55.4
Northwest Harbor	52.2	51.6	47.1	36.0	32.6	27.6	27.3	20.0	22.5	13.2	19.4	23.1	33.0	54.1
Threemile Harbor	50.8	50.1	45.8	34.3	31.3	26.0	26.0	11.9	20.9	11.9	18.1	21.8	30.7	51.9

5.26.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for placement of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the one FNP in the Shelter Island Sound and Gardiners Bay Dredging Center, the analysis matched projects with placement alternatives as shown below. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

Greenport Harbor: Future maintenance of the Greenport Harbor FNP will yield mainly sandy dredged materials over the DMMP planning horizon. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, or for other upland applications.

Table 5-245 – Greenport Harbor FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	3,200	2041-2045	Falkner Island CDF – Cap	$388
			Falkner Island CDF – Fill	$388
			Gull Pond Beach – On-Beach	$225
			Duck Island Roads – Fill	$388
			Duck Island Roads – Cap	$388
			Cornfield Shoals Disposal Site	$211
			New London Disposal Site	$245
			Twotree Island CDF – Fill	$388
			Twotree Island CDF – Cap	$388
			Clinton Harbor CDF – Fill	$388
			Clinton Harbor CDF – Cap	$388
			Hashamomuck Cove – Rt-48 – NS	$288
			Kenney's Beach – Nearshore	$303
			Orient Beach State Park – Nearshore	$303
			Town Beach, Southold – On-Beach	$288
			Central Long Island Sound DS	$270
			Rhode Island Sound DS	$341
			Sandy Bay RI Marsh Site	$283

The least cost placement alternative for the maintenance dredging of sand from the Greenport FNP is open water placement at the Cornfield Shoals site in LIS. The second least costly alternative is direct placement by pipeline on Gull Pond Beach in Greenport to the east of the Stirling Basin jetty, at a seven percent increase in cost over using the CSDS. The next least costly alternatives are open water placement at the New London or Central Long Island Sound sites at a 16 or 28 percent increase in cost, respectively, over using the CSDS. The next least costly alternative is use in a marsh creation project at Sandy Point in Little Narragansett Bay, at a 34 percent increase over the CSDS. Placement nearshore off other beaches in eastern Suffolk County is 36 percent more expensive than using the CSDS. Use of more distant beaches, or as CDF cap material at various sites around LIS would be more costly.

U.S. DHS Facilities – Plum Gut and Orient Harbors: Future maintenance of the U.S. DHS facilities at Plum Gut Harbor on Plum Island and at Orient Point on Long Island will be dependent on the final closure and redevelopment of the island and its access facilities. For the purposes of this DMMP, it was assumed that someone would continue with the maintenance of the two facilities to continue access to the island for whatever purposes are made of it. These facilities are expected to yield only clean sandy material in the future over the DMMP planning horizon. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, of for other upland applications. The following are the top ten scoring alternatives from the screening process and additional low cost alternatives.

Table 5-246 – U.S. DHS Facilities – Plum Island Gut and Orient Point Placement Alternatives Screening

Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	10,000	2015-2020	Duck Island Roads – Cap	$188
	10,000	2026-2030	Cornfield Shoals Disposal Site	$93
			New London Disposal Site	$93
			Plum Island Beach or Orient Beach – On-Beach	$82
			Twotree Island CDF – Cap	$188
			Clinton Harbor CDF – Cap	$188
			Groton Black Ledge CDF – Cap	$188
			Rocky Neck State Park – Nearshore	$131
			Orient Beach State Park – Nearshore (From Plum Gut Harbor)	$119
			Falkner Island CDF – Cap	$214
			Lake Montauk Harbor – Nearshore	$171
			Hashamomuck Cove – Rt-48 – NS	$171
			Kenney's Beach – Nearshore	$171
			Central Long Island Sound DS	$275

The least cost placement alternative for the maintenance dredging of sand from Plum Gut Harbor is placement on the beach at Plum Island Beach, or at Orient Point State Park. The next least costly alternatives are open water placement at either the New London or Cornfield Shoals sites at an increase of 13 percent over beach placement. The next least costly alternative is nearshore placement at Orient Beach State Park, at 45 percent above the cost of using the Plum Island Beach. Nearshore placement at Rock Neck State Park in Connecticut is the next least costly alternative at an increase of 60 percent over Plum Island Beach. Placement at more distant beaches of as CDF cap at various sites would be at least twice as costly as beach placement at Plum Island and Orient Point.

Non-Federal public and private project from the harbors in this dredging center are expected to yield both clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment and fine-grained materials that would require other placement options.

Other beneficial uses such as upland fill, and waterfront structural backfill, marsh creation, or containment site cap, should also be considered.

Sag Harbor: The dredged features of the Sag Harbor FNP were deauthorized by the WRDA of 1992, and a 2013 condition survey showed no shoaling in the anchorage. Maintenance of the dredge features is now a non-Federal responsibility and therefore no Federal base plan for dredged material placement was developed for Sag Harbor.

5.26.7 Identification of Federal Navigation Project Base Plans

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-247 – Greenport Harbor Federal Navigation Project Base Plans

FNP Project and Segment	Material Type	Federal Base Plan
Greenport Harbor	Suitable Sand	Cornfield Shoals Disposal Site or at Gull Pond Beach
U.S. DHS Facilities at Plum Gut Harbor and Orient Point	Suitable Sand	Beach placement at Plum Gut Beach and Orient State Park

Alternatives to the Federal Base Plan: The Federal base plan for placement of sand from the Greenport Harbor FNP is either open water placement at the Cornfield Shoals site in LIS (the least cost plan), or direct beach placement as nourishment on the adjacent Gull Pond Beach (a 7 percent increase in cost). Placement in a marsh creation project at Sandy Point in Little Narragansett Bay, or nearshore on more distant beaches on the LIS shore of the North Fork would require non-Federal funding or cost-sharing.

The base plan for placement of sand from Plum Gut Harbor or the Orient Point landings for island access would be as nourishment material on beaches adjacent to each of those sites. Nearshore placement of Plum Gut Harbor materials at Orient Beach State Park, or at the more distant Rocky Neck State Park in Connecticut would require non-Federal funding, or cost-sharing should another Federal authority apply to that work.

5.27 Montauk Area Dredging Center

The Montauk Area Dredging Center consists of all shores and waters along the Gardiners Bay shoreline of the South Fork of Long Island from Lions Head Rock east to Montauk Point. The area includes the New York communities (west to east) of Springs, Amagansett, Napeague, and Montauk, all in the East Hampton township. The dredging center includes the Federal Navigation Project for Lake Montauk Harbor, which is also home to a seasonal interstate ferry terminal, a U.S. Coast Guard station, and the state's largest fishing port. The dredging center also includes Gardiners Island, a large privately-owned island with its own landing.

The waterways in this area which have dredging records and/or navigation access facilities are:

- Gardiners Island Landing
- Accabonac Harbor
- Napeague Bay
- Napeague Harbor
- Fort Pond Harbor
- Lake Montauk Harbor (Includes FNP)

The waterways and facilities in this dredging center yield mainly sandy dredged material. These materials are typically suitable for direct beach placement or nearshore bar placement. In some instances, dredging from inner areas of marinas, yacht clubs and small terminals can yield silty sands and sandy silts not suitable for beach nourishment that are typically placed upland. Sandy materials are also occasionally stockpiled upland for transport to more distant beaches or can be held for emergency shoreline projects after major storms. Testing for specific projects is required to confirm suitability for various uses.

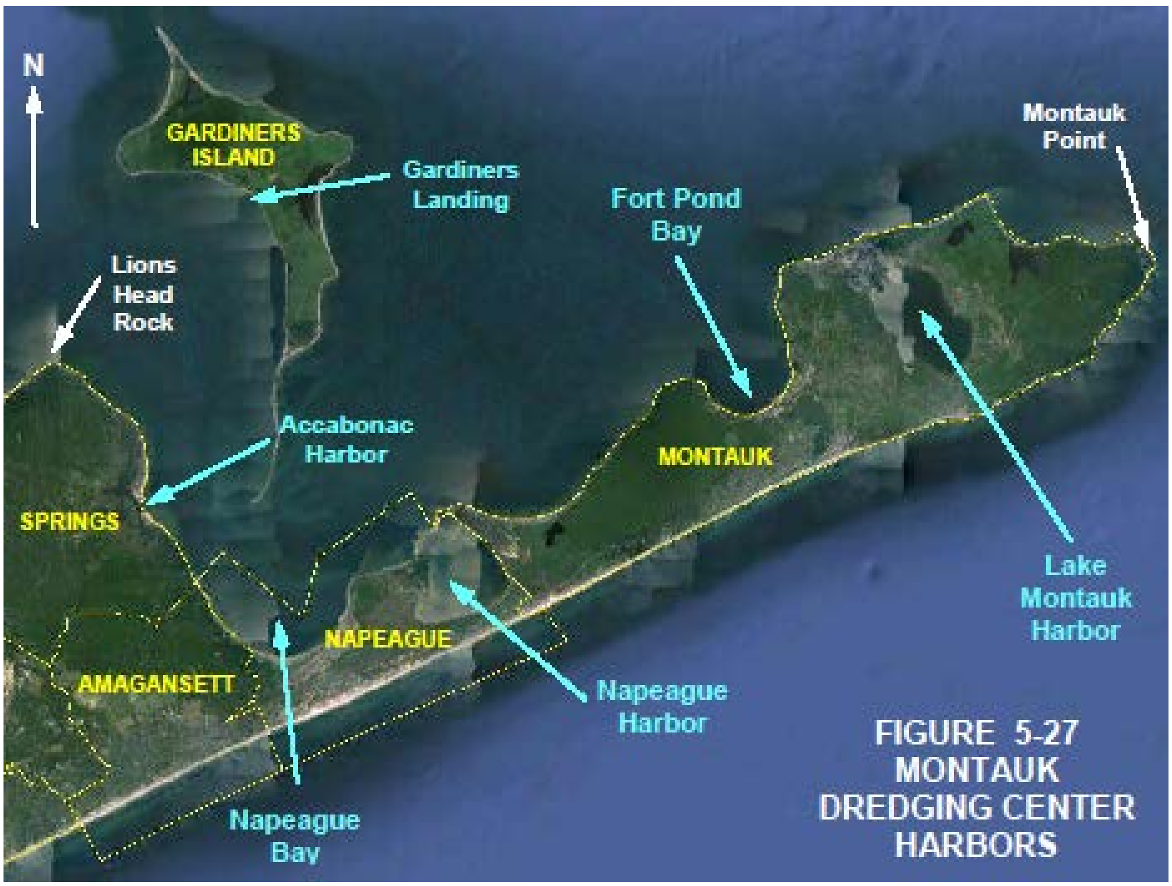


FIGURE 5-27
MONTAUK
DREDGING CENTER
HARBORS

5.27.1 Federal Navigation Project - Maintenance

The most recent dredging operation for the single FNP in this dredging center (maintenance of the entrance channel at Lake Montauk Harbor) is shown below.

Table 5-248 – Federal Navigation Project Dredging History Montauk Area Dredging Center				
FNP Activity	Year Dredged	Cubic Yards	Placement Method	Material Type
Lake Montauk Harbor	2014	20,400	West Beach	Suitable Sand
	2011	12,000	West Beach	Suitable Sand
	2004	15,000	West Beach	Suitable Sand
	1984	21,900	Unknown	Unknown
	1976	25,900	Unknown	Unknown
	1972	36,200	Unknown	Unknown
	1970	41,900	Unknown	Unknown
Improvement	1969	110,400	Unknown	Unknown
	1966	28,500	Unknown	Unknown
	1962	36,200	Unknown	Unknown
	1959	45,400	Unknown	Unknown

Lake Montauk Harbor: The FNP for Lake Montauk consists of a 12-foot channel through the inlet controlled by two rubblestone jetties, and a 10-foot west basin located on the west side of Star Island. Lake Montauk is home to a U.S. Coast Guard Station, and is Long Island's largest commercial fishing port. Lake Montauk is also the western terminus of a seasonal ferry service that carries passengers between Long Island, New York and Block Island, Rhode Island. The area around Star Island and the West Basin is a densely developed commercial waterfront with ferry terminals, boat yards, marinas and marine support facilities. A few other marinas and yacht clubs are located around the eastern shores of the Lake.

The entrance channel and jetty extension portion of the FNP for Lake Montauk was adopted in 1945, though construction had been accomplished with Navy Department funds in 1942-1943. The west basin was completed in 1968-1969. A 2014 condition survey of the project (Survey #4017, soundings from March 2014) showed about 20,400 CY of shoaling in the entrance channel and 1,000 CY in the west basin. A solicitation for maintenance of the entrance channel during the 2014-2015 season had been issued.

Since its completion in 1943, the project has been maintained at least 14 times, or an average of every five years. The average maintenance volume from these 14 actions was 32,200 CY. This figure was used to project volumes for each five-year maintenance cycle for the Lake Montauk FNP as shown below.

Table 5-249 – Dredging Activity Timeline – Federal Navigation Projects – Maintenance – Montauk Area Dredging Center						
FNP	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Lake Montauk FNP	32,200	32,200	32,200	32,200	32,200	32,200
Total Suitable Sandy	32,200	32,200	32,200	32,200	32,200	32,200

5.27.2 Harbor Characterization for Federal Navigation Projects

Lake Montauk Harbor FNP: The Federal project at Lake Montauk Harbor was last maintained in 2014. Approximately 20,000 CY of sandy material was placed on the beach west of the West Jetty in Montauk Harbor by pipeline dredge. Sediment sampling in the Lake Montauk FNP was conducted in 2005. In the Federal navigation channel, grab samples were predominantly comprised of sand, with medium-grained sand the dominant grain size found in seven out of 10 grab samples. Similar to the areas east and west of the Lake Montauk jetty, trace amounts of very fine sand and silt were collected, and no clay was found in any of the samples collected in the channel. Core samples collected in the shoal area were dominated by coarse and medium-grained sand. Very little gravel, trace amounts of very fine sand and silt, and no clay was found in any of the core samples collected in the shoal area (Offshore & Coastal Technologies, 2005).

For the beach area east of the Lake Montauk jetty, gravel was the dominant sediment collected in both intertidal and subtidal locations, for all samples except the intertidal sampling site located closest to the jetty. At this sample location, sand is likely to accumulate due to coastal sand transport processes. The sand component was comprised of predominantly very coarse to coarse-grained sand, with trace amounts of medium, fine, and very fine sand. No clay was found in any of the core samples collected to the east of the jetty. For the beach area west of the Lake Montauk jetty, gravel was the dominant sediment in six out of 10 intertidal core samples, with the majority of the predominantly gravel cores collected furthest west of the jetty. The remaining four intertidal core samples were comprised of predominantly medium or coarse-grained sand. Only trace amounts of very fine sand and silt were collected, and no clay was found in any of the intertidal samples collected west of the jetty. Similar to the intertidal samples, five out of 10 subtidal core samples were comprised of predominantly gravel, with the remaining subtidal core samples comprised of predominantly medium or coarse grained sand. The subtidal sampling site located furthest from the jetty had the highest amount of smaller grain-size material, with predominantly medium and fine-grained sand making up 78% of the sample (Offshore & Coastal Technologies, 2005).

Sediment samples were also taken from the harbor in 1981. The predominant substrate type in areas of swift currents (i.e., at the mouth of the inlet) included coarse material such as gravels and sands. In areas of slow currents (i.e., in the center of the lake), were mud and silts, but these areas are south of the dredged channels and anchorage basins. Wave action along the shoreline/intertidal zone washed away the mud and silts, resulting in a stone, sand, and gravel substrate (SCPD, 1981).

Any future maintenance of the Lake Montauk Harbor FNP is expected to yield sandy dredged material suitable for direct beach or nearshore bar nourishment. The material is therefore also expected to be suitable for open-water placement if a cost-effective site were available. The material may also prove usable for upland placement for purposes such as in construction, port or other structural fill, highway projects or other applications requiring sand. The material could also be stockpiled for use in emergency response to shore stabilization needs after major storms or for coastal resiliency projects. Testing of the project's materials prior to each dredging operation will be needed to confirm suitability for alternative placement.

5.27.3 Other Federal (Non-USACE) Dredging Projects

The U.S. Coast Guard's Montauk Station is located on the North End of Star Island on the 12-foot channel. The Coast Guard was included in the 2009 dredging needs survey and responded that they did not anticipate the need for any maintenance dredging at the Station over the next 30 years. There are no other navigation-dependent non-USACE Federal facilities in the Montauk dredging center. No other Federal dredging needs are projected for this dredging center.

5.27.4 Non-Federal Dredging Projects (Permit Activities)

There are a number of maritime interests in the Montauk Dredging Center that periodically generate dredged material. Most of the larger facilities are located at Lake Montauk Harbor where commercial fishing and recreational boating support several marinas and boat yards and smaller public and private access facilities. Other small facilities are found throughout the dredging center's bays and small harbors.

There is no municipal dredging activity noted in any of the records supplied for this dredging center. Only one non-Federal permit action is included in the permit database, and that is for the Devon Yacht Club in Amagansett on Napeague Bay for about 2,200 CY placed upland as fill in 1995.

The Suffolk County Department of Public Works records for County dredging activity under permit for this dredging center are shown below and total about 1.26 million CY over the 32 year period from 1959 to 1991. All of this material was characterized as sand and gravel. None of these events were listed in the USACE regulatory permit records, which indicates that the material may have been deposited upland or on a beach as nourishment.

USACE regulatory permit records for harbors in this dredging center list only one dredging permit, issued in 1995 for a yacht club at Napeague Bay, which dredged 2,200 CY and placed it at an upland site. Overall, non-Federal dredging in this dredging center is expected to yield clean sand suitable for nourishment purposes, open water placement, or applicable beneficial uses.

Table 5-250 – Suffolk County Dredging Projects History Montauk Dredging Center				
Suffolk County DPW Permit Activity	Dredged	Cubic Yards	Placement Method	Material Recorded
Acabonac Harbor (Springs)	1959	205,400	Unknown	Sand
3 Events	1965-1976	120,500	Unknown	Sand
4 Events	1985-1996	69,900	Unknown	Sand
Napeague Harbor	1967	341,500	Unknown	Sand
	1988	26,300	Unknown	Sand
	2004	32,400	Unknown	Sand & Gravel
Lake Montauk Harbor	1949	112,000	Unknown	Sand
	1959	100,200	Unknown	Sand
3 Events	1969-1976	201,700	Unknown	Sand
3 Events	1984-1991	47,700	Unknown	Sand

The 2009 Dredging Needs Update report projected, based on survey responses from eight facilities, that about 165,300 CY of maintenance dredging and 75,000 CY of improvement dredging would be needed by non-Federal facilities. Further about 176,300 CY was projected for Suffolk County maintenance dredging project over the DMMP planning horizon. This total, distributed over the 30-year DMMP planning horizon is shown in the table below. These activities are expected to generate mainly sand suitable for direct beach or nearshore bar placement.

Table 5-251 – Dredging Activity Timeline – Montauk Area Dredging Center – Non-Federal Permit Activities						
Non-Federal Permit Activities	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045
Maintenance	27,500	27,600	27,500	27,600	27,500	27,600
Suffolk County Maintenance Projections	29,300	29,400	29,400	29,400	29,400	29,400
Improvement Projects	75,000					
Total Non-Federal	131,800	57,000	56,900	57,000	56,900	57,000

Sand material such as that produced by the Montauk dredging center would be suitable for beach or nearshore bar nourishment or for stockpile upland for future use in coastal resiliency projects as are presently done. Occasionally materials from marina basins or other inner harbor or upper river areas may prove to be silty sands and sandy silts not suitable for beach or bar placement. Such materials could be placed upland as typically done now in adjacent dredging centers, or used in marsh restoration projects. Ocean placement can be an environmentally acceptable and cost effective alternative when other uses are not practicable, however the nearest active open water site (NLDS) is a considerable distance from this dredging center. Additionally, open-water placement is not the best use of sandy material. Nourishment and coastal resiliency focused projects and opportunities are found throughout this dredging center in areas adjacent to most dredging locations.

5.27.5 Placement Alternatives Available to Dredging Center Activities

As described in the sections below, this dredging center is expected to produce a small to mid-sized range of dredging project sizes over the planning horizon. Projects from small marina maintenance activities and private residential access dredging generating a few hundred cubic yards, up to FNP and county channel maintenance activities generating more than 20,000 CY are anticipated. Most dredged materials from this dredging center in recent decades have been beneficially used for beach and other shoreline projects, or placed upland for various purposes. There are a number of state, county, and municipal beaches located throughout the dredging center that receive dredged sandy material as nourishment. There is evidence of past port-fill activities inside the Lake Montauk inlet and any future bulkhead replacement or bank stabilization projects may have need of sandy material for backfill. The several investigations of placement alternatives identified the following as opportunities for placement for projects from this dredging center.

Placement alternatives available for suitable sandy materials in this dredging center include open water placement, beach nourishment by either direct beachfill or nearshore feeder bar/berm placement, or as cap material for CDFs, CAD cells, or COW sites. Placement alternatives for suitable fine-grained materials in this dredging center include open water placement, marsh creation/augmentation, upland landfills, placement as fill in CDFs, and as fill or cap material at CAD cells and COW sites. No unsuitable materials are projected to be dredged from projects in this dredging center during the 30-year DMMP planning horizon.

Brief descriptions of these types of placement options and specific alternatives were provided earlier in this report. Detailed descriptions of the full range of alternatives identified and evaluated are included in the technical supporting documents covering the several types of placement options.

Table 5-252 – Montauk Area Dredging Center Available/Potential Placement Alternatives				
Alternatives	Site Type	CY Capacity	Years Available	Material Accepted
Bailie's Beach - Mattituck	Nearshore	35,100	Recurring	Sand
Jamesport (Hallock) State Park	Nearshore	129,641	Recurring	Sand
Hashamomuck Cove – Cty Rd 48	Nearshore	155,100	Recurring	Sand
Kenney's Beach - Southold	Nearshore	72,800	Recurring	Sand
Orient Point State Park Beach	Nearshore	204,100	Recurring	Sand
Town Beach, Southold	On-Beach	31,300	Recurring	Sand
Lake Montauk Harbor Beach	On-Beach	400,000	Recurring	Sand
	Nearshore	105,100		
Camp Hero State Park	On-Beach	103,800	Recurring	Sand
	Nearshore	84,300		
T. Roosevelt County Beach	On-Beach	577,000	Recurring	Sand
Gin Beach	On-Beach	12,200		
Both Beaches Nearshore	Nearshore	202,400		
Hither Hills State Park	Nearshore	276,100	Recurring	Sand
Montauk Point State Park	On-Beach	198,900	Recurring	Sand
	Nearshore	131,100		
Shadmoor State Park	Nearshore	33,700	Recurring	Sand
Cornfield Shoals Disposal Site	Open Water	200,000,000	All	All Suitable
New London Disposal Site	Open Water	20,000,000	All	All Suitable
Central Long Island Sound DS	Open Water	20,000,000	All	All Suitable
Groton Black Ledge CDF – Cap	Island CDF	570,000	Once Built	All Suitable
Twotree Island CDF - Cap	Island CDF	433,800	Once Built	All Suitable

Beach and Nearshore Nourishment Sites: The coastline of the Montauk Area Dredging Center is a mix of narrow beach backed by a mix of dunes, small coastal marshes, bays, salt ponds, and stony bluffs. There are several large and small public beaches, including those within state and county parks, and lengthy private beach fronts. Other more distant dredging centers in New York include additional beaches that could receive sandy material from the Montauk area. The beaches listed above and below were identified by the screening process for this and adjacent dredging centers. Haul distances for nearshore placement off area beaches for the one FNP and a few selected non-Federally dredged harbors in this center are shown below.

Table 5-253 – Scow Haul Distances to Nearshore Placement Sites														
Project (Distances in Statute Miles)	Jamesport State Park	Bailie Beach (Mattituck)	Kenneys Beach	Town Beach - Southold	Hashamomuck Cove	Orient Beach State Park	Gull Pond Beach	Hither Hills SP	Lake Montauk Beach (W)	T. Roosevelt (Gin) Bch	Montauk Point SP	Camp Hero State Park	Shadmoor State Park	Misquamicut Beach, RI
Lake Montauk Harbor	41.5	39.0	33.0	29.2	28.1	18.6	24.8	7.6	1.4	1.7	4.8	7.8	11.7	18.6
Napeague Harbor	40.2	37.7	31.7	27.9	26.8	15.4	19.2	4.1	9.0	10.1	13.8	16.7	20.7	26.2
Accabonac Harbor	36.4	33.9	27.9	24.1	23.0	11.6	15.5	6.4	11.8	12.7	16.1	18.7	22.5	28.4

Open Water Placement Sites: The closest currently active open water placement site to this dredging center is the Cornfield Shoals site located offshore of the mouth of the Connecticut River. The Central Long Island Sound site and the New London site are more distant. These sites could receive any suitable material, either sandy or fine-grained. The historic Orient Disposal Site is located a short distance Orient Point and west of Plum Gut but has been inactive since the 1970s and is unlikely to be approved for further use by the state of New York.

Upland Landfills: Use of upland sites requires dewatering of dredged material on shore and loading and transport to the upland site. There are few remaining landfills in the LIS region. Sites in Brookhaven and Melville, New York could receive material from this dredging center that meets their states' upland placement requirements. However, use of such alternatives carries a very high cost compared to other options for all expect the smallest dredging projects.

Confined Aquatic Disposal and Confined Open Water Sites: CAD cells and COW sites are available for receipt of suitable materials if located in the waters of LIS, or all types of material if located inside a river or harbor. Open borrow pits at Morris Cove or offshore of Sherwood Island could receive materials from this and other dredging centers, as either fill or cap material, but these sites are a significant distance from the harbors in the Montauk dredging center.

Confined Disposal Facilities: Many locations around LIS, nearly all in Connecticut, have been proposed for CDF development. CDFs could receive all types of materials as fill, and suitable materials, particularly sand, as cap. The two CDF sites located near this dredging center or identified in the screening process include the Twotree Island and Groton Black Ledge sites.

Habitat Creation Sites: As with CDFs, many locations around LIS have been proposed for habitat enhancement or creation over the past several decades. One such marsh creation site is located at Sandy Point in Little Narragansett Bay. Haul distances for placement areas, other than beaches, for the one FNP and a few selected non-Federally dredged harbors in this center are shown below.

Table 5-254 – Scow Haul Distances to In-Water and CDF Sites

Project (Distances in Statute Miles)	Central LIS DS	Falkner Island CDF	Mattituck DS	Clinton Harbor CDF	Duck Island Roads CDF	Cornfield Shoals DS	Twotree Island CDF	Orient DS	Niantic DS	New London DS	Sandy Point Marsh Site	Misquamicut Beach, RI	Rhode Island Sound DS
Lake Montauk Harbor	52.5	41.4	38.0	27.3	32.7	25.4	27.3	18.6	24.8	28.5	40.3	18.6	33.3
Napeague Harbor	51.2	40.1	36.7	26.0	31.4	24.1	22.7	17.3	23.5	27.2	26.9	26.2	42.0
Accabonac Harbor	47.4	36.3	32.9	22.2	27.6	20.3	22.4	13.5	19.7	23.4	28.8	28.4	44.1

5.27.6 Alternatives Screening for Federal Projects

Matching projected dredging projects and needs with identified placement alternatives involves consideration of dredged material types, volumes produced, and the anticipated years of project construction and site availability. Once sites have been screened for these factors, the Federal Base Plan for management of dredged material from each FNP needs to be identified. The base plan is typically the least cost environmentally acceptable placement alternative, as evaluated and determined consistent with the Federal Standard. For the one FNP in the Montauk Area Dredging Center, the analysis matched that FNP with placement alternatives as shown below. Non-Federal dredging project proponents should consult the site inventories applicable to their dredged material classification and then employ the site screening matrix and cost estimating tool to examine the benefits and impacts, including cost, of the various available alternatives.

Lake Montauk Harbor: Future maintenance of the Lake Montauk Harbor FNP will yield mainly sandy dredged materials over the DMMP planning horizon. Sand can be beneficially used for beach or nearshore bar nourishment, as cap for CAD cells and CDFs, or for other upland applications.

Table 5-255 – Lake Montauk Harbor FNP - Placement Alternatives Screening				
Material Type	CY	Year	Alternative	Cost/CY
Suitable Sand	3,200	2041-2045	Theodore Roosevelt County Park & Gin Beach – Nearshore	$34
			Lake Montauk Harbor Beach	$34
			T. Roosevelt County Park – On-Beach	$40
			Twotree Island CDF – Cap	$142
			Groton Black Ledge – CDF – Cap	$142
			Lake Montauk Harbor – Nearshore	$34
			Shadmoor State Park – Nearshore	$55
			Hither Hills State Park – Nearshore	$67
			Camp Hero State Park – Nearshore	$55
			Montauk Point State Park – On-Beach	$55
			Camp Hero State Park – On-Beach	$55
			New London Disposal Site	$47
			Gin Beach – On-Beach	$34
			Montauk Point State Park – Nearshore	$55
			Misquamicut State Beach – Nearshore	$84
			Orient Beach State Park – Nearshore	$84
			Cornfield Shoals Disposal Site	$57
			Hashamomuck Cove – CR-48 – NS	$98
			Jamesport State Park – Nearshore	$98
			Central Long Island Sound DS	$80
			Kenney's Beach – Nearshore	$98
			Bailie's Beach – Nearshore	$98
			Rhode Island Sound DS	$80
			Sandy Bay RI Marsh Site	$182

The least cost placement alternative for the maintenance dredging of sand from the Lake Montauk Harbor FNP is either nearshore or direct placement at any of the three beaches directly adjacent to the harbor's inlet (Lake Montauk (West) Beach, Gin Beach or Montauk County (Theodore Roosevelt) Park Beach), with direct placement on Montauk County Park being about 18 percent more expensive than the others. The next least costly alternative would be open water placement at the New London site, at an increase of 38 percent over the least cost alternatives. Next least costly are direct beach placement on the Camp Hero or Montauk

Point State Park beaches, or nearshore placement at those sites and Shadmoor State Park, all at a 62 percent increase over the least cost alternatives, with nearshore placement at Hither Hills State Park requiring a 97 percent increase. Placement in open water at the Cornfield Shoals site would be a 68 percent increase over the least cost alternative. More distant nearshore and open water sites would be more than twice as costly.

Non-Federal public and private project from the harbors in this dredging center are expected to yield mainly clean sandy material available for beneficial uses such as beach or nearshore bar/berm nourishment, and minor amounts of fine-grained materials that would require other placement options. Other beneficial uses such as upland fill, and waterfront structural backfill, marsh creation, or containment site cap, should also be considered.

5.27.7 Identification of Federal Navigation Project Base Plan

Federal Base Plans: The Federal base plans for dredged material placement for projects in this dredging center, as determined from the screening process and post-screening cost analysis, are as follows:

Table 5-256 – Lake Montauk Harbor Federal Navigation Project Base Plans

FNP Project and Segment	Material Type	Federal Base Plan
Lake Montauk Harbor	Suitable Sand	Nearshore or Beach at Adjacent Lake Montauk, Gin or Montauk County (T. Roosevelt) Beaches

Alternatives to the Federal Base Plan: The Federal base plan for placement of sand from the Lake Montauk Harbor FNP is direct beach or nearshore placement as nourishment on the adjacent Montauk Harbor (West), or Gin (East) Beaches. Placement at Montauk County (formerly Theodore Roosevelt) Beach further east would be about 18 percent more costly. Placement nearshore at more distant beaches on Montauk Point, on the Atlantic shore of the South Fork or more westerly towards Napeague would be at a 62 to 97 percent increase in cost and would require non-Federal funding or cost-sharing.

5.28 Regional and Sub-Regional Alternatives

The realities of limited budgets at the Federal, state, and local levels, have led to a backlog in navigation maintenance, and in transportation infrastructure maintenance in general, for public projects at all levels. This situation makes predicting with any certainty which projects will be funded over more than a limited timeframe very difficult. The USACE practices performance based budgeting, works with a five-year plan for operation and maintenance, and prepares its budget submissions two years in advance. However, the final Federal budget for any year can be different from the request, and natural events such as major storms can significantly affect the total funds available, and supplemental appropriations made to cover emergency needs. All of this makes development and implementation of a single coordinated plan for dredged material facility construction and operation difficult.

There are a number of regional and sub-regional placement facility alternatives identified and discussed in this DMMP. How long it would take to design, construct, fill, cap and close those facilities, and thereby recover the investment is a function of which dredging projects are funded from year to year, and what cost-sharing is involved in the facility and the individual project placement actions. The following sections of this chapter describe the limitations of each type of facility, and provide examples of how facility and dredged material source stream planning might occur in the future if these alternatives are pursued.

5.28.1 Regional CAD Cell and COW Site Capacity Issues

There are two former borrow pits along the Connecticut shore that were identified and described earlier as potential regional placement sites. These are the Morris Cove CAD cell site at New Haven Harbor and the Sherwood Island COW site off Westport. These sites were identified by the screening process as within the top 10 ranked sites for nearly all of the harbors around LIS, since filling these sites would have environmental benefits, and as existing borrow pits, no excavation would be required to create them. However, capacity of these sites for fill and capping is limited as shown below.

Table 5-257 – Capacity of Existing Borrow Pits as CAD and COW Sites

Morris Cove CAD Cell Site	Fill Capacity (CY)	466,100
	Cap Capacity (CY)	143,900
	Total	610,000
Sherwood Island COW Site	Fill Capacity (CY)	266,000
	Cap Capacity (CY)	484,000
	Total	750,000

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With several million CY of material potentially vying for space in these sites, either under Federal base plans, or as non-open water alternatives to base plans, their capacity should be prioritized. Timing of fill and cap, especially for Morris Cove which could receive unsuitable material as fill, will be critical as well, as any cap should be placed within one year after filling. To examine which projects may be the most reasonable to assign use of the Morris Cove CAD cell, the screening inventory was filtered by placement site, unit cost rank, and screening score rank. The top dozen projects that process yielded are shown below.

With a fill capacity of only 466,100 CY Morris Cove can accommodate only a few of these projects. The Mill and Quinnipiac Rivers would consume nearly the entire capacity, as would Greenwich and Port Chester Harbors. Unsuitable materials have ranked higher because this is a containment site, and there are few other low cost options available. Whether and in what year any of these projects receives funding is unknown. What is clear is that Morris Cove can only receive a small fraction of the projects and materials which the screening tool has flagged as candidates.

Table 5-258 – Morris Cove Borrow Pit CAD Cell Site, New Haven Harbor, CT Screening of Dredged Material Source Projects						
Harbor/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost $/CY)	Project Rank	
					Score Rank	Cost Rank
Mill River, New Haven	201,500	2036	385.16	$67	1	1
Quinnipiac River, New Haven	217,100	2036	385.16	$67	1	1
Johnsons Creek, Bridgeport	88,000	2021	385.16	$79	1	1
Eastchester Creek – Unsuitable	286,300	2021	285.16	$66	5	1
U.S. Navy New London – Maintenance – Unsuitable	50,000	2020	285.16	$83	5	1
Shaws Cove, New London	30,900	2021	285.16	$94	5	1
Glen Cove Creek, NY	14,300	2020	285.16	$112	6	1
Block Island Harbor of Refuge – Fine Material in Anchorage	2,200	2020	285.16	$366	6	1
Port Chester Harbor, NY	199,600	2020	285.16	$68	7	1
Greenwich Harbor, Unsuitable	255,400	2019	285.16	$69	7	1
Norwalk Harbor – West Branch – Unsuitable	20,000 20,000	2024 2034	335.16	$107	7	1
Stamford Harbor – East Branch Channel – Unsuitable	144,600	2031	285.16	$71	9	1

The same procedure was used to examine the population of dredging projects that were matched with the Sherwood Island COW Site, with the following results.

With a fill capacity of only 266,000 CY, and a cap capacity of 484,000 CY, the Sherwood Island COW can accommodate only a few of these projects. The first five smaller projects on the timeline; Westport, Greenwich entrance, Milton, Milford inner harbor and Westcott Cove would fill the COW site in the next few years. Capping could be accomplished with a single large project such as Norwalk or Stamford as soon as a year later. Whether, and in what year, any of these projects would receive future funding is unknown. However, the Sherwood Island COW Site can only receive a small fraction of the projects and materials for which the screening tool has flagged it as a candidate.

Table 5-259 – Sherwood Island Borrow Pit CAD Cell Site, Westport, CT Screening of Dredged Material Source Projects						
Harbor/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost $/CY)	Project Ranks	
					Score Rank	Cost Rank
Fill Material – Site Capacity 266,000 CY						
Westport Harbor	50,700	2020	385.57	$31	1	1
Housatonic River – Upstream	203,900	2041	385.57	$32	1	1
Greenwich Harbor – Entrance Channel – Suitable	65,200	2020	385.57	$44	1	2
Milford Harbor – Inner Channels and Anchorages	71,600	2021	385.57	$44	1	2
Fivemile River	55,400	2024	385.57	$34	2	2
Southport Harbor – Inner Area	22,800	2025	385.57	$51	2	2
Norwalk Harbor – Suitable	236,400 196,300	2024 2034	327.99	$21	8	2
Milton Harbor	72,900	2020	285.57	$44	8	2
Black Rock Harbor	619,500	2025	328.51	$18	9	2
Hempstead Harbor	186,900	2030	285.57	$38	9	2
West River	156,300	2021	335.57	$40	9	2
Westcott Cove – Fines	34,400	2023	335.57	$47	7	3
Wilson Point	618,900	2030	278.55	$18	12	3
Cap Material – Site Capacity 484,000 CY						
Fivemile River	55,400	2024	385.57	$34	1	1
Southport Harbor – Inner Harbor	22,800	2024	385.57	$51	1	1
Norwalk Harbor – Suitable	236,400 196,300	2024 2034	362.76	$21	3	1
Black Rock Harbor	619,500	2025	363.70	$18	5	1
Mianus River	84,700	2017	385.57	$39	1	2
U.S.C.G. Station Eaton's Neck	6,200	Annually	335.57	$110	1	2
Westport Harbor	50,700	2020	385.57	$31	2	2
Housatonic River – Upstream	203,900	2041	385.57	$32	2	2
New Rochelle Harbor	82,600	2025	335.57	$43	4	2
Eastchester Creek – Suitable	111,500	2036	335.57	$40	5	2
Stamford Harbor – Suitable	486,000	2033	335.16	$27	6	2
Westcott Cove – Fines	34,400	2021	335.57	$47	6	2

5.28.2 Capacity of Regional Marsh Creation Project Sites

In a manner similar to the CAD cells and COW site, potential marsh creation sites have been flagged as placement candidates by the screening process in a large number of the region's harbor projects. Yet only three potential sites, with a combined capacity of only 2.5 million CY, have been suggested, as listed below.

Table 5-260 – Capacity of Potential Marsh Creation Project Sites		
Sandy Point, Little Narragansett Bay, RI	Fill Capacity (CY)	500,000
Sandy Point, West Haven, CT	Fill Capacity (CY)	1,100,000
Norwalk Harbor Islands, CT Marsh Creation Alternative	Fill Capacity (CY) Cap Capacity (CY)	554,000 376,000

Only one of those sites, Norwalk Harbor Island, was defined prior to the development of the screening process. The other two were suggested later and have only been screened for cost. For the Norwalk Islands marsh site, the high environmental benefits score given to this use resulted in a high overall score, but the top ten projects matched with the fill volume for this site only ranked between eight and three on both the costs and total score rankings. No projects matched within the top 16 cost rankings for the cap volume at Norwalk Islands.

Table 5-261 – Potential Norwalk Outer Harbor Islands Marsh Creation Site, CT Screening of Dredged Material Source Projects

Harbor/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost ($/CY)	Project Rank	
					Score Rank	Cost Rank
Norwalk Harbor – West Branch, Unsuitable	20,000 20,000	2024 2034	366.90	$126	4	3
Port Chester Harbor – Unsuitable	199,600	2020	366.90	$124	3	4
Greenwich Harbor – Unsuitable	255,400	2019	366.90	$124	3	4
Eastchester Creek – Unsuitable	286,300	2025	316.90	$127	3	4
Stamford Harbor – East Branch – Unsuitable	144,600	2031	366.90	$114	4	4
Glen Cove Creek, NY, Unsuitable	14,300 19,600	2019 2031	366.90	$160	4	5
Wilson Point, Norwalk	618,900	2030	356.41	$88	4	8
Norwalk Harbor – Suitable	236,400 196,300	2024 2034	355.26	$94	5	8
Johnsons Creek, Bridgeport	88,000	2021	366.90	$126	6	8
Fivemile River	55,400	2024	366.90	$104	8	8
Stamford Harbor – Suitable	486,000	2033	366.90	$111	3	10

The uncertainties with project budgeting on both the Federal and non-Federal level make predicting what project may be funded in any period impractical. However, an example of how the data outlined above might be used to manage regional demand and capacity together is shown below. This example assumed that the implementation of a proposed Norwalk Islands Marsh Creation project would begin in 2019 and the site will be filled and capped concurrent with the 2024 projected next major maintenance cycle for Norwalk and Fivemile River Harbors. This example is developed with only Federal project information, and without limitation as to the Federal Base Plans for these projects, and some projects matched with this placement site are 2.5 times the Federal base plan level.

Table 5-262 – Norwalk Outer Harbor Islands Marsh Creation Project Example Dredged Material Input Schedule

Design Fill Capacity (CY)	554,000	
Design Cap Capacity (CY)	376,000	
Project	Year	Volume (CY)
Greenwich Harbor, CT, Unsuitable	2019	255,400
Glen Cove Creek, NY, Unsuitable	2019	14,300
Port Chester Harbor, NY, Unsuitable	2020	199,600
Johnsons Creek, Bridgeport, Unsuitable	2021	88,000
Norwalk Harbor, West Branch, Unsuitable	2024	20,000
TOTAL FILL		557,300
Norwalk Harbor, Suitable	2024	236,400
Fivemile River, Suitable	2024	55,400
Milton Harbor	2020	84,700
TOTAL CAP		376,500

5.28.3 Regional Confined Placement Facilities

Regional placement facilities are those with a combined fill and cap capacity of more than five million CY. Above that capacity, a facility would serve the needs of more than one dredging center and possibly the entire LIS region over the 30-year planning period. Only four dredging centers are projected to exceed this amount over the 30-year planning period: New London, the Connecticut River, New Haven, and Bridgeport. Bridgeport is the subject of a second harbor-specific DMMP with its own identified placement recommendations, and the Connecticut River is mainly a sand producing project with in-river and on-shore alternatives for most of its projected volume. There are five 'regional' CDFs identified in this DMMP; Groton Black Ledge, Falkner's Island, New Haven Breakwaters, Stratford Point, and Penfield Reef, with capacities as listed below.

The facility suggested at the New Haven Breakwaters site could accommodate the entire projected 30-year volume of dredged material from all sources in the LIS region. If sandy material was used beneficially at other sites, then the Stratford Point and Penfield Reef sites could also accommodate the 30-year volume of fine-grained material from the entire region.

Table 5-263 – Regional Confined Placement Facilities and Capacities				
Facility	Type	Fill Capacity	Cap Capacity	Total Capacity
Groton Black Ledge	Island CDF	6,930,000	570,000	7,500,000
Falkners Island	Island CDF	16,010,200	1,169,800	17,180,000
New Haven Breakwaters	Island CDF	52,695,600	5,554,400	58,250,000
Stratford Point	Shore CDF	33,666,900	5,283,100	38,950,000
Penfield Reef	Shore CDF	33,539,300	5,010,700	38,550,000
Total LIS Dredging Needs over Next 30 Years				53,123,100
30-Year Total without Sandy Material				37,943,400

An example applying the screening and cost ranks to the candidate sites for the Groton Black Ledge CDF Site is provided below. This shows that 77 percent of the site's total capacity, or 83 percent of its fill capacity, could be derived from its dredging center and the three adjacent dredging centers over the 2020-2041 period.

Table 5-264 – Groton Black Ledge Confined Placement Facility Site, CT Screening of Dredged Material Source Projects						
Harbor/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost $/CY)	Project Rank	
					Score Rank	Cost Rank
New London Harbor, Shaw's Cove - Unsuitable	30,900	2026	367.53	$112	2	2
Thames River, US Navy, Maintenance, Unsuitable	50,000	2018	367.53	$121	2	3
US Coast Guard Station, New London, Maintenance	4,000	2026-30	367.53	$262	2	5
Little Narragansett Bay, Inner Channel, Suitable	261,000	2027	367.53	$112	3	8
Stonington Harbor, O&M	6,600	2040	367.53	$208	3	8
New London Harbor, O&M	785,300	2026	367.53	$88	4	8
Thames River - Upper Channel	2,902,500	2041	367.53	$100	3	9
Mystic Harbor - Improvement	450,000	2026-30	367.53	$111	3	9
Mystic Harbor - Maintenance	105,100	2039	367.53	$114	3	9
Thames River - Lower Channel	832,000	2026	367.53	$107	4	9

Harbor/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost $/CY)	Project Rank	
					Score Rank	Cost Rank
U.S. Navy New London - Improvement	350,000	2015-25	367.53	$113	4	9
U.S. Navy New London - Maintenance	75,000	2015-20	367.53	$117	4	12
U.S. Coast Guard Academy, Thames River	110,000	2021-35	367.53	$120	2	15
Hay (West) Harbor, Fishers Is	12,000	2026	367.53	$166	4	15
Niantic Bay, Suitable Fines	8,500	2030	367.53	$190	4	15
TOTAL CY	5,780,500					

5.28.4 Sub-Regional Confined Placement Facilities

Sub-regional confined placement facilities are those of less than five million CY total fill plus cap capacity. These facilities could either accommodate one or a few very large dredging projects, or a number of smaller projects from their own and nearby dredging centers. A list of these facilities and their capacities is shown below.

Table 5-265 – Regional Confined Placement Facilities and Capacities

Facility	Type	Fill Capacity	Cap Capacity	Total Capacity
Twotree Island	Island CDF	2,966,200	433,800	3,400,000
Duck Island Roads	Island CDF	1,376,100	233,900	1,510,000
Clinton Harbor	Shore CDF	640,200	59,800	700,000
Milford Outer Harbor	Shore CDF	219,100	50,900	270,000
Yellow Mill Channel	Shore CDF	197,900	102,100	300,000
Norwalk Harbor (CDF)	Island CDF	242,600	157,400	400,000
Stamford Harbor	Island CDF	1,700,000	340,000	2,040,000
Greenwich Captain Harbor	Island CDF	498,200	331,800	830,000
Byram Harbor	Island CDF	750,000	290,000	1,040,000
Hempstead Harbor	Shore CDF	2,787,700	712,300	3,500,000

For example, one of the smallest of these sites, Yellow Mill Channel, and one of the larger sites, Hempstead Harbor were selected to representatively screen candidate source harbors. The results are as shown below.

Table 5-266 – Yellow Mill Channel Confined Placement Facility Site, CT Screening of Dredged Material Source Projects						
Harbor/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost $/CY)	Project Rank	
					Score Rank	Cost Rank
Johnsons Creek	88,000	2018	371.25	$99	2	2
Norwalk Harbor-West Branch I-95 Area	20,000	2024	371.25	$156	1	5
Glen Cove Creek	17,800	2019	271.25	$201	10	10
Southport Harbor - Inner Harbor	22,800	2024	371.25	$132	4	13
Northport Harbor - Silt	25,400	2024	321.25	$149	10	13
Milford Harbor - Inner	44,400		371.25	$121	6	15
Total CY Fill from Sources	193,000					
CY Design Fill Capacity	197,900					
Westport Harbor	50,700		371.25	$133	4	17
Northport Harbor - Sand	25,400	2024	321.25	$149	14	
Southport Harbor Entrance (1/2)	8,300		371.25	$145	4	
Milford Harbor - Entrance Channel and Outer Anchorage	22,000		371.25	$132	6	
Total CY Cap from Sources	106,400	Total Source Material = 299,400				
CY Design Cap Capacity	102,100	Total CDF Capacity = 300,000				

Table 5-267 – Hempstead Harbor Confined Placement Facility Site, CT Screening of Dredged Material Source Projects						
Project/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost ($/CY)	Project Rank	
					Score Rank	Cost Rank
Eastchester Creek - Unsuitable	286,300	2025	367.58	$112	2	2
Port Chester Harbor	199,600	2020	367.58	$124	2	3
Greenwich Harbor – Upper Unsuitable	255,400	2019	367.58	$124	2	3
Glen Cove Creek	14,300	2019	367.58	$141	3	3
Stamford Harbor - 12-Foot East Branch Channel	144,600	2033	367.58	$125	3	5

Project/Segment	Volume (CY)	Year Dredged	Screening Score	Unit Cost ($/CY)	Project Rank	
					Score Rank	Cost Rank
Norwalk Harbor-West Branch I-95 Area	20,000	2024	317.58	$160	10	10
Wilson Point	618,900	2030	367.58	$119	1	11
Little Neck Bay	817,200	2023	367.58	$111	1	12
Eastchester Creek - Suitable	111,500	2036-40	367.58	$115	3	14
New Rochelle Harbor	82,600	2021	367.58	$117	3	14
Milton Harbor	72,900	2020	367.58	$118	3	15
Mamaroneck Harbor	79,300	2022	367.58	$118	3	15
Huntington Harbor - Silt	13,900	2026	367.58	$170	3	16
Greenwich Harbor - Suitable	65,200	2019	367.58	$135	6	16
Echo Bay	59,200	2020	367.58	$119	2	
Westcott Cove - Fines	34,400	2023	367.58	$141	3	17
Northport Harbor - Silt	25,400	2024	367.58	$149	3	17
Yocum Sailing Center, US Merchant Marine Academy	33,200	2021	317.58	$123	5	
Hempstead Harbor	186,900	2030	317.58	$94	6	
Mianus River	84,700	2017	367.58	$126	6	17
Fivemile River	55,400	2024	367.58	$131	7	18
Norwalk Harbor - Suitable	236,400	2024	317.58	$128	11	21
TOTAL CY	3,497,300					
Total Site Capacity	3,500,000					

Final plans for design, placement capacities, sources and types of material, facility operations and maintenance, and closure plans and schedules would be the subject of future studies, NEPA coordination, public involvement and cost-sharing. The USACE may be a partner in those studies, design and construction, or it may be a user of such facilities subject to partnership and cost-sharing agreements for placement actions at such facilities.

This concludes the development of the dredged material management plans for the individual Federal Navigation Projects within the several geographical dredging centers around the Long Island Sound region.

6. CONCLUSIONS

The Long Island Sound DMMP examined a wide range of dredged material placement alternatives, from open water to containment, upland placement, beach nourishment, marsh creation, and others. The Long Island Sound DMMP is not a Decision Document, in that it does not recommend specific dredged material placement solutions for specific Federal Navigation Project activities. The DMMP provides a framework for managers, regulators and project proponents to consider a range of alternatives to open water placement, and to determine through specific study whether any such alternatives are feasible and practicable.

The DMMP will inform decision-making for Federal actions with respect to dredging and dredged material placement. As individual projects come up for their next maintenance cycle, or as feasibility studies for proposed improvement dredging projects are prepared, those studies would reference the evaluations and recommendations in this DMMP in examining placement alternatives and making a final determination as to the Federal Base Plan, appropriate beneficial use opportunities beyond the base plan. These additional project-specific studies would include preparation of Environmental Assessments (EA) and/or Environmental Impact Statements (EIS) under the requirements of the National Environmental Policy Act (NEPA). Where the projects consist of improvement dredging, or implementation of new placement facilities a feasibility report or other decision document would also be prepared. These individual studies and reports would solicit public input as they are prepared, and would be subject to Federal agency review, public review, and State regulatory reviews before they are finalized and any decision made as to dredging and dredged material placement recommendations.

It is anticipated that upon completion of the final DMMP report by the end of 2015, EPA will revisit the 2005 Rulemaking with respect to continued use of the CLDS and WLDS open water placement sites in LIS. EPA will need to determine whether or not to allow placement of dredged material at those or other sites after the current time extension expires in April 2016. If the sites remain available for use, EPA will also need to consider what conditions may be placed on that use, such as time-of-year restrictions on placement activities, types of material that can be placed, best management practices to be used, and any requirements for further site monitoring and investigations.

6.1 Likely Federal Base Plans

The Long Island Sound DMMP has identified the likely Federal Base Plans for each of the 52 FNPs and sub-projects in the LIS region that will or may require maintenance dredging of project features during the 30-year planning horizon for the DMMP. The Federal Base Plan for any particular project is defined as the least cost environmentally acceptable alternative for constructing the project. Projects must be planned, designed and constructed in a manner that most efficiently uses Federal fiscal resources (and non-Federal sponsor fiscal resources where improvements are included), consistent with Federal law and regulations, and the economic and environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies. The term Federal Standard is often used synonymously with Federal Base Plan, and is defined in USACE regulations as the least costly dredged material placement alternative identified by USACE that is consistent with sound engineering practices and meets all Federal environmental requirements (including those established under the CWA and the

MPRSA). Federal Base Plan is a more accurate operational description of the Federal Standard, because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project. The importance and applicability of the Federal Standard was recently re-emphasized in an October 21, 2015 memorandum of the USACE Direct of Civil Works (see Appendix K).

Establishing the Federal Base Plan for a particular dredging project is not the same as selecting a placement option for that project, nor does it limit potential Federal participation in the project. Other factors beyond cost contribute to decisions on placement options for dredging projects. Ecosystem restoration is recognized as one of the primary missions of the USACE under its planning guidance, and the placement option that is selected for a project should maximize the sum of net economic development and environmental restoration benefits. A beneficial use option may be selected for a project even if it is not the Federal Base Plan (Federal Standard) for that project.

If a beneficial use is selected for a project and that beneficial use happens to be (or be part of) the Federal Base Plan option for the project the costs of that beneficial use are assigned to the navigational purpose of the project. If the project is Federal maintenance dredging then all costs of the Base Plan are Federal. If the project involves improvement dredging then the Base Plan costs are shared with the non-Federal sponsor according to the navigation project depth. Beneficial use project costs exceeding the cost of the Federal Base Plan (Federal Standard) option become either a shared Federal and non-Federal responsibility, or entirely a non-Federal responsibility, depending on the type of beneficial use.

For Federal improvement dredging projects at New Haven Harbor and Mystic Harbor that are or may be studied during the DMMP planning horizon, alternatives and potential base plans were identified. For projects likely to be undertaken by other Federal agencies in the LIS region, alternatives and potential base plans were also identified. Where different types of dredged materials (sand, suitable fines, or unsuitable) will be produced by a project, different sets of alternatives and likely Federal Base Plans were identified for each material type.

The following table presents each FNP, Federal improvement and other Federal agency action with the identified likely base plan, and the most likely alternatives identified for each. These likely alternatives are either those involving a lesser cost above the base plan than other alternatives considered, or alternatives that may have additional NED, environmental or other quantifiable benefits that may make implementation eligible for Federal participation under another USACE authority. Each Federal project, as it is considered and funded for dredging, must make its own analysis of the available alternatives, other eligible authorities, and the willingness and capability of non-Federal cost-sharing partners to participate before recommending any final plan for dredged material placement or beneficial use. Each project will require sediment analysis, and analysis of available placement alternatives and beneficial uses, before a final suitability determination and recommendation for placement is made. Placement alternatives which have not been adequately investigated and documented will require further study and review before they can be considered as alternatives. The status of landfills and other upland sites is subject to change and will require investigation by specific projects that consider their use.

Table 6-1 - Base Plans for Federal Navigation Projects		
Material Type & CY	**Likely Federal Base Plans for Dredged Material Placement (Least Cost Environmentally Acceptable)**	**Other Lower Cost and Non Open Water Alternatives to Federal Base Plans (% Increase)**
Block Island Harbor of Refuge, Rhode Island - FNP Maintenance		
Sand 346,200	Crescent Beach Nearshore or on Beach	Sachems Pond West Beach (97%) Misquamicut Nearshore (248%) Montauk Point Nearshore (248%)
Fines 2,200	Rhode Island Sound Disposal Site	NY and CT Landfills (3%)
Great Salt Pond, Rhode Island - FNP Maintenance		
Sand 141,000	Sachems Pond West Beach Nearshore or on Beach	Crescent Beach Nearshore (47%) Misquamicut Beach Nearshore (90%)
Hay (West) Harbor, Fishers Island, New York - FNP Maintenance		
Fines 12,000	Generic Upland on Island New London Disposal Site (1%)	Sandy Point Marsh Creation (47%)
Pawcatuck River & Inner Little Narragansett Bay Channel, RI & CT - FNP Maintenance		
Fines 261,000	New London Disposal Site	Rhode Island Sound DS (77%) Sandy Point Marsh Creation (103%)
Little Narragansett Bay Entrance Channel, RI & CT - FNP Maintenance		
Sand 65,100	Sandy Point Beach or Nearshore	Napatree Point Beach (18%) Watch Hill Beach (18%)
Watch Hill Cove, Rhode Island - FNP Maintenance		
Sand 12,000	Watch Hill or Napatree Beaches or Nearshore	Sandy Point Beach NS (14%) Misquamicut Beach NS (46%)
Stonington Harbor, Connecticut - FNP Maintenance		
Fines 6,800	New London Disposal Site	Sandy Point Marsh Creation (58%) Rhode Island Sound DS (65%)
Mystic Harbor, Connecticut - FNP Maintenance		
Fines 105,100	New London Disposal Site	Sandy Point Marsh Creation (236%)
Mystic Harbor, Connecticut - FNP Improvement		
Fines 450,000	New London Disposal Site Mystic Seaport Upland Fill (17%)	Sandy Point Marsh Creation (333%)
New London Harbor, Connecticut - FNP Maintenance		
Fines 785,300	New London Disposal Site	Sandy Point Marsh Creation (354%) Rhode Island Sound DS or CLDS (269%)
Unsuitable 30,900	New London Harbor CAD	Groton Black Ledge CDF – Fill (20%) Twotree Island CDF – Fill (33%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
U.S. Coast Guard Station - New London Harbor, Connecticut - Maintenance		
Fines 4,000	New London Disposal Site	Sandy Point LNB Marsh Site (41%) Groton Black Ledge CDF – Fill (50%)
Thames River, Connecticut – Lower Channel - FNP Maintenance (Below Cow Point)		
Fines 832,000	New London Disposal Site	Sandy Point LNB Marsh Site (241%) Rhode Island Sound DS (141%)
Thames River, Connecticut – Upper Channel FNP Maintenance (Cow Point to Norwich)		
Fines 2,902,500	Upland Onshore along River New London Disposal Site (21%)	Groton Black Ledge CDF – Fill (426%)
U.S. Coast Guard Academy – Lower Thames River, Connecticut – Maintenance		
Fines 110,000	New London Disposal Site	Sandy Point LNB Marsh Site (121%) Rhode Island Sound DS (100%) Cornfield Shoals DS (24%)
U.S. Navy - Lower Thames River, Connecticut - Maintenance		
Fines 75,000	New London Disposal Site	Sandy Point LNB RI Marsh Site (129%) Rhode Island Sound DS (106%) Cornfield Shoals DS (23%)
Unsuitable 50,000	US Navy Thames River CAD – Fill	Groton Black Ledge CDF – Fill (53%) Morris Cove Pit CAD – Fill (5%)
U.S. Navy - Lower Thames River, Connecticut - Improvement		
Fines 350,000	New London Disposal Site	Sandy Point LNB RI Marsh Site (150%) Rhode Island Sound DS (119%) Cornfield Shoals DS (23%)
Niantic Bay and Harbor, Connecticut – FNP Maintenance		
Sand 9,500	New London Disposal Site, or Cornfield Shoals DS (3%)	Rocky Neck State Park Nearshore (28%) Bluff Point State Park Nearshore (42%)
Fines 8,500	New London Disposal Site, or Cornfield Shoals DS (3%)	Sandy Point LNB RI Marsh Site (62%) Manchester Landfill (78%)
North Cove, Connecticut River, Connecticut – FNP Maintenance		
Fines 872,700	Cornfield Shoals Disposal Site	NLDS (30%), CLDS (61%) Sandy Point Marsh LNB RI (170%) Manchester Landfill CT (203%)
Essex Cove Harbor, Connecticut River, Connecticut – FNP Maintenance		
Fines 25,000	Onshore Placement or if Not Available then the Cornfield Shoals Disposal Site	Cornfield Shoals DS (23%), NLDS (31%) Sandy Point Marsh LNB RI (123%) Manchester Landfill CT (203%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
Eightmile River, Connecticut River, Connecticut – FNP Maintenance		
Fines 45,200	Onshore Placement or if Not Available then the Cornfield Shoals Disposal Site	Cornfield Shoals DS (19%) New London DS (35%) Manchester Landfill CT (200%)
Wethersfield Cove, Connecticut River, Connecticut – FNP Maintenance		
Sand/Fines 10,500	In-River Placement	Upland On-Shore Placement (10%)
Connecticut River – Entrance Bars, Connecticut – FNP Maintenance		
Fines 878,000	Cornfield Shoals Disposal Site	NLDS (93%), CLDS (171%) Sandy Point Marsh LNB RI (329%)
Connecticut River – Lower Bars, Connecticut – FNP Maintenance		
Sand 281,000	Cornfield Shoals Disposal Site	NLDS (58%), CLDS (95%) Hammonasset State Beach NS (168%)
Connecticut River – Middle Bars, Connecticut – FNP Maintenance		
Sand 797,300	In-River Placement	Upland On-Shore Placement (111%)
Connecticut River – Upper Bars, Connecticut – FNP Maintenance		
Sand 1,481,600	In-River Placement	Upland On-Shore Placement (280%)
Patchogue River, Connecticut – FNP Maintenance		
Sand 85,800	Grove Beach or Westbrook Town (West) Beach – Nearshore or Direct	Cornfield Shoals DS (18%), Hammonasset State Beach NS (50%)
Fines 34,200	Cornfield Shoals Disposal Site	Central LIS DS (30%), Morris Cove CAD (58%), Sherwood Island COW and Sandy Point West Haven Marsh (69%)
Duck Island Harbor of Refuge, Connecticut – FNP Maintenance		
Sand 1,948,000	Nearshore at Grove Beach, Westbrook Town Beach or Hammonasset State Park and other Area Beaches	Cornfield Shoals DS (114%), Central LIS DS (386%), Sandy Point West Haven Marsh (729%)
Clinton Harbor, Connecticut – FNP Maintenance		
Sand 110,600	Direct Placement on Clinton Town Beach or Hammonasset State Beach (16%)	Cornfield Shoals DS (23%), Grove and Westbrook Town Beaches NS (58%), CLDS (63%)
Fines 54,300	Cornfield Shoals Disposal Site	Central Long Island Sound DS (31%) Sandy Point West Haven Marsh (76%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
Guilford Harbor, Connecticut – FNP Maintenance		
Sand 13,600	Jacob's Beach, Guilford - Beach	Cornfield Shoals or Central LIS DS (52%), Hammonasset Beach NS (111%)
Fines 122,200	Central Long Island Sound DS or Cornfield Shoals DS	Sandy Point West Haven Marsh (52%), Sherwood Island COW Site (60%), Falkner Is or Duck Is Roads CDFs (69%)
Stony Creek Harbor, Connecticut – FNP Maintenance		
Fines 132,700	Central Long Island Sound DS	Sherwood Island COW Site (65%), CSDS (13%), Sandy Point West Haven Marsh (83%)
Branford Harbor, Connecticut – FNP Maintenance		
Fines 289,200	Central Long Island Sound DS	Sherwood Island COW Site (44%), WLDS (115%), Sandy Point West Haven Marsh (144%)
New Haven Harbor, Connecticut – FNP Maintenance		
Fines 2,640,000	Central Long Island Sound DS	Sandy Point West Haven Marsh (247%) New Haven Breakwaters CDF (418%)
Unsuitable 418,600	Morris Cove Pit CAD Cell - Fill	New Haven Breakwaters CDF or Milford Harbor CDF (66%), Manchester Landfill or Yellow Mill Channel CDF (79%)
West River, New Haven Harbor, Connecticut – FNP Maintenance		
Fines 227,300	Central Long Island Sound DS	Sherwood Island COW Site (43%), WLDS (114%), Sandy Point West Haven Marsh (139%)
New Haven Harbor, Connecticut – FNP Improvement		
Fines 5,100,000	Central Long Island Sound DS	Cornfield Shoals DS or Sherwood Island COW Site (145%), WLDS (191%), New Haven Breakwaters CDF (500%),
U.S. Coast Guard, New Haven Harbor, Connecticut – Maintenance		
Fines 60,000	Central Long Island Sound DS	Cornfield Shoals DS or Sherwood Island COW Site (30%), Sandy Point West Haven Marsh (70%), WLDS (77%)
Milford Harbor, Connecticut – FNP Maintenance		
Sand 66,300	Gulf Beach or Silver Sands State Beach (17%) (On-Beach)	Central LIS DS (24%), Sherwood Island COW Cap (31%), Prospect Beach NS (60%), Savin Rock Beach NS (88%)
Fines 133,200	Central Long Island Sound DS	Sherwood Island COW Cap (19%) Sandy Point West Haven Marsh (108%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
Housatonic River, Connecticut – Lower Channel - FNP Maintenance		
Sand 1,237,000	Short Beach, Stratford (On-Beach) and Central Long Island Sound DS	Hammonasset State Beach NS (79%) Various CDF Caps (296%)
Housatonic River, Connecticut – Upper Channel - FNP Maintenance		
Sand 102,000	In-River, On-Shore, Central Long Island Sound DS or Area Beaches	
Fines 101,900	In-River or On-Shore Placement (40%), or if Unavailable then Central Long Island Sound DS (60%)	Sherwood Island COW (60%), WLDS (180%), Sandy Point West Haven Marsh (220%)
Bridgeport Harbor, Connecticut Johnsons River – FNP Maintenance		
Unsuitable 88,000	Morris Cove Pit CAD Cell - Fill	Yellow Mill Channel or Stratford Point CDFs (25%), Milford Harbor CDF (47%)
Black Rock Harbor, Connecticut – FNP Maintenance		
Fines 619,500	Sherwood Island Borrow Pit Fill and Cap – Total Site Capacity	Western or Central LIS DS (50%) Penfield Reef CDF (389%)
Southport Harbor, Connecticut – FNP Maintenance		
Sand 35,100	Sasco Hill Beach or Southport Beach Nearshore or Direct Placement	Sherwood Island COW (15%), WLDS (25%), Nearshore at Compo, Seaside or Sherwood Island Beaches (53%)
Fines 43,500	Sherwood Island Borrow Pit Fill/Cap, or Western LIS DS (8%)	Central LIS DS (35%), Sandy Point West Haven Marsh (84%)
Westport Harbor and Saugatuck River, Connecticut – FNP Maintenance		
Fines 50,700	Sherwood Island Borrow Pit Cap or Fill	Western LIS DS (39%), Central LIS DS (55%), Morris Cove CAD (168%)
Norwalk Harbor, Connecticut – FNP Maintenance		
Fines 627,000	Sherwood Island Borrow Pit Fill/Cap, and Western Long Is Snd DS (24%)	Central LIS DS (76%), Norwalk Islands Marsh CDF (348%)
Unsuitable 60,000	Morris Cove Pit CAD Fill, or Norwalk West Branch CAD (1%)	Norwalk Islands Marsh CDF (18%), Penfield Reef CDF (27%)
Wilson Point Harbor, Connecticut – FNP Maintenance		
Fines 618,900	Western Long Island Sound DS, or Sherwood Island Borrow Pit Fill/Cap	Central LIS DS (111%), Norwalk Islands Marsh CDF (389%)
Fivemile Harbor, Connecticut – FNP Maintenance		
Fines 55,400	Western Long Island Sound DS or Sherwood Island Borrow Pit – Fill/Cap	Central LIS DS (100%), Morris Cove CAD Cell (141%), Norwalk Islands Marsh CDF (206%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
Westcott Cove, Connecticut – FNP Maintenance		
Sand 34,300	Cummings Park Beaches – On-Beach	Cove Island Park Beach (15%), WLDS (18%), Sherwood COW Cap (42%)
Fines 34,400	Western Long Island Sound DS	Sherwood Island COW Site (21%) Upland Melville (103%) Stamford CDF (215%)
Stamford Harbor, Connecticut – FNP Maintenance		
Fines 486,000	Western Long Island Sound DS	Sherwood Island COW Site (108%) Stamford Harbor CDF (585%)
Unsuitable 144,600	Stamford in-Harbor CAD Cell, or Morris Cove Pit CAD Cell Fill (6%)	Stamford Harbor CDF - Fill (42%) Norwalk Islands Marsh CDF (70%)
Mianus River and Cos Cob Harbor, Connecticut – FNP Maintenance		
Fines 137,700	Western Long Island Sound DS	Sherwood Island COW Site (22%) CLDS (103%)
Greenwich Harbor, Connecticut – FNP Maintenance		
Fines 90,800	Western Long Island Sound DS	Sherwood Island COW Site (19%) Central LIS DS (95%), Upland Melville or Flushing Airport (105%)
Unsuitable 336,900	Greenwich In-Harbor CAD Fill, or Morris Cove Pit CAD Fill (5%)	Captain Harbor CDF - Fill (42%) Stamford CDF (71%) Norwalk or Hempstead CDFs (88%)
Port Chester Harbor, New York and Connecticut – FNP Maintenance		
Unsuitable 366,000	In-Harbor CAD Cell at Greenwich or Stamford, or Morris Cove Pit CAD	Captain Harbor CDF - Fill (38%) Stamford Harbor CDF - Fill (66%)
Milton Harbor, New York – FNP Maintenance		
Fines 140,400	Western Long Island Sound DS	Sherwood Island COW Site (13%) HARS or CLDS (67%), Upland (123%)
Mamaroneck Harbor, New York – FNP Maintenance		
Fines 210,100	Western Long Island Sound DS	Sherwood Island COW Site (13%) HARS or CLDS (67%) Upland Melville Landfill (123%)
Echo Bay, New York – FNP Maintenance		
Fines 59,200	Western Long Island Sound DS	Sherwood Island COW Site (12%) HARS or CLDS (63%) Flushing Wetlands (93%)
New Rochelle Harbor, New York – FNP Maintenance		
Fines 82,600	Western Long Island Sound DS	Sherwood Island COW Site (16%) HARS or CLDS (70%) Flushing Wetlands (105%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
Eastchester Creek, New York – FNP Maintenance		
Fines 111,500	Western Long Island Sound DS	Sherwood Island COW Site (21%) HARS (82%), Flushing Wetlands (124%)
Unsuitable 286,300	In-Harbor CAD Cell	Hempstead Harbor CDF - Fill (70%) Captain Harbor CDF - Fill (85%)
Little Neck Bay, New York – FNP Maintenance		
Fines 1,114,400	Western Long Island Sound DS	Sherwood Island COW Site (32%) Ocean Placement at HARS (32%)
U.S. Merchant Marine Academy, Kings Point, New York – Co-Located with the U.S. Coast Guard Station Kings Point - Maintenance		
Fines 66,400	Western Long Island Sound DS	Sherwood Island COW Site (19%) Flushing Wetlands or Upland Melville Landfill (60%)
Hempstead Harbor, New York – FNP Maintenance		
Fines 186,900	Western Long Island Sound DS	Sherwood Island COW Site (19%) Ocean Placement at HARS (78%)
Glen Cove Creek, New York – FNP Maintenance		
Unsuitable 53,500	Glen Cove/Hempstead Harbor In-Harbor CAD Cell	Stamford Harbor CDF - Fill (65%) Hempstead Harbor CDF - Fill (107%)
Huntington Harbor, New York – FNP Maintenance		
Sand 27,800	Gold Star Beach and Crescent Beach (16%) in combination with the Western LIS DS (1%), or Sherwood Island COW Site Cap (6%)	Asharoken Beach Nearshore (30%) Bayville Beach Nearshore (46%) Sunken Meadow Beach Nearshore (46%)
Fines 27,800	Western Long Island Sound DS, or Sherwood Island COW Site	Sherwood Island COW Site (4%) Upland on Long Island (49%-65%)
Northport Harbor, New York – FNP Maintenance		
Sand 50,800	Western Long Island Sound DS, or Sherwood Island COW Site Cap (4%)	Asharoken Beach Nearshore (27%) Sunken Meadow Beach Nearshore (52%)
Fines 50,800	Western Long Island Sound DS, or Sherwood Island COW Site Fill (4%)	Long Island Landfills (46%-73%) Hempstead Harbor CDF - Fill (210%)
U.S. Coast Guard Station, Eaton's Neck, New York - Maintenance		
Sand 186,000	Western Long Island Sound DS, or Sherwood Island COW Site Cap (4%), or Hobart Beach (5%)	Stamford Harbor CDF – Cap (83%) Hempstead Harbor CDF – Cap (100%)

Material and CY	Likely Federal Base Plan(s)	Other Lower Cost and Non Open Water Alternatives
Port Jefferson Harbor, New York – FNP Maintenance (Generic – No O&M in Period)		
Sand None	Central Long Island Sound DS, or Sherwood Island COW Site Cap, or East Beach (McAllister Park) (9%)	Cedar Beach (Mt Sinai) Nearshore (42%) Sunken Meadow State Park – NS (42%)
Fines None	Central Long Island Sound DS, or as fill/cap at the Sherwood Is. COW Site	Morris Cove Pit CAD Cell – Fill (35%) Sandy Point West Haven Marsh (46%)
Mattituck Harbor, New York – FNP Maintenance		
Sand 113,200	Bailie's Beach, Mattituck	Central Long Island Sound DS (50%) Jamesport State Park – Nearshore (64%) Hashamomuck Cove CR-48 (107%)
Fines 7,000	Central Long Island Sound DS or Cornfield Shoals DS	Morris Cove Pit CAD Cell – Fill (39%) Sandy Point West Haven Marsh (53%) Upland Brookhaven Landfill (56%)
Peconic River, New York – FNP Maintenance		
Fines 13,300	Upland Onshore Along the River	Brookhaven Town Landfill (77%) Cornfield Shoals Disposal Site (86%)
Sand CY Unknown	Beaches on Great Peconic Bay, or if not available then Nearshore along Suffolk County North Shore Beaches Jamesport State Park (35%)	Wildwood State Park (35%) Cornfield Shoals Disposal Site (55%) Hashamomuck Cove CR-48 - NS (76%) Kenney's Beach – Nearshore (76%)
Greenport Harbor, New York – FNP Maintenance		
Sand 3,200	Cornfield Shoals Disposal Site or at Gull Pond Beach (7%)	Hashamomuck Cove CR-48 - NS (36%) Kenney's Beach – Nearshore (44%) Orient Beach State Park – NS (44%)
U.S. DHS, Plum Gut Harbor and Orient Point, New York - Maintenance		
Sand 20,000	Beach placement at Plum Gut Beach and Orient State Park	New London DS (13%) Rocky Neck State Park – (60%)
Lake Montauk Harbor, New York – FNP Maintenance		
Sand 193,200	Nearshore or on-Beach at Adjacent Lake Montauk, Gin or Montauk County (T. Roosevelt) Beaches	New London DS (38%) Nearshore at Shadmoor, Camp Hero or Montauk Point State Parks (62%)

For silty dredged materials which have been found suitable for open water placement based on stringent Federal sediment testing requirements, open water placement remains the most likely Federal base plan. Nearly 40 years of DAMOS monitoring has clearly shown that aquatic placement of dredged material can be done responsibly, with limited short-term impacts to the benthic system and the water column and no measureable long-term impacts. Further, the siting of the current Western, Central, and New London sites over areas of historic (pre-CWA and MPRSA) disposal has had the benefit of placing suitable dredged material (with suitability based on physical, chemical, and biological testing) over the historically disposed material.

Going forward, the DAMOS Program will continue to verify the placement of material at the designated sites, the recovery of the benthic system at the sites, and the long-term stability of the deposits of dredged material. Given the lack of measureable impacts at the disposal sites, synergistic effects of placement are not expected to be significant. However, alternatives to open water placement must be investigated, and where practicable, implemented if the goal of reducing reliance on open water placement in the future is to be realized.

6.1.1 CAD Cells as Base Plans for Unsuitable Materials

The USACE FNPs and other Federal agency projects are expected to generate over 3.2 million CY of unsuitable dredged materials (over 1.8 million CY excluding Bridgeport) over the 30-year period of analysis. Adding non-Federal sources brings the total to over 3.3 million CY. This is 6.3 percent of the total 30-year volume, or 9.5 percent of the Federal volume. Base plans for placement of unsuitable materials from New England projects have most often been construction of harbor or project-specific CAD cells. The USACE, the Navy, the State of Rhode Island, and other parties have found CAD cells to be an environmentally acceptable and cost-effective management alternative for these materials. CAD cells are often more cost-effective than transferring ashore, dewatering, re-handling, and transporting material upland. CAD cells, at a cost of only twice that of dredging and open water placement, are also typically more cost-effective than dewatering and treatment. CAD cells also have the added benefit of consolidating, isolating and sequestering contaminated sediments from the overlying water column and availability to environment. In LIS waters, CAD cells have been constructed and used at Norwalk Harbor by the USACE, and in the Thames River by the U.S. Navy. For FNP maintenance or improvement projects, CAD cells are disposal facilities, and as such are treated as project modifications requiring non-Federal cost-sharing. Construction of CAD cells beneath harbor bottoms typically requires the removal of large quantities of clean parent glacial materials, which themselves make excellent capping materials for open water sites, or use in other beneficial applications. However, within harbors surface materials removed to construct CAD cells often requires temporary storage and later placement in the cell(s) as it is typically similar to the harbor shoal materials destined for the cell(s).

As shown below, in-harbor CAD cells, including using former borrow pits as CAD cells, are the base plans for all instances of unsuitable materials identified in this DMMP. By themselves CAD cells are not a beneficial use, nor are they eligible for non-Federal cost-sharing beyond the Federal share applicable to navigation project cost-sharing according to channel depth. However, if the material excavated to create the CAD cell were used beneficially, that additional increment of cost may be shared if another Federal authority applied to that use, as confirmed by the appropriate study and partnership agreements.

Table 6-2 - Unsuitable Material Dredging Needs and Base Plans			
Project	Volume	Federal Base Plan	Alternative and %
New London Harbor FNP - Shaw's Cove	30,900	In-Harbor CAD Cell	Sub-Regional CDF - Black Ledge or Twotree - +20-33%
Thames River – U.S. Navy	50,000	In-River CAD Cells	Sub-Regional CDF or Morris Cove CAD cell - +5%
New Haven Harbor FNP - Mill & Quinnipiac Rivers	418,600	Morris Cove CAD	Regional or Sub-Regional CDF - +66%
Bridgeport Harbor FNP - Johnsons River	88,000	Morris Cove or In-Harbor CAD	Regional or Sub-Regional CDF - +25-47%
Norwalk Harbor FNP - West Branch I-95 Area	60,000	Morris Cove or In-Harbor CAD (+1%)	Regional or Sub-Regional CDF - +18-27%
Stamford Harbor FNP - East Branch	144,600	In-Harbor CAD or Morris Cove (+6%)	Regional or Sub-Regional CDF - +42-70%
Greenwich Harbor FNP	336,900	In-Harbor CAD or Morris Cove (+6%)	Regional or Sub-Regional CDF - +42-88%
Port Chester Harbor FNP	366,000	In-Harbor CAD Cell	Sub-Regional CDF - +33-68%
Eastchester Creek FNP	286,300	In-Harbor CAD Cell	Regional or Sub-Regional CDF - +70-85%
Glen Cove Creek FNP	53,500	In-Harbor CAD Cell	Sub-Regional CDF +65-107%
Total	1,834,800		
Bridgeport Harbor DMMP	1,379,800		
Total with Bridgeport	3,214,600		

6.1.2 Beach and Nearshore Nourishment as Base Plans for Sandy Material

The USACE FNPs and other Federal agency projects are expected to generate over seven million CY of dredged sandy material suitable for beneficial use, including beach and nearshore bar or berm nourishment. This is 20.8 percent of the total Federal 30-year volume. As shown below, of the 26 projects or project segments generating this sandy material, 20 projects generating 64 percent of the total 30-year sand volume, have likely base plans of beach or nearshore placement. Three of the project segments in the middle and upper reaches of the Connecticut River FNP have in-river placement as the base plan.

Three projects have base plans for sand which are open water placement (Niantic Bay, Connecticut River Lower Bars, and Northport), and have alternative nearshore sites available which are significantly more costly (28 to 168 percent increase). When these projects require maintenance in the future, attempts should be made to identify additional alternative nearshore placement sites closer to these projects to reduce the additional placement cost and make beneficial use more financially practicable. Two other projects, Housatonic River and Huntington Harbor, where portions of the projects yield sandy material, have beach or nearshore base plans that can accommodate part of the material. These projects should be approached in the same manner with further examination of more proximate nearshore opportunities. While this DMMP focused on public beaches for placement, there are many private beach fronts located closer to these two projects that could benefit from nearshore sand placement. However, in order for those beaches to remain private-use only, the interested parties would have to pay the difference in cost over the identified base plan, secure all required approvals, provide all necessary real estate interests, and environmental monitoring easements as required. Public funding of any portion of the difference in cost for direct beach placement would also likely require long-term public access easements, resource monitoring and management easements, and public access improvements.

6.1.3 Base Plans for Suitable Fine-Grained Materials

There are 52 USACE FNPs, several with separable dredged project segments, and a number of other Federal agency projects, that are expected to generate nearly 21.5 million CY of suitable fine-grained materials over the 30-year planning horizon, nearly 70 percent of the total Federal dredging volume in that period. As shown in the following table, the likely base plans for 42 of those, generating 77 percent of the material, are open water placement at one of the four active sites in LIS. Two projects (the upper Thames River and the Peconic River) generate a total 14 percent of the material and have a base plan of on-shore placement along the river.

One project, the upper Housatonic River, would place its upstream mixed silty-sandy materials in in-river borrow pits or onshore along the river. Six projects in western LIS that generate the final 9 percent of the material have a base plan for use of the Sherwood island COW site. However the total volume of those projects (2,015,000 CY) is nearly three times the capacity of the Sherwood Island COW site (fill plus cap). The next least costly alternative for all of the Sherwood Island COW base plan projects is open water placement at the WLDS (except for Black Rock Harbor which is placement at the CLDS). If the excess volume were allocated to the open water base plan alternatives, the total allocation of open water material would increase to 83 percent.

Table 6-3 - Sandy Material Dredging Needs and Federal Base Plans						
Project	30-Year Volume	Federal Base Plans by Category				
		Beach (%+)	Nearshore	Open Water	In-River	
Block Island Harbor of Refuge	208,000		✓			
Great Salt Pond	140,000		✓			
Little Narragansett Bay	65,100	✓				
Watch Hill Cove	13,000	✓				
Niantic Bay and Harbor	9,500			✓		
Connecticut River Lower Bars	281,000			✓		
Connecticut River Middle Bars	797,300				✓	
Connecticut River Upper Bars	1,481,600				✓	
Wethersfield Cove	10,500				✓	
Patchogue River	85,800	✓				
Duck Island Harbor of Refuge	1,948,000		✓			
Clinton Harbor	110,600	✓				
Guilford Harbor	13,600	✓				
Milford Harbor	66,300	✓				
Housatonic River	1,339,000		✓	(✓)		
Southport Harbor	35,100	✓				
Westcott Cove	34,300	✓				
Huntington Harbor	27,800	✓		(✓)		
Northport Harbor	50,800			✓		
USCG Eaton's Neck	16,000	✓ 5%				
Port Jefferson Harbor	0	✓ 9%				
Mattituck Harbor	113,200	✓				
Peconic River	0	✓				
Greenport Harbor	3,200	✓ 7%				
D.H.S. Orient and Plum Gut	20,000	✓				
Lake Montauk Harbor	193,200	✓				
TOTAL CY	7,062,100	774,200	3,708,000	290,500	2,289,400	
Number of Projects	26	16	4	3 (2)	3	
Percent of Total	100.0%	11.0%	52.5%	4.1%	32.4%	
(✓) = Separable fine-grained portion of the project only.						

Table 6-4 - Fine-Grained Material Dredging Needs and Base Plans

Project	Volume	Federal Base Plans by Category						
		Open Water				Upland	In-River	CDF/CAD
		NLDS	CSDS	CLDS	WLDS			
Block Island Harbor of Refuge	2,200	✓						
Hay (West) Harbor	12,000	✓						
Pawcatuck River	173,000	✓						
Little Narragansett Bay	88,000	✓						
Stonington Harbor	6,600	✓						
Mystic River Maintenance	105,100	✓						
Mystic Harbor Improvement	450,000	✓						
New London Harbor FNP	785,300	✓						
USCG New London	4,000	✓						
Thames River FNP - Lower	832,000	✓						
Thames River FNP - Upper	2,902,500					✓		
USCG Thames River	110,000	✓						
US Navy Maintenance	75,000	✓						
US Navy Improvement	350,000	✓						
Niantic Bay and Harbor	8,500	✓						
North Cove	872,700		✓					
Essex Cove Harbor	25,000		✓					
Eightmile River	45,200		✓					
Connecticut River Entrance Bars	878,000		✓					
Patchogue River	34,200		✓					
Clinton Harbor	54,300		✓					
Guilford Harbor	122,200		✓					
Stony Creek Harbor	132,700			✓				
Branford Harbor	289,200			✓				
New Haven FNP Main Channels	2,640,000			✓				

Project	Volume	NLDS	CSDS	CLDS	WLDS	Upland	In-River	CDF/CAD
New Haven West River	227,300			✓				
New Haven USCG	60,000			✓				
New Haven FNP Improvement	5,100,000			✓				
Milford Harbor	133,200			✓				
Housatonic River - Upper	101,900						✓	
Black Rock Harbor	619,500							✓
Southport Harbor	43,500							✓
Westport Harbor	50,700							✓
Norwalk Harbor	627,000							✓
Wilsons Point Harbor	618,900							✓
Fivemile River Harbor	55,400							✓
Westcott Cove	34,400				✓			
Stamford Harbor	486,000				✓			
Mianus River	137,700				✓			
Greenwich Harbor	90,800				✓			
Milton Harbor	140,400				✓			
Mamaroneck Harbor	210,100				✓			
Echo Bay	59,200				✓			
New Rochelle Harbor	82,600				✓			
Eastchester Creek	111,500				✓			
Little Neck Bay	1,114,400				✓			
US Merchant Marine Academy	66,400				✓			
Hempstead Harbor	186,900				✓			
Huntington Harbor	27,800				✓			
Northport Harbor	50,800				✓			
Peconic River	13,300					✓		
TOTAL	21,447,400	16,414,700				2,915,800	101,900	2,015,000
Percent of Total	100.0%	76.5%				13.6%	0.5%	9.4%
Number of Projects	51	42				2	1	6

6.2 Alternatives to the Base Plans

The Long Island Sound DMMP identified potential environmentally acceptable, practicable management plans that can be utilized by various dredging proponents in their analysis of options to manage their projects. Although it is not the intention of the Long Island Sound DMMP to identify an alternative for every potential project in the study area, the DMMP provides project managers with an array of suitable/feasible options that could be used in their alternatives analysis to meet their needs. In addition, the States may use the DMMP findings to take whatever actions are necessary to establish or expand State programs to help reduce open-water placement. To be compliant with NEPA, USACE developed the accompanying PEIS, and provided opportunities for public participation, to assess the impacts of implementing the DMMP.

6.2.1 Confined Disposal Facilities

The LIS DMMP identified potential regional and sub-regional confined disposal facilities (CDFs) that could, if constructed, accept and manage dredged material of all types from multiple sources. Different facility sizes from those that could accommodate materials produced by a group of harbors, or several dredging centers, up to those that could accommodate the entire volume of silty materials expected to be produced in the LIS region over the next 30 years or more were identified. Such facilities require a significant non-Federal investment, even if Federal participation is determined warranted (WRDA 1996, §217). The non-Federal cost of such facilities can vary anywhere from 20 to 100 percent of the cost of site studies, permitting, design, construction, operation, maintenance, monitoring and closure. Additionally, acquisition of any real estate interests required for these facilities would typically be a non-Federal responsibility (WRDA 1986). Any required utility relocations are typically non-Federal responsibilities also, though credit can be given against other non-Federal cost-share sums under certain circumstances (WRDA 1988).

Most large scale CDFs constructed in the United States, even if they are initially built with Federal cost-sharing under a USACE authority, are operated and managed by a non-Federal sponsor, typically a port authority or state agency. This is because under USACE environmental restoration, flood control, and hurricane and storm damage reduction authorities, non-Federal interests are required by those statutes to provide all real estate interests, and to operate and maintain the projects after completion of construction. The USACE placement of FNP project materials into those facilities is then shared with the sponsor and site operator on the basis of site capacity percentage used, and the cost-share percentage(s) for the navigation project depth. The ultimate end use of the site is typically either for port facility development or as state park land, activities in which USACE participation is not authorized.

6.3 Beneficial Use Project Authorities

The cost-sharing provisions for beneficial uses that protect, restore, or improve the environment, or contribute to storm damage reduction, are listed below. In cases where the beneficial use of the dredged material does not contribute to USACE navigation, ecosystem restoration, or flood and storm damage reduction missions, the project partner using the material pays the full costs of that beneficial use project.

6.3.1 Ecosystem Restoration and Protection Projects – Specifically Authorized Projects

Ecosystem Restoration and Protection (aka Environmental Protection and Restoration) is an authorized project purpose under Section 103(c) of WRDA 1986 as amended by Section 210 of WRDA 1996. Typically the non-Federal Sponsor pays 50 percent of any feasibility studies, and 35 percent of the total project first cost (design and construction). The Sponsor also provides all lands, easements, rights-of-way, relocations, and dredged material placement areas (LERRDs), and can receive a credit for LERRDs costs against its 35 percent project share. The Sponsor is responsible for all operation, maintenance, repair, replacement and rehabilitation of the project. When constructed to receive dredged material from FNPs, the cost of placing the material into the site is also cost-shared according to project depth as described earlier, including any tipping fee assessed by the site owner/operator. This was the principal authority used for Federal participation in the construction of the Poplar Island project in Chesapeake Bay, Maryland, as a dredged material placement facility with the ultimate end-use of ecosystem restoration.

6.3.2 Improvement of the Quality of the Environment - Section 1135 Projects

Project Modifications for Improvement of the Quality of the Environment: *Section 1135 of WRDA 1986*, as amended by Section 202 of WRDA 1992, Section 204 of WRDA 1996, and WRRDA 2014, is a continuing authority that authorizes the review of water resources projects, primarily flood control and navigation projects, to determine the need for modifications in the structures and operations of such projects for the purposes of improvement of the quality of the environment. Feasibility studies are cost-shared 50/50 with the non-Federal sponsor after the first $100,000. The incremental cost of design and implementation of these modifications are shared on a 75 percent Federal and 25 percent non-Federal basis. The Federal share per project is limited to $10 million. The Sponsor also provides all LERRDs, and can receive a credit for LERRDs costs against its 25 percent project share. The Sponsor is responsible for all operation, maintenance, repair, replacement and rehabilitation of the project. In New England, Section 1135 authority is most often used to restore marsh areas that were filled with dredged materials from navigation projects many decades ago.

6.3.3 Regional Sediment Management - Section 204 Projects

Regional Sediment Management: *Section 204 of WRDA 1992*, as amended by Section 207 of WRDA 1996, Section 209 of WRDA 1999, WRDA 2007, and WRRDA 2014, is a continuing authority that authorizes USACE to carry out projects for managing the beneficial use of dredged material on a regional or project-specific basis, in connection with dredging for constructing, operating, or maintaining USACE navigation projects. Feasibility studies are performed at 100% Federal cost; however, if the proposed project is approved for implementation the costs of the study must be included with the costs of design and implementation, as part of total project costs subject to cost-sharing. The incremental costs of such projects are shared on the basis of the purpose of the beneficial use (e.g. 65 percent Federal and 35 percent non-Federal if the use is coastal storm protection, structural flood damage reduction). The Federal share per project is limited to $10 million. The Sponsor also provides all LERRDs, and can generally receive a credit for LERRDs costs against its project share. Though some authorities (e.g. non-structural flood damage reduction) do not allow that credit, and others require a minimum of 5% of the Sponsor's share be in cash. Section 204 authority is specific to beneficial use of dredged material. This is the most commonly used authority for funding beneficial uses of maintenance dredging both because of this specific focus and because it is appropriated programmatically.

6.3.4 Aquatic Ecosystem Restoration – Section 206 Projects

Aquatic Ecosystem Restoration: Section 206 of WRDA 1996 as amended, is a continuing authority that authorizes USACE to carry out projects for aquatic ecosystem restoration and protection if the project will improve environmental quality, is in the public interest, and is cost-effective. Feasibility studies are cost-shared 50/50 with the non-Federal sponsor after the first $100,000. The cost of design and implementation of these modifications are shared on a 65 percent Federal and 35 percent non-Federal basis. The Federal share per project is limited to $10 million. The Sponsor also provides all LERRDs, and can receive a credit for LERRDs costs against its 35 percent project share. The Sponsor is responsible for all operation, maintenance, repair, replacement and rehabilitation of the project. Section 206 can be used for building marsh, shellfish habitat and other purposes where dredged material can be used and where the source of that material is not a USACE Federal Navigation Project.

6.3.5 Flood Risk Management – Section 205 Projects

Flood Risk Management: Section 205 of the 1948 Flood Control Act, as amended, is a continuing authority that authorizes USACE to carry out projects for flood damage reduction purposes. Feasibility studies are cost-shared 50/50 with the non-Federal sponsor after the first $100,000. The cost of design and implementation of these modifications are shared on a 65 percent Federal and 35 percent non-Federal basis. The Federal share per project is limited to $10 million. The Sponsor also provides all LERRDs, and can generally receive a credit for LERRDs costs against its project share. Though some authorities (e.g. non-structural flood damage reduction) do not allow that credit, and others require a minimum of 5% of the Sponsor's share be in cash. With respect to dredged material, Section 205 can be used to elevate lands, construct dikes, and other methods of reducing flood damages where Section 204 authority might not otherwise apply.

6.3.6 Shore Damage Mitigation – Section 111 Projects

Shore Damage Mitigation: Section 111 of the River and Harbor Act of 1968, as amended through WRRDA 2014, is a continuing authority that authorizes USACE to carry out projects for mitigating shore damage caused in whole or in part by a Federal navigation project. This authority is most commonly used to address erosion in areas adjacent to USACE jetties and breakwaters from reflected wave energy. Feasibility studies are cost-shared 50/50 with the non-Federal sponsor after the first $100,000. The USACE must make a determination of the extent which the FNP is responsible for the shore damages relative to other natural forces or other structures or conditions. The Federal government will share in that portion of the project design and implementation costs attributed to the FNP's affects in the same percentage that the FNP feature responsible for a portion of the damages was cost-shared. The Federal share per project is limited to $10 million, but Congress may increase that limit on a project-specific basis. Section 111 was recently used at Mattituck Harbor, New York for a project to place maintenance dredging material, and a significant volume of over-dredging material from the entrance channel, to secure sand to mitigate beach erosion in areas adjacent to the jetties.

6.3.7 Hurricane and Storm Damage Reduction – Section 103 Projects

Hurricane and Storm Damage Reduction: Section 103 of the River and Harbor Act of 1962, as amended by WRDA 1986 (§103), (formerly small beach erosion projects authority) is a continuing authority that authorizes USACE to carry out projects for controlling beach erosion. USACE policy limits Federal involvement to only those projects formulated primarily for hurricane and storm damage reduction. Projects that support recreational activities or are in tourist areas that provide substantial benefit to regional or local economies can be undertaken solely by non-Federal interests. Feasibility studies are cost-shared 50/50 with the non-Federal sponsor after the first $100,000. For developed shorefront lands where public access requirements are met, the cost of design and implementation of these modifications are shared on a 65 percent Federal and 35 percent non-Federal basis. The Federal share per project is limited to $5 million. The Sponsor also provides all LERRDs and public access facilities, and can generally receive a credit for LERRDs costs against its project share. The Sponsor is responsible for all operation, maintenance, repair, replacement and rehabilitation of the project. Section 2103 can be used for building beaches and other shoreline features where the source of the needed material is not required to be USACE Federal Navigation Project.

6.3.8 Beneficial Use of Improvement Dredging Materials

Improvement dredging in New England most often involves removal of parent materials or marine or glacial origin deposited before the industrial revolution and exhibiting very low, if measurable, levels of contaminants. Such materials present significant opportunities for beneficial use. Deep draft improvement projects, or excavation of large regional CAD cells, can produce millions of CYs of clean dredged material. This material is often semi-consolidated (hard pan, stiff marine clays, and glacial tills), and can be used to cap other disposal sites or to construct dikes and other shore protection features, or can be used as structural fill.

In LIS there is a proposed deep draft improvement project for the deepening of the port of New Haven, Connecticut. If ultimately found in the Federal interest, authorized by Congress and funded by the Government and a non-Federal Sponsor, is expected to yield more than 5 million CY of clean parent material, mainly clay and till. If a large regional or sub-regional CAD cell is constructed in the LIS region to handle unsuitable dredged materials, that facility could also yield a large volume of clean clay and till that could be beneficially used. Such projects would need to be extensively coordinated with agencies and other stakeholders during their feasibility phase to determine the best uses of these materials from both a cost-effectiveness and beneficial use/regional sediment management view.

6.4 Beneficial Use and the Federal Standard

The largest quantities of dredged material are generated from the maintenance of existing FNPs, or large-scale deep draft improvement projects. Where a beneficial use is (or is part of) the Federal Standard or Federal Base Plan option, it can be accomplished using the cost sharing specified for that purpose. Where the purpose is FNP maintenance and no placement facilities are required Federal operation and maintenance funding will cover the cost of dredging and placement (i.e., the Federal share is 100 percent). Where the base plan requires facilities be constructed, and or improvement dredging is the purpose, cost sharing is required under WRDA 1986 according to the project design depth.

Where the recommended placement is not the Base Plan and other Federal authorities can be applied to the beneficial use, the cost-sharing is determined as required for the beneficial use purpose as described above. This is the most common way of using dredged material from maintenance projects beneficially. Where the recommended placement is not the base plan, and other Federal authorities are not applicable to warrant the increased cost, non-Federal funding is required to cover any incremental increase in placement cost. The importance of the Federal Standard was recently re-emphasized in the USACE October 21, 2015 guidance memorandum included as Appendix K to this DMMP.

New navigation projects require specific authorization by the Congress based upon a major planning effort culminating in the preparation of a feasibility study, an Environmental Impact Statement (EIS), and a Report of the Chief of Engineers. This comprehensive planning effort normally spans three years and includes detailed economic, environmental, and engineering evaluations. Smaller-scale navigation improvements can be carried out by the USACE without new Congressional authorization under its continuing authority for navigation projects, Section 107, which limits the Federal share of total project cost to $10 million.

In planning for new projects, the *Economic and Environmental Principles and Guidelines for Water Resources Development* and the USACE's "Planning Guidance Notebook" (USACE 2000) that implements the *Principles and Guidelines* identify national ecosystem restoration as one of the objectives to consider in planning new navigation projects. This guidance provides the basis for considering beneficial uses of dredged material in the planning effort for new navigation projects. Beneficial uses can be considered as part of a new project's implementation without invoking separate authorities, though cost-sharing according to the requirements of project purpose must be identified and adhered to in implementation of beneficial uses.

The most commonly used beneficial use authority for maintenance dredging is Section 204 of WRDA 1992, as amended, which promotes regional sediment management and beneficial use for various project purposes, with the cost-sharing related to each purpose applied to the incremental increase in placement cost beyond the Federal Base Plan. This is a continuing authority, so projects using it do not require specific Congressional authorization. Because the Federal per-project limit for Section 204 is $10 million, it is most applicable to smaller beneficial use projects, although there is nothing in the Section 204 authorization that limits the size of the project provided that non-Federal interests fund any amount over that limit in addition to their cost-sharing percentage.

6.5 Agency and Public Involvement in Beneficial Use Planning

Successful beneficial use projects are developed through collaborative planning processes involving USACE, EPA, the ports, Federal, state, and local resource and regulatory agencies, marine commercial and environmental interest groups. These agencies and groups, and the general public, all have opportunities to identify beneficial use options during the planning effort for new navigation projects. These opportunities are provided through legislation such as the National Environmental Policy Act (NEPA), which mandates coordination among and input from interested stakeholders. NEPA recognizes the need for public review and provides a number of opportunities for agency and public input, starting with NEPA scoping at the beginning of the study process. The USACE's dredged material management planning program can be the framework for these efforts. National programs such as the National Estuary Program and Coastal America also can provide the framework for the broad partnerships needed for successful beneficial use planning. One of the primary roles of the National Dredging Team (NDT) and the Regional Dredging Teams (RDTs) is to promote these partnerships. In New England there is both a New England RDT and a separate Long Island Sound RDT. The LIS RDT was created in accordance with the June 2005 EPA rulemaking that designated the CLDS and WLDS and established the LIS RDT to help manage dredged material placement in LIS during preparation of the LID DMMP, and to promote alternatives to open water placement in LIS.

Local Planning Groups (LPGs) or technical working groups (TWG) are often formed in conjunction with USACE navigation and DMMP studies to provide a mechanism to solicit agency and interest group input to the planning process and in identifying and evaluating beneficial use opportunities. TWGs are not Federal advisory panels and have no input to Federal or state regulatory evaluations or decision-making. TWG/LPGs are interagency Federal/state/local teams, including non-government stakeholders, which develop dredged material management plans at the local and regional level. These groups generally function within the context of USACE dredged material management planning process. A primary goal of the TWG/LPG is to maximize the beneficial use of dredged materials. A TWG was formed early in the LIS DMMP process and their input was sought into beneficial use opportunities and screening criteria used for alternative placement options.

The success of beneficial use projects depends on the creation of partnerships between federal and non-Federal interests. Each of the USACE's beneficial use funding authorities includes a requirement for non-Federal cost sharing of a minimum of 25 percent for incremental costs. Therefore, beneficial use projects require local leadership and local financial commitments to succeed.

6.6 Climate Change Relative to Dredged Material Management Planning

Climate change, with its anticipated sea level change (SLC) and increases in coastal storm events presents both challenges and opportunities relative to dredged material management. Increases in water levels, storm frequency and strength, storm surge elevations and other factors must be taken into account when designing dredged material placement facilities, for example; CDF dike elevations, beachfill and marsh fill elevations, and CAD cell cap thickness.

Flood risk management efforts involving the beneficial use of dredged material, such as port fill either for new facilities or to increase the elevation of existing facilities in response to SLC

Continued climate change will also increase the demand for beneficial use of dredged materials in coastal and environmental resiliency, as shoreline erosion and marsh inundation increases. Sandy material in particular will become a more valuable resource, and more projects using sand for storm damage reduction are likely to be found economically justified for Federal participation in the future. Should states and local communities find an increasing need for marsh elevation, even silty material could become more in demand for ecological resiliency applications.

Future dredging projects through their public involvement, sponsor engagement, and preparation of project-specific NEPA and decision documents will need to examine climate change impacts and investigate opportunities for beneficial uses of their dredged material. Project specific surveys, tidal datum, sea level rise scenarios, and future projections will need to be developed for each harbor and considered in the planning and design of dredging projects, and alternative dredged material placement options. Continued climate change is expected to increase the demand for using dredged material beneficially, thereby reducing the need for open water placement.

7 RECOMMENDATIONS

The PMP, in response to EPA's 2005 Rule, calls for "the development of procedures and standards for the use of practicable alternatives to open-water disposal" in LIS. The pertinent section of the Rule, Section (b)(4)(vi)(C), is as follows:

> *(C) Except as provided in paragraphs (b)(4)(vi)(D) and (E) of this section, the disposal of dredged material at the CLIS and WLIS sites pursuant to this designation shall not be allowed beginning eight (8) years after July 5, 2005 unless a regional dredged material management plan (DMMP) for Long Island Sound has been completed by the North Atlantic Division of the USACE, in consultation with the State of New York, State of Connecticut and EPA, with a goal of reducing or eliminating the disposal of dredged material in Long Island Sound, and the EPA thereafter amends this site designation to incorporate procedures and standards that are consistent with those recommended in the DMMP.[1] Completion of the DMMP means finishing the items listed in the work plan (except for any ongoing long-term studies), including the identification of alternatives to open-water disposal, and the development of procedures and standards for the use of practicable alternatives to open-water disposal.*

Accordingly the DMMP recommends procedures to be followed and standards to be applied in evaluating and recommending dredged material placement options, tracking dredged material placement, pursuing opportunities for alternative and beneficial uses of dredged material in LIS, and researching and monitoring impacts of past and future placement activities.

There are also several ongoing long-term efforts to promote beneficial uses of dredged material and monitor dredged material placement in LIS and the New England region. These efforts should be continued and could be improved to help in understanding the impacts of dredged material placement and assist in the goal of reducing the need for open water placement in LIS.

7.1 Standards Including Federal Base Plans and Alternatives

This recommendation will first address the issue of Standards; the alternatives identified as likely cost-effective and environmentally acceptable for dredged material placement. This DMMP has identified likely Federal Base Plans for dredged material placement for all Corps Federal Navigation Projects and for the activities of other Federal agencies. The DMMP also identifies alternatives to the Base Plans that are either close in cost to the Base Plans or that represent opportunities for beneficial use and reduction in open water placement. Additionally the inventories of placement alternatives can be used by non-Federal parties in evaluating potential alternatives for use in their own projects. The DMMP also examined other regulatory activities in the LIS watersheds which may impact sedimentation in the coastal zone or contaminant loading of those sediments.

7.1.1 Recommendations for Individual Federal Projects

To address the Designation Rule provision with respect to "standards", the LIS DMMP has identified all the potential dredging needs, both Federal and non-Federal for all of the harbors in Long Island Sound and vicinity, through a comprehensive dredging needs survey in 2009 and updated that work in 2014-2015. The LIS DMMP also identifies a wide range of potential environmentally acceptable, practicable management plans that can be utilized by various dredging proponents in their analysis of options to manage dredging projects. Although it was not the intention of the LIS DMMP to identify an alternative for every potential non-Federal project in the study area, the DMMP provides project proponents with an array of suitable/feasible options that they can use in their future alternative analyses that will meet or exceed their needs. Also the States may use the DMMP findings to take whatever actions are necessary to establish or expand State programs to assist in implementing reductions in open water placement.

Recommendations for individual Federal projects are provided in Section 6. These include those alternatives identified as the likely Federal Base Plans (the least costly environmentally acceptable alternative) for each Federal project, and other environmentally acceptable alternatives that are either very close in cost to the Base Plan or represent opportunities for beneficial use and reduction in open water placement. These alternatives were developed and evaluated based on the type(s) of dredged material generated by each project, as one of three classifications of material: sandy (coarse grained) material suitable for beach nourishment purposes, fine-grained (silty) material otherwise suitable for open-water placement, and material determined to be unsuitable for open water placement.

The Federal Base Plan for navigation dredging and dredged material placement is that plan which is the least costly environmentally acceptable plan according to Federal standards (the environmentally acceptable plan that requires the least cost to implement). The Base Plan may also involve beneficial use of the dredged material so long as it is the least costly plan. The cost of implementing the Base Plan is either (1) a 100% Federal cost for maintenance of projects with design depths of no greater than 50 feet, or (2) for improvement dredging placement is cost-shared with the non-Federal sponsor as part of the navigation project. Recommendation and implementation of a placement alternative more costly than the Base Plan would require either (1) a non-Federal sponsor willing to fund the entire difference in project cost over the Base Plan, or (2) in the case of beneficial use, non-Federal sponsorship and applicability of another USACE program authority (including benefit-cost analysis and environmental acceptability), that would allow Federal participation in a share of the difference in cost over the Base Plan.

Actual decisions on the Federal Base Plan and any alternative Recommended Plan would be made as projects are funded and investigated in the future. These projects would each need to conduct investigations on sediment suitability and placement site acceptability, prepare any NEPA and decision documents, provide for adequate public involvement and review, secure any necessary Federal and state agency regulatory approvals, and secure Federal and sponsor funds for implementation.

Unsuitable Materials: The most likely cost-effective and environmentally acceptable alternative for placement of unsuitable dredged materials (3 to 4 percent of all the material generated in LIS) is creation of CAD cells in the harbors generating those materials, or use of former borrow pits within harbors as CAD cells, with adequate capping when filling is complete. For Federal navigation project maintenance the cost of creating and or capping these cells or pits would require cost-sharing. Non-Federal sponsors could also fully fund expansion of these cells beyond Federal project needs to accommodate materials from non-Federal projects.

Sandy (Coarse Grained) Material: Sandy material in LIS is coarse grained material of generally up to 20 percent fines when used for direct beach placement, or up to 40 percent fines when used for nearshore bar/berm nourishment. In general the most likely cost-effective and environmentally acceptable method for placement of clean sandy material (about 19 to 20 percent of the material generated in LIS) is beach or nearshore bar/berm nourishment. Even where this is not the base plan for a particular project, it is likely that non-Federal funding would be made available to use this material as nourishment. Sandy material has a high value as nourishment or in other coastal resiliency applications, and recent experience is that state and local governments as wells as property owners groups, are willing to fund the additional cost even where there is no other Federal project authority to assist in that cost, primarily as placement of dredged sand is typically far less costly than acquiring sand from an upland source.

Suitable Fine-Grained Material: Suitable material is that found suitable for open water placement through testing and analysis. Fine grained material in LIS is typically clay and silty material of more than 20 to 40 percent fines that is not suitable for beach or nearshore placement. For 82 percent of the Federal projects and project segments generating 77 percent of the regions fine-grained dredged sediments found suitable for open water placement through testing and evaluation, the most likely cost-effective and environmentally acceptable method of placement is at open water sites. Use of the one COW site, and on-shore or in-river placement of materials dredged from Upper River channels are the likely base plans for the remaining 18 percent of such projects. Beneficial uses such as marsh creation, while more expensive, should be examined for specific groups of projects to determine if environmental and/or other benefits may offset the incremental project cost sufficiently to warrant Federal participation under one or more of the other authorities discussed in Chapter 6. If the states wish to pursue additional alternatives for these materials, such as CDF construction, one or more of the sites identified in this DMMP can be examined in greater detail to better estimate costs and determine if cost-sharing is warranted.

7.1.2 Source Reduction

The LIS DMMP is intended to help achieve the goal of "reducing or eliminating the disposal of dredged material in Long Island Sound." EPA and state environmental agencies have extensive authorities under the Clean Water Act (CWA) and associated state laws to reduce sediment and contaminant loading to the watersheds that drain to LIS, and they have a long and successful track record of reducing these loads since these laws came into effect in the 1970s. Permitting of storm water discharges under the CWA National Pollutant Discharge Elimination System, pretreatment of commercial wastewater before entering a municipal wastewater conveyance

system, and nonpoint source management programs have led to significant reductions in both sediment and contaminant loading to Long Island Sound and its tributaries. Section 4.9.2 of the DMMP details the programs in place towards this goal within the LIS watersheds.
Efforts to control sediment entering the waterways can reduce the need for maintenance dredging of harbor features and facilities by reducing shoaling rates. This could either reduce the volumes dredged in each maintenance operation or reduce the frequency of maintenance. Efforts to prevent introduction of contaminants into the watershed can result in reduced contaminant levels in sediments which can increase the range of options available to beneficially use those sediments. Continued source reduction efforts for both sediment and contaminants will assist in further reducing the need for open water placement of dredged material in LIS. Federal, State and local agencies tasked with regulating those discharges into the watershed should continue to pursue and strengthen those efforts.

Many commenters on the draft DMMP, including New York state agencies, believe that the USACE should have done more extensive investigations of upland sources of sediment and contaminants and defined measures that it would use to manage and reduce those inputs to the watershed. However, these activities are not within the authority of the USACE to regulate beyond those measures already taken to limit sediment input from permitted activities under the USACE regulatory program. Further investigation, regulation and enforcement of these activities and sources is currently the responsibility of the EPA and state and local governments. As Major General Riley noted in his response of March 17, 2005 to the Governors of New York and Connecticut, evaluations of reducing sediment sources and contaminant loadings in the watersheds are beyond the typical scope that can be funded by a USACE DMMP, but that those studies could be included if the states agreed to fund them. EPA and the states of NY and CT agreed to conduct that work themselves and the results of their efforts related to sediment and contaminant reduction are included as Appendix E to the DMMP/PEIS. The DMMP recommends that EPA and the states continue their efforts to control discharges of sediment and contaminants in the watersheds of LIS.

7.2 Procedures

The 2005 Rule's requirement for developing procedures for using placement alternatives can best be advanced through continuation of the LIS RDT and expansion of its geographic scope to cover placement opportunities in the entire LIS region.

7.2.1 Long Island Sound Regional Dredging Team

The Federal-state agency partnership that is the Long Island Sound Regional Dredging Team, originally established pursuant to EPA's 2005 rule-making designating the CLDS and WLDS, should be continued. Under the Rule, and the RDT's charter, the RDT was to operate for the duration of the DMMP, however it will be critical for successful implementation of the DMMP's recommendations for the RDT to continue its collaborative efforts. Regional dredging teams are important tools in managing dredged material placement on a regional basis and in developing practicable cost-effective beneficial use alternatives and building the case for the partnerships and funding needed to implement those alternatives. From a Federal agency perspective (due to the requirements of the Federal Advisory Committee Act) an RDT cannot exercise regulatory authority, advise, make recommendations, or supplant the authority of its member agencies, the collaborative nature of the team should provide those agencies with more information and greater options for their evaluations and decision-making on the projects and applications for approval before them for action. For efforts to reduce the need for open water placement to be successful, the member agencies must be committed to a robust Sound-wide RDT for projects subject to MPRSA. Each agency should program sufficient funding to enable its active participation in the RDT. Specific recommendations for the RDT to meet its charge to reduce, wherever practicable, the open-water disposal of dredged material, are outlined below. The first four recommendations cover RDT membership and outreach, and the scope of the RDT's review of projects both geographically and by project type. The other recommendations cover long-term tasks assigned to the RDT and its state agency members.

- The RDT's geographic scope has been limited to projects subject to MPRSA (Ambro Amendment) restrictions, and those projects seeking to use the CLDS and WLDS. If the EPA does, as is expected, designate one or more open water placement sites in eastern LIS waters, then the geographic range of the LIS RDT should be expanded to include all of LIS and adjacent waters inside the territorial sea (3 mile limit), or in other words from Throgs Neck to a line three miles east of the baseline across western Block Island Sound. That would encompass all harbors and areas included in this study except Block Island.

- The RDT should make efforts to engage those agencies which have not actively participated in the RDT to this point; the U.S. Navy, U.S. Coast Guard, U.S. Fish and Wildlife Service, County level public works and environment officials in New York, and the new Connecticut State Port Authority. These agencies should be encouraged to join the RDT, or at a minimum participate in RDT investigation of alternatives that may apply to their own actions. The Commander, Naval Submarine Base New London, in a letter dated October 9, 2015 stated that the Navy welcomed the opportunity to engage with the RDT.

- The RDT should seek input from the member organizations of the Technical Working Group for the DMMP, as well as the Long Island Sound Study (LISS, part of EPA's National Estuary Program) Science and Technical Advisory Committee (STAC) and Citizens Advisory Committee (CAC), in examining the potential costs and practicability of the many placement alternatives and beneficial uses identified in the DMMP, and help identify other alternatives that may come up.

- The LIS RDT might also consider retaining the Technical Working Group as a means of apprising the NGOs and interest groups in the progress being made on beneficial use alternatives, aiding in soliciting public views on new alternatives that may arise, and in general showing a collaborative interstate and interagency public face to dredged material management issues and practices in LIS. The LISS CAC could also be used in this regard, whether or not the DMMP Technical Working Group is retained.

- The RDT should review the alternatives analysis for all projects submitted, to help ensure that practicable alternatives as described in the DMMP for each harbor and dredging center have been thoroughly evaluated and are implemented where practicable.

- The member agencies of the RDT, particularly at the state level, should develop proposals for implementation and prioritization of beneficial use options and other non-open water alternatives. The RDT and its member agencies should examine strategies for making these alternatives more affordable (cost-effective). The agencies should present their ideas and findings to the RDT for discussion.

- The RDT's state agency members should investigate those placement opportunities which consensus shows have merit and are practicable cost-effective solutions. The states should champion funding to pursue cost-sharing opportunities for implementing such alternatives. Where a Federal authority and interest exists in such investigations, the USACE may partner with the States and local governments in the study, design, and construction of some beneficial use opportunities.

- The RDT should further investigate and develop, where practicable, opportunities for approving and funding long-term regional CDFs which could accommodate suitable and unsuitable dredged materials and provide environmental and social benefits as parkland and habitat once filled and closed.

- The LIS RDT must also have a central role in each of the four following long-term recommendations. However, even in the event the RDT is not continued, the USACE and EPA should work cooperatively to implement these recommendations.

7.3 Ongoing Activities

There are a number of ongoing activities concerning dredged material placement supported by the USACE and EPA, some which include state participation, which should be continued. The LIS RDT and its member agencies can assist in promoting and improving these activities.

7.3.1 Dredged Material Tracking System

The USACE-NAE maintains a detailed database of its FNP studies, improvement and maintenance activities undertaken since the 1800s. The USACE-NAN has records of much of its activities in the 1900s through the present. For NAE's navigation program all planning feasibility studies, all Congressional documents, all dredging specifications since the late 1940s, all NEPA documents, and all reports produced by the DAMOS program are available in electronic format (PDF). The dredging histories of each NAE FNP have been developed in detail, and the placement history can be tracked for more than seven decades. However, records of similar information for non-USACE activities are not as extensive.

One of the problems that consumed considerable time and effort in this DMMP study was determining what projects had been dredged, how much yardage was actually removed, when dredging was accomplished, and where the material was placed. Records are incomplete or non-existent for projects that do not use open water placement. Records kept for Federal projects are different in the two Corps Districts, and detailed information was lost from damage caused by Hurricane Sandy to NAN facilities at New York Harbor. Further, it would be easier to evaluate the impacts, cost, and effectiveness of placement alternatives if examples of what was currently being done were available to provide information and help make the case on the practicability of various placement sites and methods, and best management practices followed.

The LIS RDT can assist in improving data collection and availability. Federal and state regulatory approvals for all dredging projects, regardless of project size and placement method, should include a requirement to submit post-project information regarding dredged material type, dates of work, volume removed, placement sites and methods, and monitoring of impacts. Sediment quality data on each project should also be maintained and provided with those records. All of the permitting agencies represented on the RDT should collect this information, and a single agency should assemble and report on the records annually. Each RDT agency should have a point of contact specified for dredging records collection and maintenance. The USACE-NAE, through its DAMOS program, can act as the agency responsible for assembling all submitted information and maintaining a long-term database, and the EPA can continue its role in producing an annual report to the RDT on dredging and placement activities in LIS.

7.3.2 Examine the Long-Term Impacts of Open Water Placement

For more than 35 years the Corps DAMOS program has studied and closely monitored the impacts of open water placement of dredged sediments in New England, including Long Island Sound. All four of the currently active sites (WLDS, CLDS, CSDS and NLDS) have been extensively studied for subjects such as mound stability, cap integrity, benthic community recovery, and fisheries resources. EPA and other agencies have also extensively studied the sites and the issues raised with their continued use. The dredged material evaluation procedures followed by the Corps, EPA and others under the regulations and guidelines implementing MPRSA and the CWA are comprehensive and insure that unsuitable materials posing a risk to the environment are not placed in open water. Yet the principal disagreement concerning the management of dredged material in LIS remains; whether open water placement of any fine-grained material, no matter what the testing and studies show, is an environmentally acceptable practice. The Corps believes, with the body of evidence available today, the safeguards of the present testing and evaluation requirements, and continued monitoring of the sites and the Sound, that open water placement of materials deemed suitable for such, is an environmentally acceptable practice, and in most cases, the most cost-effective method available.

There are significant differences of opinion between the states and agencies on the technical issues surrounding the impacts of open water placement. Continued scientific analysis is the only way to address the questions surrounding environmental impact and acceptability. There is a substantial body of science and study on the subject of dredged material placement in the Sound, with most work in recent decades focusing on the four currently active placement sites and their long-term reference stations. While these determinations adequately address the suitability of specific materials for placement and guide the management of the sites, there are lines of inquiry that could assist in addressing the question of the long-term environmental acceptability of open water placement.

- EPA and others have made efforts to compare contaminant concentrations in tissues of marine organisms collected from the active sites and their reference areas. However, a more Sound-wide study of areas beyond the active sites, including the more heavily used historic sites, the New York City garbage dump sites in the western Sound, areas removed from active and historic placement sites, and control locations outside of the Sound, could provide useful information regarding the overall health of the Sound and long-term impacts of historic placement actions.

- The historic placement sites (i.e. Stamford, Norwalk, Eaton's Neck, Bridgeport, Milford, Orient, etc.) were all closed in the late 1970s or earlier, thus material that was placed in these sites did not undergo the rigorous testing and evaluation that dredged materials are subject to today. Few of these areas have been surveyed to determine if mounds are still present, to determine if more contaminated sediments are present and exposed or have been moved off-site, or whether the benthic community has recovered to levels comparable to areas not impacted by dredged material. Some of the more heavily used historic sites that may have received materials that likely could not be found suitable today (Stamford, the two Norwalk sites, Eaton's Neck) should be studied to provide information on these topics.

- The state of New York has raised the issue of the impact of active placement sites on recreational and commercial fishing and the economic impact of reduced activity in those sectors due to site use and presence. While the four active sites occupy a total area of about six square nautical miles, and the dredging season covers six months of the year, the sites are actively fished, especially the two eastern sites. An examination of fishing activity and catch yields at the sites, within their vicinity, and in areas of the Sound removed from the sites could provide useful information concerning this question.

The Corps DAMOS program, and EPA's funding of studies to support periodic updates of site management and monitoring plans, provide a means for Federal participation in these long-term ongoing studies. Any major efforts above and beyond current DAMOS and EPA-funded studies would require additional funding so as not to neglect the programs' responsibilities in other areas of the region. The RDT can assist in promoting these continued investigations, and in bring other groups and resources into these efforts, such as through the LIS Study, and Sea Grant and University funded activities. The RDT and the DAMOS Program can engage these groups as a scientific forum to review the state of the science on long-term impacts of open water placement, and make recommendations on the focus of future study efforts, monitoring, and best management practices for placement actions.

7.3.3 Efforts to Support Opportunities for Using Dredged Parent Materials

As described earlier, major improvement dredging projects and CAD cell excavation in New England waters most often yield clean dredged materials of pre-industrial origin, largely glacial tills and marine clays. It has become common practice in recent decades to use such parent improvement dredging materials beneficially for habitat creation/enhancement and in capping older (pre-CWA/pre-MPRSA) deposits of historic placed materials. The RDT agencies and the states can assist in promoting these ongoing activities by examining the potential to use these materials in LIS in a cost-effective and beneficial manner. A number of the historic open water placement sites, as described above, likely received dredged materials that would not be approved for placement in open water under today's procedures. Efforts should be made to examine the most likely of these sites to determine if remedial capping using these parent materials might be warranted. Large scale improvement projects do not occur often, so the availability of large volumes of clean cap material can present a rare opportunity to address such issues.

7.3.4 Continued Support for Beneficial Use Opportunities

Existing USACE policy promotes the beneficial use of dredged material. USACE FNP activities, whether maintenance or improvement, must consider opportunities for beneficial use, determine if other Federal authorities provide a means for Federal participation in the incremental cost, identify non-Federal cost-sharing partners, and determine the economic and environmental justification for Federal participation. In the LIS region the states of CT and NY have participated in beneficial use projects, both through cost-sharing where Federal interest was warranted, and by providing full non-Federal funding in other cases. These activities are expected to continue in the future, but could be assisted through the involvement of the LIS RDT. It is in part through these efforts that the volume of open water placement in LIS has been reduced in the past several years.

This DMMP has identified a number of beach and nearshore placement sites that may benefit from receipt of sandy dredged material as nourishment, either as Federal Base Plans for particular harbors, or as plans requiring non-Federal incremental funding or cost-sharing. The States should examine the site inventory and the relative estimated cost differences, and begin to prioritize those sites where they are willing and capable of supporting such activities, either now or at some point during the 30-year period. The Corps can then work with the States as sponsors to determine if Federal participation in the incremental costs is warranted under other Corps authorities, and if so what cost-sharing and other partnership requirements may apply. When it comes to opportunities beyond the base plans, studies and the incremental cost of implementation may be eligible for Federal participation, but the Sponsors must take the lead as the Corps does not have the authority to be a project proponent.

Similar to the issue of beach and nearshore nourishment, whether or not to pursue other environmental and coastal resiliency beneficial uses must be championed by non-Federal sponsors. Marsh creation, land elevation, dune construction and other uses must be considered by the states and prioritized, after careful consideration of the estimated costs and expected benefits to the economy and environment.

The LIS RDT can and should be used as a sounding board to bring forward and discuss these opportunities and provide the means to evaluate, build public support for, and implement those proposals deemed likely to meet regulatory scrutiny and approval. Other groups such as the LIS DMMP Work Group participants, and the LIS Study TAC and CAC should also be consulted in this process. It is recognized that the states of CT and NY have already begun discussing these issues, and those states should make efforts to include RI in those discussions going forward, as the Little Narragansett Bay and Westerly area contains one potential marsh creation site and several beach and nearshore nourishment sites.

7.4 Summary of Recommendations

In summary, the USACE preferred alternative is to implement the recommendations of the Long Island Sound Dredged Material Management Plan. The several recommendations made by the LIS DMMP for the development of procedures and standards for the use of practicable alternatives to open water placement in LIS, and for continuation and improvement of ongoing activities concerning dredged material placement in LIS, all contributing to the goal of reducing or eliminating the need for open water placement of dredged material in LIS, are summarized as follows:

Standards

- As Federal projects are funded for study, design and construction this DMMP should be consulted as to the likely Federal Base Plan and alternatives. The NEPA process for each project should examine those base plans and alternatives with more specificity to determine which placement method should be recommended for each project considering engineering feasibility, cost-effectiveness, any non-economic benefits, the willingness and capability of non-Federal sponsors to meet their responsibilities, and other aspects of practicability. If the dredged material is suitable for open water placement, open water placement is the base plan, and no practicable alternatives are implementable, then the base plan should be followed.

- The agencies and states should continue their efforts to reduce sediment and contaminants in the LIS watersheds. The states, counties, and municipalities should continue their regulatory efforts to reduce the introduction of sediment and contaminants of the LIS watersheds that contribute to shoaling of harbors and coastal waters and to the contaminant load in those sediments. These may include frequent catch basin and storm drain maintenance and cleaning, street sweeping, and the many other programs and practices in coastal and watershed communities as outlined in Appendix E.

- Non-Federal dredging project proponents (non-Federal applicants for permits under the CWA and MPRSA) should use this DMMP as a framework for scoping their own investigation of placement alternatives as their projects are planned, designed and submitted to the LIS RDT for input, and to the Federal and state regulatory processes.

Procedures

- The Long Island Sound Regional Dredging Team should be continued. The RDT's geographic range should be expanded to include all areas of LIS including those inside the territorial sea in western Block Island Sound. The RDT should also be used by its member agencies to put forth, discuss and examine opportunities to further reduce the need for open water placement of dredged material in LIS, and to identify means for funding and implementing alternatives to open water placement, with a focus on beneficial use.

- The LIS RDT should enlist the participation of other Federal and state agencies with activities and regulatory responsibilities concerning dredging and dredged material placement alternatives, including the US Navy, USCG, and US F&WS.

- The LIS RDT should seek input from other organizations such as the DMMP Technical Working Group participants, the LISS STAC and CAC, universities and other interests concerning identification, evaluation, prioritization of study and funding for alternatives to open water placement.

- The RDT should review the alternatives analysis for all projects submitted for its consideration, to help ensure that alternatives to open water placement are implemented where practicable.

- The USACE should periodically review the LIS DMMP as any new regional disposal facilities are constructed, new regional beneficial use opportunities are proposed for projects, any significant advances are made in practicable cost-effective treatment and placement options are made, or the understanding of the impacts of any placement alternatives changes sufficiently to impact these recommendations. Any modifications to the DMMP should be submitted to the RDT members for review and comment.

Continue and Improve Ongoing Activities

- The USACE-NAE database for FNP dredging and placement activity should be continued and improved, with the assistance of the RDT and its member agencies, to provide a means of collecting, reporting on and maintaining information on all dredging and dredged material placement and use activities in Long Island Sound from all three states, whether approved under Federal or state procedures. This will serve as a regional tracking system of dredged material, and provide examples of real-world application of placement alternatives.

- The USACE and EPA ongoing efforts through the DAMOS Program and SMMP updates should continue. These efforts should also be improved, with the assistance of the RDT, its member agencies, and universities to target data collection and studies to better address the question of the long-term impacts and acceptability of past and continued open water placement of dredged materials in Long Island Sound. As this is the key point of disagreement between the agencies and the states, closer inspection may yield a better understanding of the matter. Chemical and biological data and information, whether from the current literature or collected in the near term, should be compiled to evaluate the health of the Sound at the active and historic placement sites, the Sound as a whole, and adjacent waters for comparison.

- The USACE and EPA should continue their ongoing practice in New England waters of considering opportunities for beneficial use of parent materials removed in future major improvement dredging projects, and CAD cell construction projects, with a focus on capping of historic open water placement sites.

- The USACE and the states should continue their recent ongoing efforts to reduce open water placement through implementation of beneficial use opportunities. Efforts should be made to examine the additional opportunities for beneficial use identified in this study, evaluate those opportunities, prioritize them according to the states willingness and capability to approve and implement, and work with the Corps to determine what opportunities for Federal cost-sharing participation may exist.

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