**Draft Environmental Impact Report (EOEA File Number 8695)**
**and**
**Draft Environmental Impact Statement**
**Volume 1 of 2**

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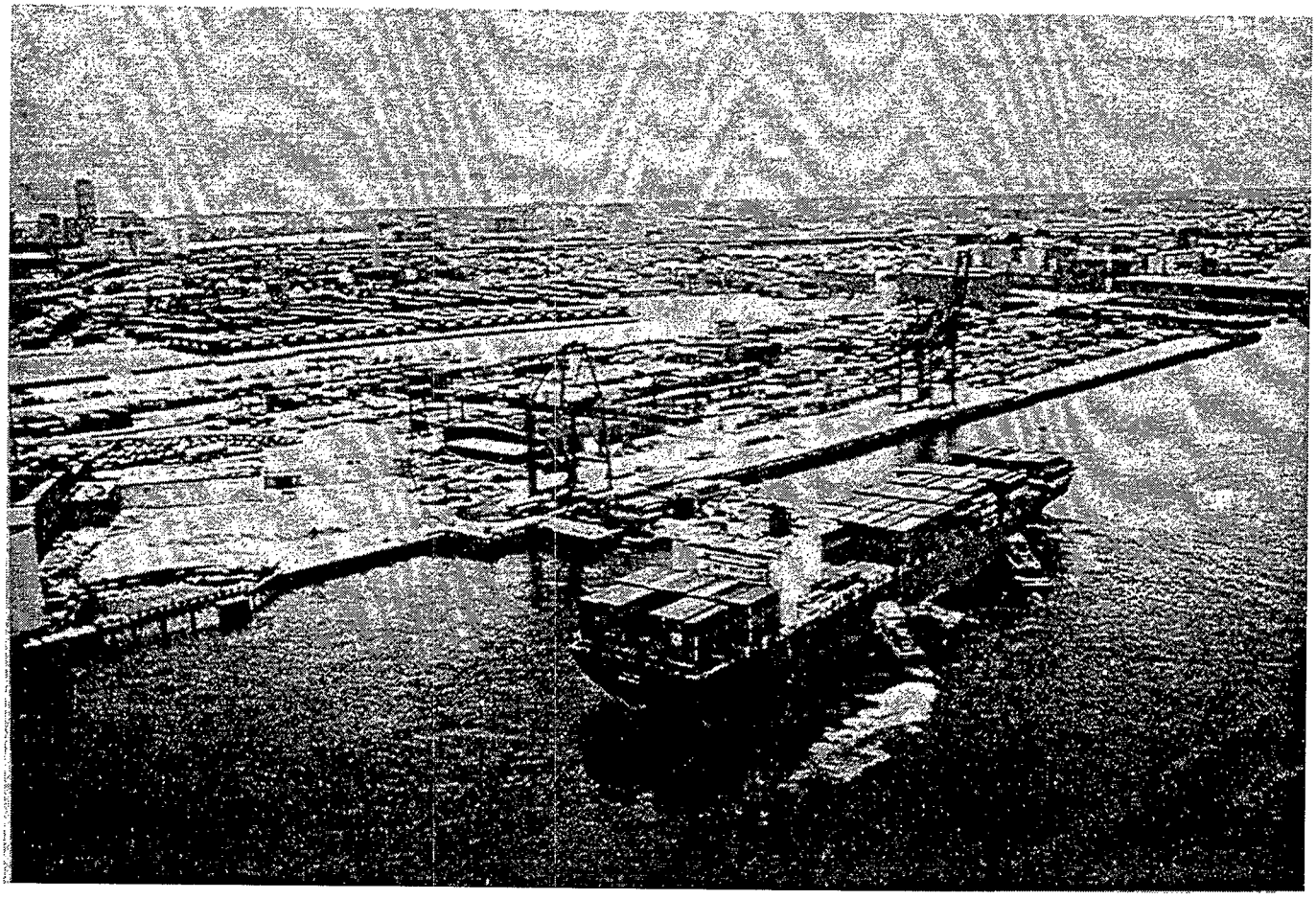
# Boston Harbor, Massachusetts

## Navigation Improvement Project and Berth Dredging Project



**April 1994**

**US Army Corps of Engineers**
New England Division

**Massachusetts Port Authority**
Maritime Department

**DRAFT**
**ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT**
**(DEIR/S)**

**Volume 1 of 2**
**APRIL 1994**

# BOSTON HARBOR NAVIGATION IMPROVEMENT DREDGING BERTH DREDGING PROJECT

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This joint Federal and State document addresses the impacts associated with the Congressionally authorized navigation improvement dredging and disposal of material from the Federal navigation channel and associated berthing areas in Boston Harbor, Massachusetts. The Reserved Channel and Mystic River would be deepened from 35 feet mean low water (MLW) to 40 feet MLW. The Chelsea Creek would be deepened from 35 feet MLW to 38 feet MLW. Disposal of the underlying parent material is proposed at the Massachusetts Bay Disposal Site. Disposal alternatives for the silt material (maintenance material) overtopping the parent material are assessed in this DEIR/S.

Comments should be sent to Colonel Miller at the U.S Army Corps of Engineers and Ms. Trudy Coxe, Secretary, Executive Office of Environmental Affairs, Commonwealth of Massachusetts by the date indicated in the transmittal letter. If you would like further information on this document, Mr. Peter Jackson of the U.S. Army Corps of Engineers can be reached at (617) 647-8861 or contact Ms. Janeen Hansen, Massport, at (617) 973-5355.

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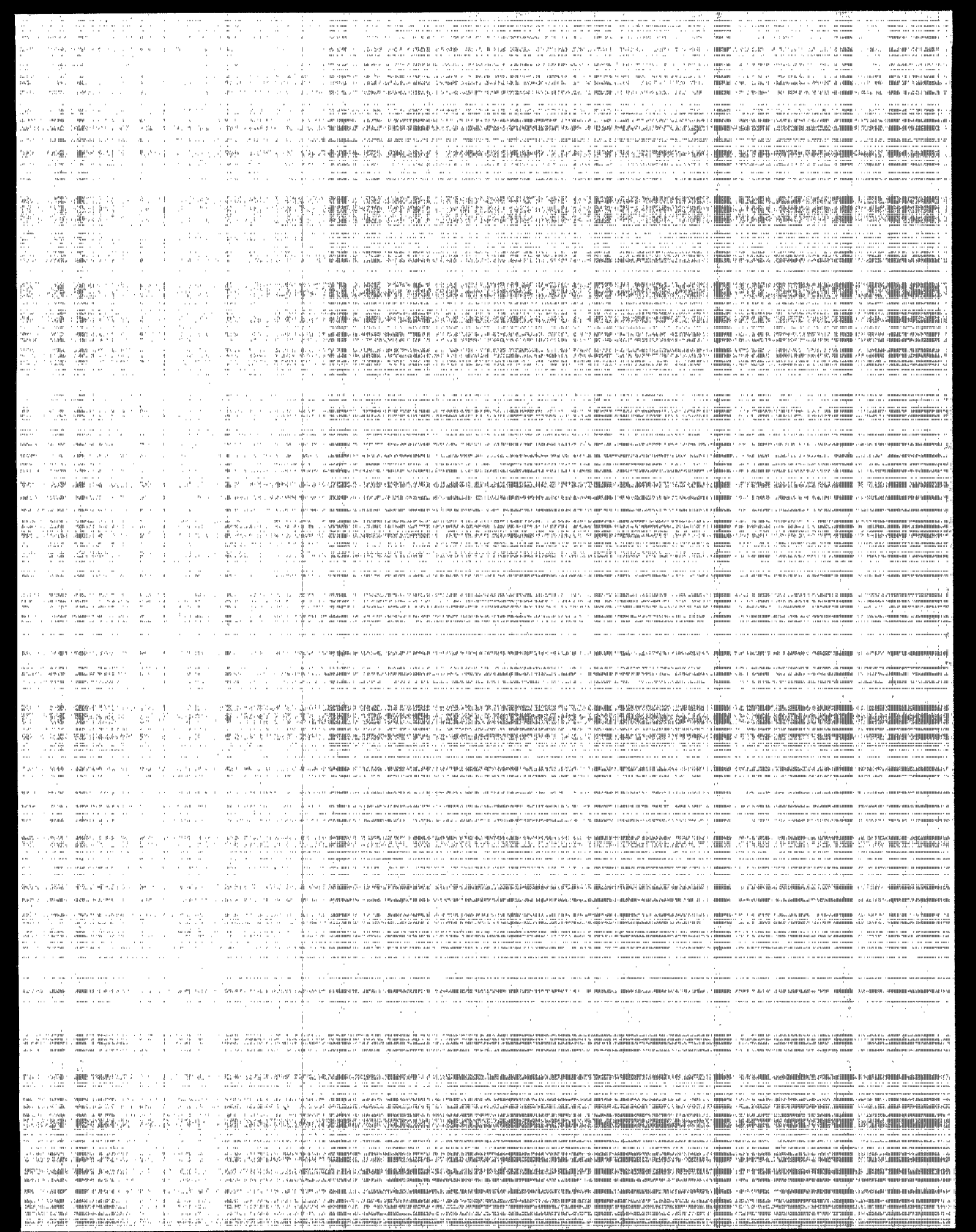

# BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT DRAFT ENVIRONMENTAL IMPACT REPORT/STATEMENT

## EXECUTIVE SUMMARY

### Project Description

The Boston Harbor Navigation Improvement and Berth Dredging Projects (BHNIP) encompass the deepening of three tributary channels (Reserved Channel, Mystic River Channel and Chelsea Creek Channel) and two areas in the Main Ship Channel (Inner Confluence and the mouth of Reserved Channel) to provide sufficient ship maneuvering areas for the deepened channels; six berth areas that would benefit directly from the channel deepening (Conley 11-13, Prolerized, Distrigas, Moran, Eastern Minerals and Gulf Oil); and six berth areas and one intake structure that would not benefit directly from (i.e., be connected to) the channel deepening (Boston Army, Boston Edison Intake, Boston Edison Barge, Conley 14-15, Revere Sugar, Mystic Piers 1, 2, 49 and 50). The President Roads Anchorage Area and adjacent channels would be re-marked to enlarge the deep water anchorage without additional dredging. Deepening of the channels to -40 ft MLW (except Chelsea Channel to -38 ft MLW) would allow greater use of the hitherto underutilized -40 ft MLW Entrance Channel and Main Ship Channel (see Figure ES-1).

The improvements to the three Federal channels were proposed as a result of a Feasibility Study completed by the Corps of Engineers. The three-channel project was selected as the economically and environmentally preferred project alternative. It was authorized by Congress in the Water Resources Development Act of 1990 (P.L. 101-640). The authorized project would allow the Port of Boston to maintain its competitiveness in the highly competitive national and international marine trade business by reducing the cost of transporting goods and thus improving efficiency.

Massachusetts Port Authority (Massport), as local sponsor of the project, submitted an Environmental Notification Form (ENF) to Massachusetts Executive Office of Environmental Affairs in April 1991. The Secretary's Certificate on the ENF required the preparation of an Environmental Impact Report (EIR) with three major areas of focus:

- sediment characterization,
- evaluation of disposal alternatives and
- a dredging management plan.

The Corps of Engineers, New England Division, committed to preparing an EIS in 1992 due to the cumulative impacts of Federal actions (maintenance dredging, navigation improvement dredging, and permitting of the associated berthing areas) and the significant public concern over disposal of dredged material. Because the channel improvement and berth dredging projects are intricately linked and interdependent and would be reviewed by the same regulatory audience, it was determined that preparation of a joint Environmental Impact Report/Statement (EIR/S) would be most efficient.

### Public Participation

Massport, the project's local sponsor, and the Corps of Engineers recognized the need to involve key agencies and groups in the planning process through consultation, information exchange and presentation of diverse viewpoints. In March 1992, Massport formally invited thirty-five federal, state and local agencies and public and private interest groups to participate in a project Advisory Committee. The Committee's function was to advise Massport and the Corps of

how/ where did they get 4.4 mcy future maint. 1.3 mcy silt (contam) 2 mcy parent (clean)

Engineers in the overall design and planning of environmental studies which would form the basis of the environmental review. The Committee met seven times over the course of the studies leading to the preparation of this EIR/S.

Early in the public participation process two specific technical issues were identified as those which would benefit from a more focused analysis and review than that which could be provided by the Advisory Committee. As a result, two Working Groups were formed as subsets of the Advisory Committee to provide guidance and expertise in : 1) sediment characterization; and 2) disposal site identification and screening. Through the course of the project these Working Groups, and the larger Advisory Committee, provided valuable commentary on sampling and testing protocols and information on identifying and characterizing disposal sites. The Working Group process contributed in creating a dynamic and responsive work product by increasing the scope of the sediment sampling and testing and expanding the types of disposal options and specific disposal sites to be screened for the project.

## Sediment Characterization

The BHNIP will result in approximately 1.3 million cubic yards (cy) of silt requiring disposal. This quantity includes approximately 0:5 ft of underlying parent material and a (post-dredging) estimated expansion factor of 20%. An extensive sediment sampling and testing program, developed interactively with the Sediment Characterization Working Group, was undertaken to characterize the dredged material. The surficial silt layer (or "maintenance" material) was found to contain varying concentrations of metals, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), other organics. The sediment bulk chemistry data, in combination with test organism toxicity and bioaccumulation testing, indicated that the silt was generally not suitable for unconfined open water disposal. It was further determined that the underlying sediment (parent material) was composed of clay and sand/gravel which generally has low levels of metals and organics. For the purposes of providing sufficient capacity among disposal alternatives it was assumed that all the silt material would not be suitable for unconfined open water disposal and that only confined open water disposal or confined land-based alternatives would be evaluated as potential disposal options.

The underlying parent material, composed primarily of Boston Blue Clay with gravel pockets, has been shown on this and other projects to be uncontaminated and suitable for unconfined open water disposal. The total volume of approximately 2 million cy of parent material (including the expansion factor) can be disposed at an unconfined open water site if no beneficial use (e.g., landfill and/or sediment capping) are identified. The final component of the dredged material is rock that would be removed from Mystic River Channel and two areas of the Main Ship Channel. Beneficial uses considered for the 132,000 cy (post-dredging volume) of rock included habitat enhancement.

In addition to addressing the dredged material disposal ~~needs for the~~ BHNIP itself, disposition of the future maintenance of the deepened channels over the 50 year project life was addressed. The estimated 4.4 million cy of future maintenance material would be composed primarily of silt. For the purpose of the disposal alternatives analysis, it has been assumed that this material could contain elevated levels of contaminants. Under this assumption (which may or may not be the case), the material would have to be deposited in a confined disposal site.

## Disposal Alternatives Analysis

A Disposal Options Working Group was convened to develop criteria for evaluation of the universe of potential disposal sites and beneficial uses of parent material, rock, silt and future maintenance dredging material. The group participated in the disposal site selection process at regular intervals, reviewing argu-

cost

nents for retaining or eliminating specific sites. The hort list of potential disposal alternatives included ites in two major categories, land-based and aquatic ites, and eight subcategories: landfills, land-based nland, land-based coastal, aquatic shoreline, aquatic ubaqueous, aquatic borrow pit, existing aquatic lisposal sites, in-channel disposal and one treatment echnology. All disposal alternatives would provide containment of the silt: the upland sites through dilution with other soil material or burial; the shoreline sites through bulkheading and capping; and the other aquatic sites through capping.

The disposal alternatives analysis screening process was comprised of three phases. In the first phase, comparisons were made using evaluation criteria among sites within each alternative category (i.e., andfills were evaluated together but not compared to aquatic shoreline sites). A subsequent evaluation focussed on regulatory and other limiting criteria to select the sites which provided the least environmental mpact with the greatest project benefit. Finally, sites were screened for practicability issues of cost, logistics and technology in relation to project needs and goals. From an initial list of 376 sites and eight treatment echnologies, 24 sites and one treatment technology remained under consideration as disposal alternatives after the screening process (Figure ES-2).

The development of disposal options next focused on combining sites to meet the capacity requirements of the project. This evaluation emphasized the fact that few sites are large enough to accommodate the disposal needs of the BHNIP by themselves. Finally, an evaluation of options led to the development of a short-list of six practicable alternatives (see Table ES-1a). Of these six sites, five sites (Meisburger 2 and 7, Boston Lightship, Spectacle Island CAD and the Massachusetts Bay Disposal site (with capping) have the necessary capacity, individually, for the disposal of all the silt material. The sixth alternative consists capping the contaminated silts in-place in trenches within the tributary channels to be dredged.

Although not necessarily the controlling issue, cost is a factor in site screening under the definition of practicability. To put cost in perspective, a relative cost (per cy) for disposal for the silt material was developed for the various alternatives (Figure ES-3). These costs were compared against the historical method of unconfined disposal of dredged material at MBDS ($7.10/cy for silt) in accordance with MEPA directives. These costs show that the relative costs per cubic yard for the aquatic sites range from 1 to 5 times the costs for unconfined ocean disposal while the upland sites range from 5 to 14 times higher than this base. However, land acquisition costs are not included in the upland options so relative costs would be even higher. These relative costs were used in the assessment of practicability described below.

The cost of disposal of silt material at one of the full capacity sites (Meisburger 2 or 7, Boston Lightship, Spectacle Island CAD and the Massachusetts Bay Disposal site) would range from about $24 million to about $33 million. The limited capacity sites, when combined to accommodate the total volume, would cost at least $10 million more than the most expensive full capacity site.

Through the screening process, this alternatives assessment identified practicable alternatives for the three categories of dredged material: parent material (including rock), silt material and future maintenance material. Once public comment is received on this Draft EIR/S, a preferred alternative will be selected and identified in the Final EIR/S. It is possible that a single site or combination of sites could be included in the preferred disposal alternative.

While the selection of a preferred disposal alternative is not required by the Massachusetts Environmental Policy Act (MEPA), it is required under the National Environmental Policy Act (NEPA). Federal agencies (e.g., the Corps of Engineers) are required to "identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement...". In addition, the Final Rule for Operation and Mainte-

376 → 24 → 6



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nance of Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged Material into Waters of the U.S. or Ocean Waters (33 CFR 209, 335-338), states that dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404 (b)(1) evaluation process or ocean dumping criteria, will be designated the Federal standard for the proposed project. In compliance with the above regulations, the Massport and the Corps select the Massachusetts Bay Disposal Site (MBDS), the Boston Lightship, Meisburger sites 2 or 7, and Spectacle Island CAD as the preferred disposal alternatives. These sites are selected based on a totality of factors including least environmental impact, logistics, capacity and cost.

The DEIR/S is to be used also as a disposal site selection process for maintenance dredging if the proposed navigation improvement project is delayed or not implemented. Maintenance dredging of accumulated silt material will be needed to allow ships to transit the harbor safely. Unlike the navigation improvement project, maintenance dredging would not produce clean parent material which could be used for capping. Therefore, disposal options which provide cap material such as the Meisburger sites, Spectacle Island CAD and in-channel disposal are preferable. Disposal could occur at other sites if suitable cap material can be found from other projects.

## Effects of the Project

The BHNIP would have several important benefits to the Port of Boston. Vessel passage would be less dependent on tidal navigation or lightering and would enable Boston to keep pace with the changing character (i.e., larger vessels) of the world fleet. Goods would then be transported through Boston economically and would help maintain the port's competitive status in the national and world marketplace. Although the volume of cargo would not be projected to increase due to this project, improvement of the channels and berthing facilities are necessary to allow the region to remain competitive in a global marketplace. Ship passage would be less tidally restricted, thus a smooth flow and timely movement of ship traffic could be maintained. In addition, reduction in the need to lighter would reduce the potential for cargo spills and related environmental impacts.

The BHNIP should contribute to the improvement of Boston Harbor water quality by removing and isolating silts in the channels and berths that contain contaminants that are continually resuspended during storm and vessel activity. MWRA is making major strides in reducing inputs of contaminants into Boston Harbor, primarily by removing solids starting in 1992. Further improvements to Boston Harbor will occur when the secondary treatment with offshore discharge replaces the Deer Island outfall. Removing and isolating the existing silts should hasten this clean-up process.

The parent material and rock could be used beneficially for such activities as closing landfills, lining disposal sites, capping disposal sites, and enhancing or creating habitat. Demand for the material and timing with other construction projects will determine the fate of appropriate portions of the parent material. Material not used beneficially will be disposed at MBDS.

Certain adverse effects of the project would be unavoidable. Some benthic organisms and demersal fish would be killed during dredging and blasting. Substrate in the areas dredged would be temporarily devoid of benthic organisms but would be recolonized in approximately one year, reforming habitat with prey suitable for finfish. Turbidity would increase in the area of the dredge. Use of an environmental (closed) bucket would help minimize contaminant elution. Other turbidity controls, such as silt curtains, will be assessed in terms of suitability depending on the location of the dredging operation. Close monitoring of the dredging operations to identify problems and quickly seek corrective measures would be undertaken.

1½-yr dredging process

The anticipated dredging rate would generate approximately two to four barges per day, depending on whether one or two dredges were operating and the size of the barges. Thus barge traffic should not noticeably impede normal ship traffic; interferences with navigation would be minimized by coordination from the Coast Guard.

PA?

Impacts due to disposal of dredged materials would vary depending on the alternative selected. The alternatives evaluation indicated that the least environmentally damaging practicable alternative would be use of one or more aquatic sites. Practicability is defined as providing a reasonable combination of logistics, technology and cost. All potential practicable sites would be managed to provide final containment of the project silt through burial or capping. Use of these sites would involve temporary alteration of existing substrate although aquatic habitat would ultimately be maintained.

During the 1½ year dredging process benthic organisms utilizing the disposal areas would be buried, and the frequency of disposal would prevent colonization of the dredged material. Finfish should generally be displaced from the area, tending to avoid the area during disposal due to noise and turbidity disturbances. Both of these biologic disruptions would be temporary and ultimately would help reduce the potential for transfer of contaminants through the food chain in the disposal area. The benthos and fish would eventually recolonize the dredge site and will benefit from the removal of contaminated silts.

The water column in the vicinity of the disposal site would experience increased turbidity following each disposal event. Approximately three to five percent of the silt/clay fraction would be lost to the environment during the disposal descent phase. Disposal simulation model evaluations indicated that disposal at the open water sites should not cause adverse exposure (i.e., exceedances of water quality criteria) from the most conservative element (copper) to sensitive resources outside the disposal site after four hours. Use of mitigation measures to contain suspended solids and associated chemicals may be necessary to protect resources surrounding some aquatic disposal sites within the harbor.

Some of the potential sites support commercial fishing operations. Disposal would interfere with fishing but only in a very localized area compared to the fishing ground available; appropriate site restrictions and/or mitigation steps during project construction may be necessary.

## Dredge Management Plan

The DEIR/S has addressed the requirement for a Dredge Management Plan, as requested in the MEPA Scope, on two levels. The first level evaluated alternative dredging projects, including No Action with and without Maintenance Dredging, Full Project, Reduced Project, and Delayed Project. The Full Project was found to achieve the greatest benefits for the port and is the preferred option. The second level addressed implementation of the dredging and disposal activities. Until the preferred disposal alternative has been identified, the Dredge Management Plan provides general protocols for handling disposal for each generic disposal type. Methods for isolating the silt from the surrounding environment (liners, caps, bulkheads) are described. Procedures will be developed in greater detail for the preferred disposal alternative once the type and location of the preferred site(s) is identified.

## Other Actions

Two other large projects are currently under construction in Boston - the Deer Island wastewater treatment facilities upgrade and the Central Artery/ Third Harbor Tunnel (CA/T). The level of ship traffic generated by the BHNIP, its location relative to the Deer Island and CA/T projects and the anticipated schedules for the three projects should result in minimal conflicts among the projects. The Massachusetts



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Highway Department expects that the Third Harbor Tunnel excavate at Spectacle Island will be complete in 1995. As with other harbor infrastructure, coordination with the construction of the Third Harbor Tunnel would have to be carefully orchestrated. The BHNIP is expected to commence in 1996 and be completed in 1998. Coordination of ship traffic from each project by the U.S. Coast Guard will provide further safeguards. The Massachusetts Water Resources Authority (MWRA) anticipates substantial completion of the Deer Island plant upgrades by late 1995. Water quality (and ultimately sediment quality) would continue to improve with the operation of the secondary treatment and offshore disposal facilities. The BHNIP and future maintenance dredging would continue to reduce the mass of contaminants in Boston Harbor even further. The EPA's Biological Assessment for the MWRA outfall also has examined the interaction among these three projects and found that there are no cumulative impacts which would pose a threat to threatened and endangered aquatic species in the area.

## Federal and State Review

This DEIR/S will be reviewed by regulatory and resource agencies on the federal, state and local levels, as well as other interested parties for adherence to MEPA and NEPA guidelines. Comments on the draft document will be addressed in the final document.

Federal and state permits and consistency reviews ultimately required potentially include:

- ▸USACOE
  - Section 10
  - Section 404
  - Section 103
- ▸National Marine Fisheries Service
  - Endangered Species Act/ Section 7 consultation
- ▸local Conservation Commission(s)
  - Order of Conditions
- ▸Massachusetts DEP
  - Water Quality Certificate
  - Chapter 91 License
  - Division of Solid Waste Coordination
- ▸Massachusetts CZM
  - Coastal Zone Consistency

Once comments on this DEIR/S are received and reviewed, a preferred disposal option would be selected by the USACOE and the project sponsor. This and remaining issues and concerns raised in the review of the Draft EIR/S will be addressed in a Final EIR/S.

## Summary of Findings

The remaining pages of this Executive Summary consist of a figure, chart and table which highlight several key issues raised in the Draft EIR/S. As described in Figure 1, the BHNIP preferred project alternative consists of a combination of improvement dredging (deepening) of three tributary channels and two areas of the Main Ship Channel; maintenance dredging of silt from berthing and all other project areas; and non-dredging improvements to the President Roads Anchorage Area.

This project design will generate approximately 3.5 million cy of material requiring disposal. This quantity is comprised of over 2 million cy of uncontaminated parent material from the improvement dredging; 132,000 cy of rock from channel improvements, and over 1.3 million cy of silt from the maintenance dredging portion of the project.

Environmental considerations regarding disposal of the silt material, based on sediment characterization and site evaluation, resulted in the identification and screening of numerous aquatic and land-based disposal

options. Practicability considerations of each option, regarding logistics, technology and costs, relative to the capacity available at each environmentally screened potential disposal site, indicated that land based options are, overall, more costly than aquatic options and can exceed, by 14 times, the cost of disposal at the MBDS. This cost/quantity comparison is depicted in a chart represented in Figure ES-3.

The combination of environmental and practicability considerations resulted in the identification of six disposal options as listed in Table ES-1a and depicted on Figure ES-2a. This list of potential disposal sites includes those which could provide the capacity needed for the BIINIP as well as potential future disposal needs for maintenance material expected over the 50-year design life of the project. Table ES-1b lists potentially practicable sites that were evaluated against the screening criteria but which failed to meet a minimum of 200,000 cy of capacity and/or exceeded 4 times the cost per cubic yard as compared to ocean disposal (see Figure ES-2b). While not considered practicable for the BIINIP project, these sites may provide disposal capacity for future maintenance projects.

cost criteria
≥4 X cost/cy
compared to
ocean disposal

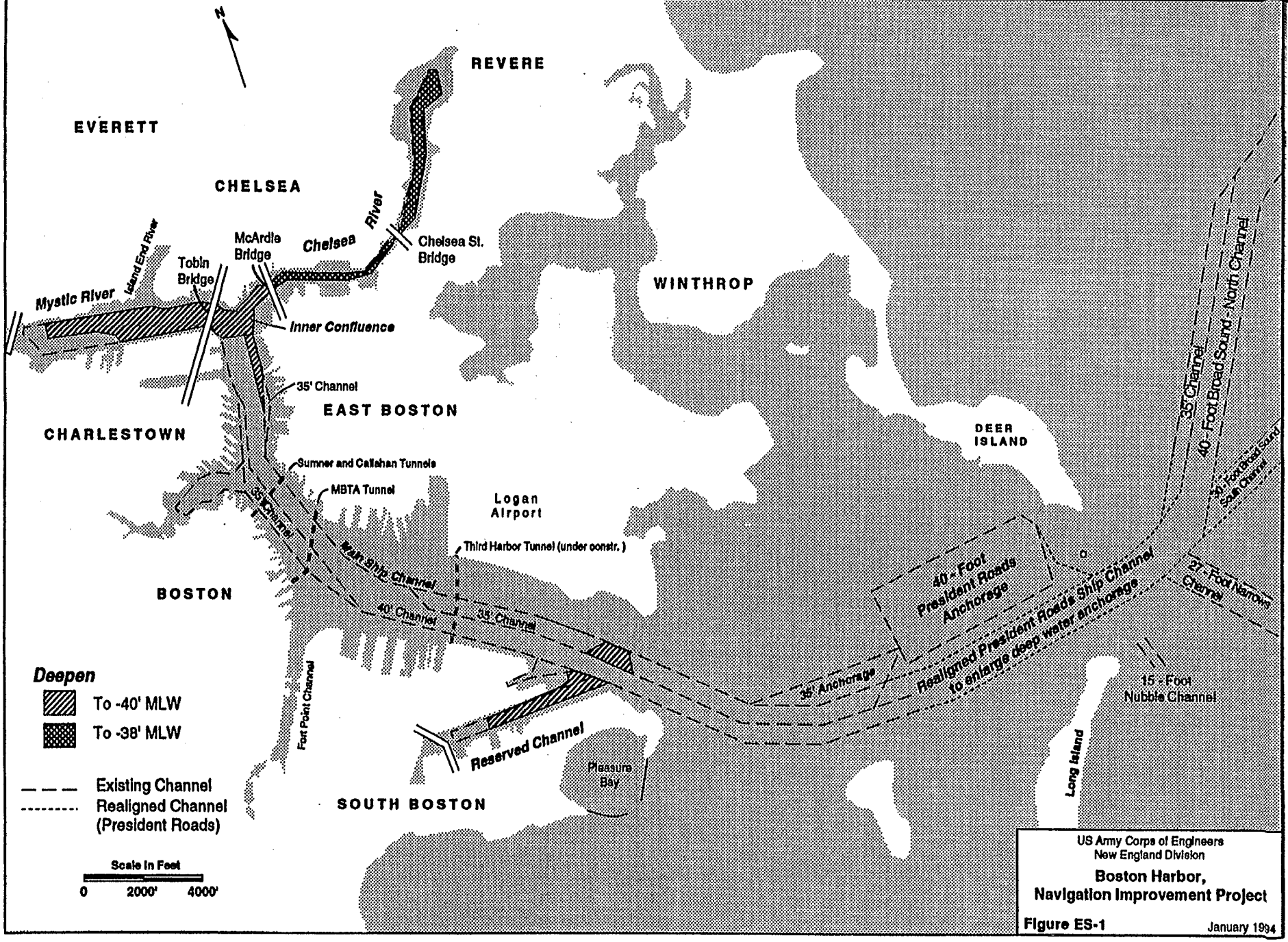
Table ES-1c (Figure ES-2c) lists the remaining sites of the 24 that survived the screening evaluation but under further analysis are neither practicable nor potentially practicable for the BIINIP project since they are not the least environmentally damaging alternatives and, or at least some of them, are cost prohibitve.

Massport and the Corps select the Massachusetts Bay Disposal Site (MBDS), Boston Lightship, Meisburger sites 2 or 7, and Spectacle Island CAD as the preferred disposal alternatives. These sites are selected based on a totality of factors including least environmental impact, logistics, capacity and cost.

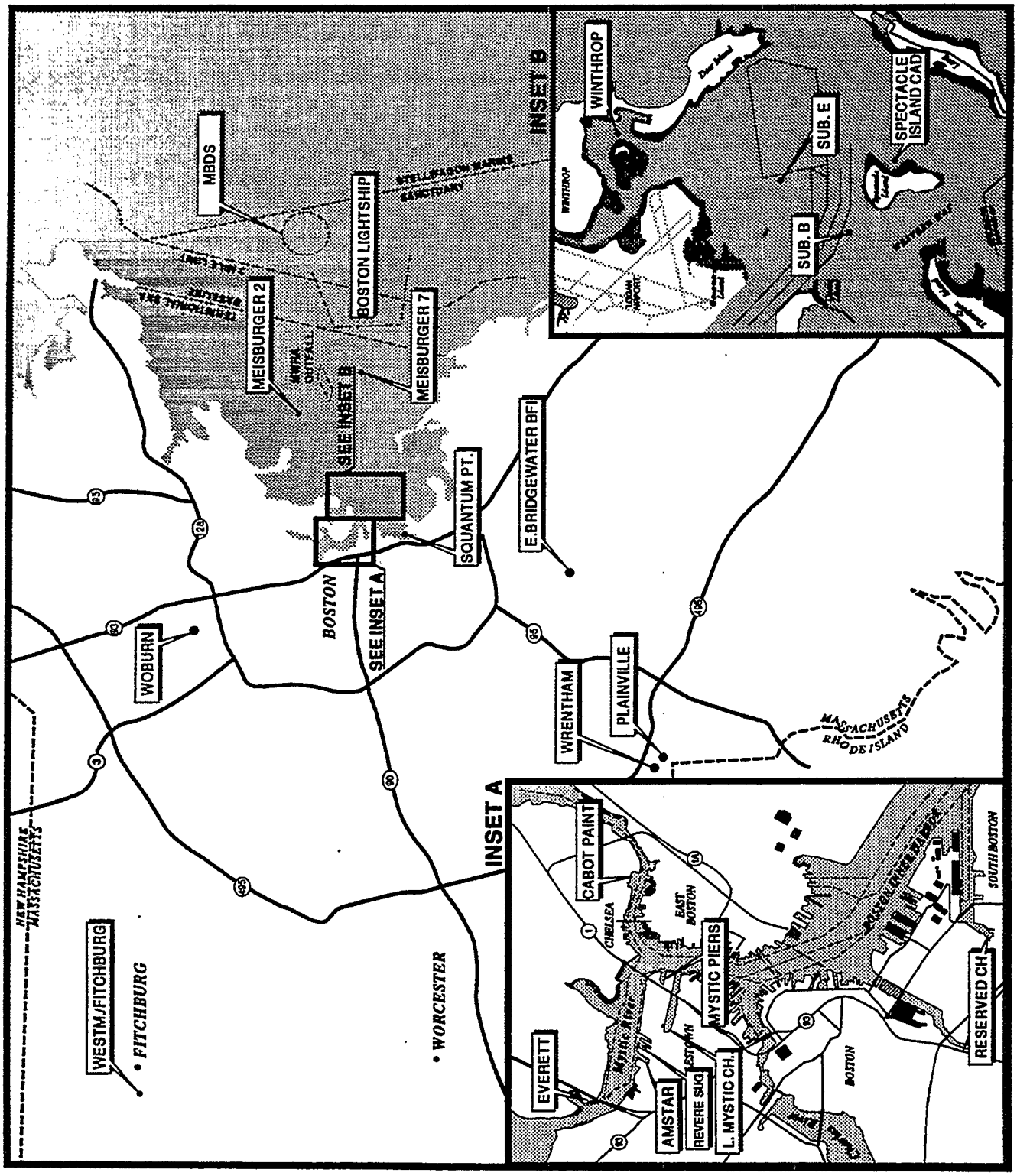
Final selection of a preferred disposal option(s) will be made based upon public comments received on this DEIR/S.



22X 21


N
REVERE
EVERETT
CHELSEA
Chelsea River
McArdle Bridge
Chelsea St. Bridge
Tobin Bridge
Island End River
Mystic River
Inner Confluence
WINTHROP
35' Channel
EAST BOSTON
CHARLESTOWN
DEER ISLAND
Sumner and Callahan Tunnels
MBTA Tunnel
Logan Airport
Third Harbor Tunnel (under constr.)
BOSTON
Main Ship Channel
40' Channel
35' Channel
40 - Foot President Roads Anchorage
35' Anchorage
Realigned President Roads Ship Channel to enlarge deep water anchorage
40 - Foot Broad Sound - North Channel
35' Channel
35' Foot Broad Sound Side Channel
21' Foot Narrows Channel
15 - Foot Nubble Channel
Fort Point Channel
Reserved Channel
Pleasure Bay
SOUTH BOSTON
Long Island
Deepen
To -40' MLW
To -38' MLW
Existing Channel
Realigned Channel (President Roads)
Scale in Feet
0 2000' 4000'
US Army Corps of Engineers
New England Division
Boston Harbor,
Navigation Improvement Project
Figure ES-1
January 1994

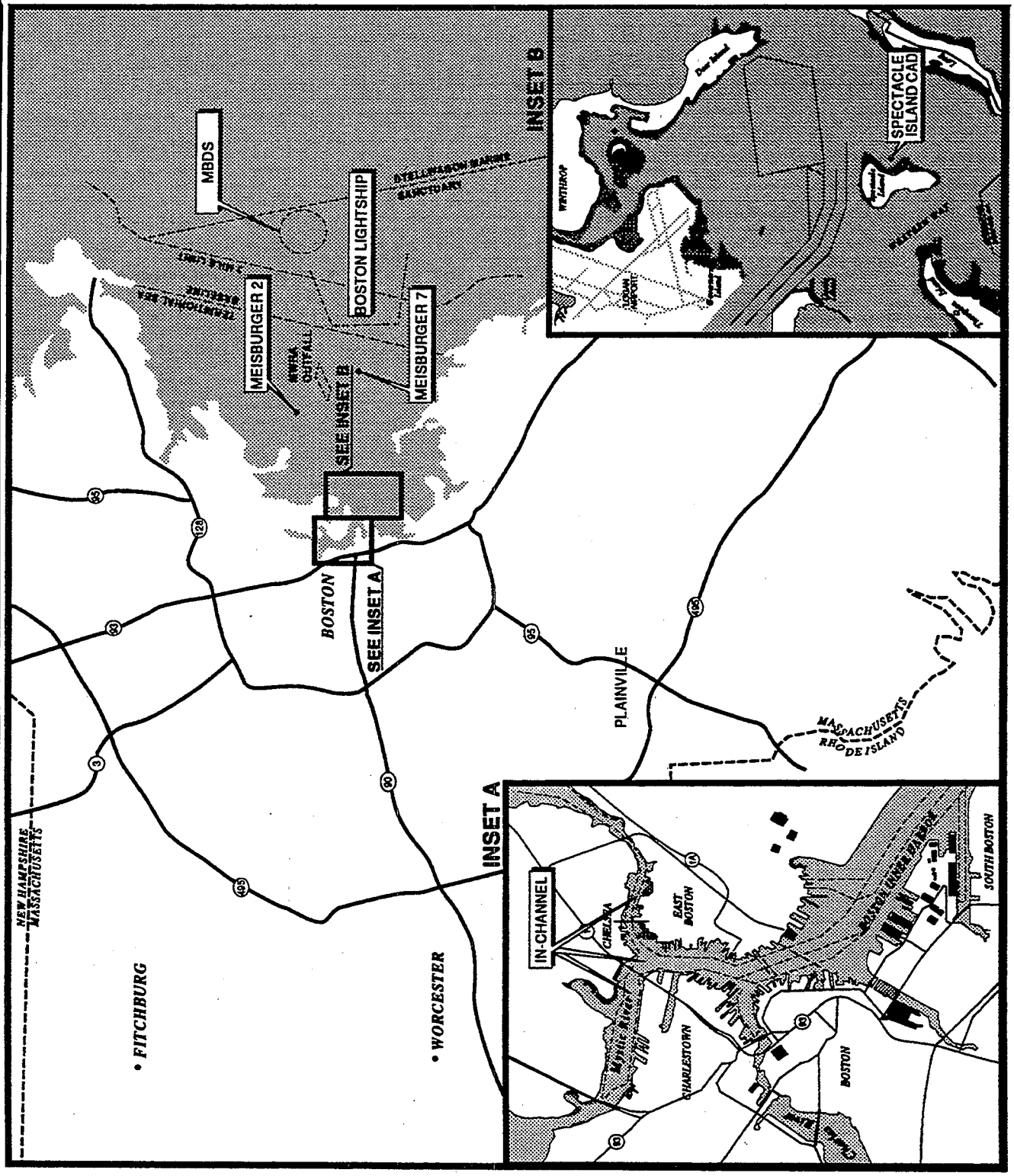
ES-3




| | |
|---|---|
| **Boston Harbor Dredging Project EIR/S** | *Figure ES-2*<br>Locations of potential disposal sites extensively evaluated. |
| *Scale:* 0 10<br>*Approx. Scale in Miles* | *Source:*<br>USGS Quadrangles<br>Revised by NAI to reflect pertinent site conditions. |

ES-9

24




| | | |
|---|---|---|
| **Boston Harbor Dredging Project EIR/S** | | Figure ES-2a. Locations of practicable disposal sites. |
| N | *Scale:* 0 10 *Approx. Scale in Miles* | *Source:* USGS Quadrangles Revised by NAI to reflect pertinent site conditions. |

**Boston Harbor Dredging Project EIR/S**

N

*Scale:* 0 — 10 *Approx. Scale in Miles*

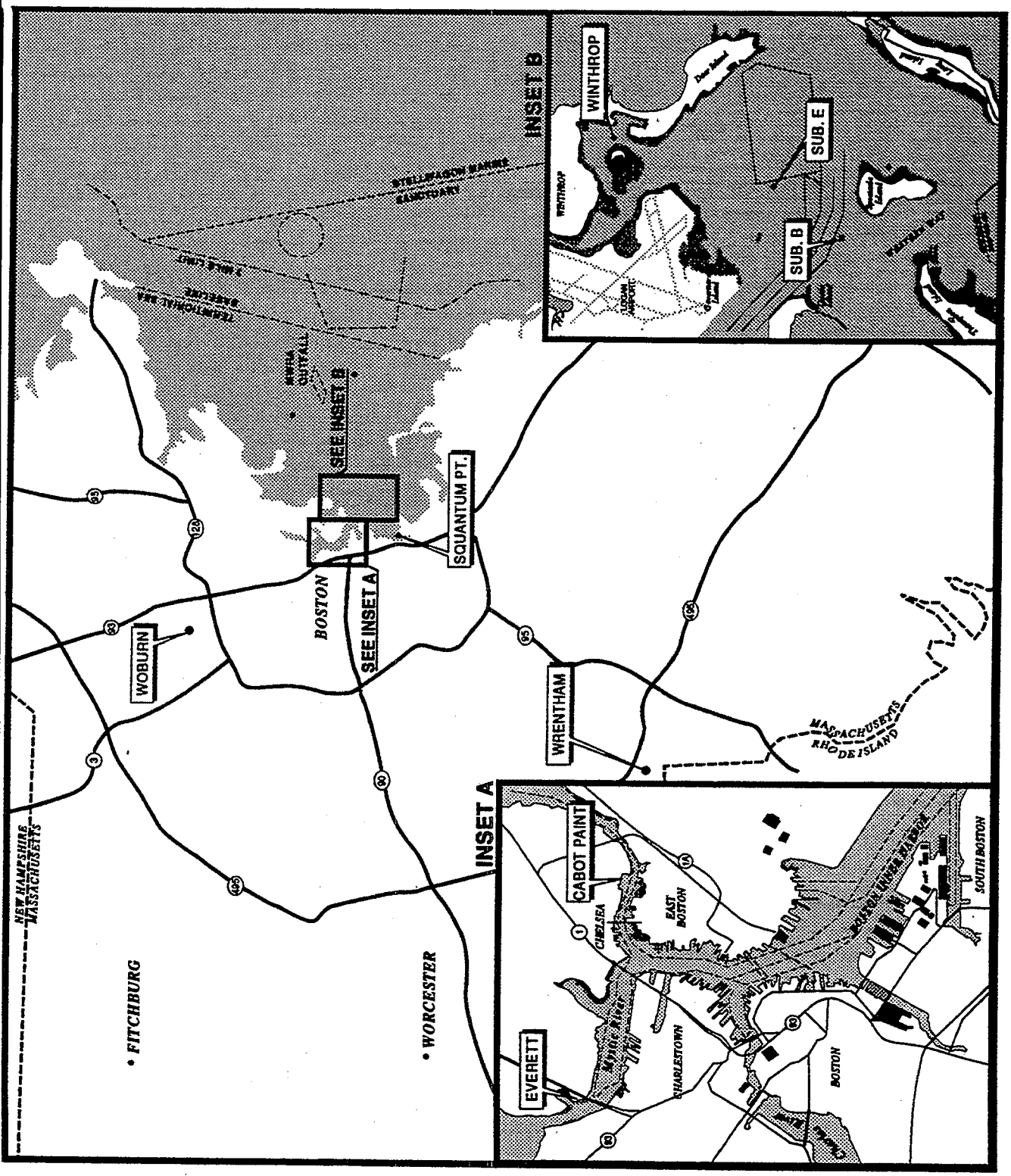
Figure ES-2b. Locations of potentially practicable disposal sites.

*Source:*

USGS Quadrangles

Revised by NAI to reflect pertinent site conditions.

ES-11




| Boston Harbor Dredging Project EIR/S | Figure ES-2c. Locations of short-listed sites found not practicable. |
|---|---|
| Scale: 0 10 Approx. Scale in Miles | Source: USGS Quadrangles Revised by NAI to reflect pertinent site conditions. |

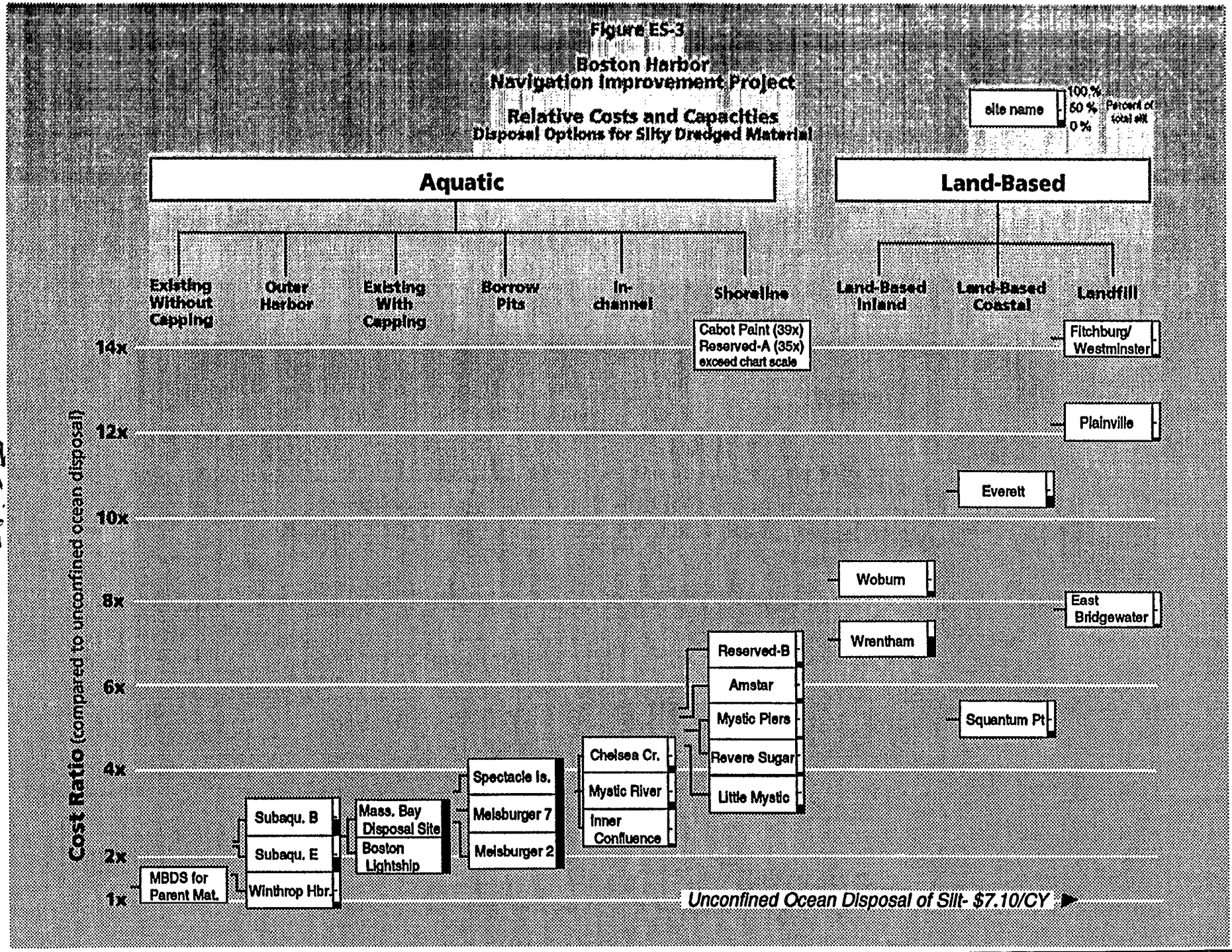


Figure ES-3
Boston Harbor
Navigation Improvement Project
Relative Costs and Capacities
Disposal Options for Silty Dredged Material
site name
100 %
50 %
0 %
Percent of total silt
Aquatic
Land-Based
Existing Without Capping
Outer Harbor
Existing With Capping
Borrow Pits
In-channel
Shoreline
Land-Based Inland
Land-Based Coastal
Landfill
Cost Ratio (compared to unconfined ocean disposal)
14x
12x
10x
8x
6x
4x
2x
1x
Cabot Paint (39x)
Reserved-A (35x)
exceed chart scale
Fitchburg/ Westminster
Plainville
Everett
Wobum
East Bridgewater
Wrentham
Reserved-B
Amstar
Mystic Piers
Revere Sugar
Little Mystic
Squantum Pt
Chelsea Cr.
Mystic River
Inner Confluence
Spectacle Is.
Meisburger 7
Meisburger 2
Subaqu. B
Subaqu. E
Winthrop Hbr.
Mass. Bay Disposal Site
Boston Lightship
MBDS for Parent Mat.
Unconfined Ocean Disposal of Silt- $7.10/CY

ES-13

TABLE ES-1a. PRACTICABLE ALTERNATIVES (LISTED ALPHABETICALLY) FOR THE BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT

| SITE NAME | CAPACITY (cy) | COST PER CY | PARENT MATERIAL AND ROCK | BHNIP SILT[1] | FUTURE HARBOR MAIN-TENANCE[2] |
|---|---|---|---|---|---|
| HIGH CAPACITY SITES | | | | | |
| Boston Lightship (with capping) | Exceeds BHNIP project and 50-year maintenance needs. Total capacity unknown. | $18 | | X | X |
| Combined In-Channel Locations | 740,000 | $25 | | X | X |
| MBDS | Exceeds BHNIP project and 50-year maintenance needs. Total capacity unknown. | $18 | X | X* (with capping) | X* (with capping) |
| Meisburger 2 | 4,660,000 | $20 | | X | X |
| Meisburger 7 | 6,125,000+ | $22 | | X | X |
| Spectacle Island CAD | 1,450,000 | $25 | | X | |

*Disposal-and-capping (of unsuitable material) is prohibited at MBDS until its efficacy can be effectively demonstrated (40 CFR 228.12 [Amended]).

ES-14

[1]BHNIP silt material consists of approximately 1.3 million cubic yards. Additional material from the BHNIP includes approximately 130,000 cy of rock and 2.0 million cubic yards of parent material.

[2]Future harbor maintenance consists of maintenance dredging approximately 4.4 million cubic yards of material from the Main Ship Channel and 1.8 million cubic yards of material from the tributary channels. These volumes are estimated as the aggregate accumulation over the 50-year life of the project (as calculated beginning in 1997). These volumes are expected to be dredged intermittently over the life of the project as needed. Maintenance dredging of the tributary channels is not likley to be needed for at least 10-years after the BHNIP project, or not until the year 2007. Minor, spot dredging may be required in the President Roads Anchorage Area and Main Ship Channel, Outer Harbor, beginning in the year 2002 if shoaling conditions warrant. More extensive maintenance dredging of the outer channels is not expected to be needed until at least the year 2007.

TABLE ES-1b. POTENTIALLY PRACTICABLE ALTERNATIVES (LISTED ALPHABETICALLY) BUT LIMITED BY CAPACITY AND COST

| SITE NAME | CAPACITY (cy) | COST PER CY | PARENT MATERIAL AND ROCK | BHNIP SILT[1] | FUTURE HARBOR MAINTENANCE[2] |
|---|---|---|---|---|---|
| Amstar | 128,000 | $37 | N/A* | | X |
| Little Mystic Channel | 303,000 | $33 | N/A | X | X |
| Mystic Piers | 98,000 | $35 | N/A | | X |
| Reserved Channel | 185,000 | $255 | N/A | | X |
| Revere Sugar | 85,000 | $35 | N/A | | X |
| Lined Landfills | 102,000 | $56-$101 | N/A | | X |
| Treatment Technologies[5] | Unknown | $55 | N/A | X | X |

*N/A - Not Applicable

ES-15

[1]BHNIP silt material consists of approximately 1.3 million cubic yards. Additional material from the BHNIP includes approximately 130,000 cy of rock and 2.0 million cubic yards of parent material.

[2]Future harbor maintenance consists of maintenance dredging approximately 4.4 million cubic yards of material from the Main Ship Channel and 1.8 million cubic yards of material from the tributary channels. These volumes are estimated as the aggregate accumulation over the 50-year life of the project (as calculated beginning in 1997). These volumes are expected to be dredged intermittently over the life of the project as needed. Maintenance dredging of the tributary channels is not likley to be needed for at least 10-years after the BHNIP project, or not until the year 2007. Minor, spot dredging may be required in the President Roads Anchorage Area and Main Ship Channel, Outer Harbor, beginning in the year 2002 if shoaling conditions warrant. More extensive maintenance dredging of the outer channels is not expected to be needed until at least the year 2007.

[5]Screening and evaluation of treatment technologies resulted in solidification as being the only practicable alternative for the BHNIP project. Other technologies were eliminated based on availability, quantity of material to be dredged, throughput requirements and costs which, for some of the technolgoies screened, could run as high as $350 per cy.

TABLE ES-1c. ALTERNATIVES (LISTED ALPHABETICALLY) EVALUATED BUT FOUND NOT PRACTICABLE DUE TO ENVIRONMENTAL FACTORS OR COST

| SITE NAME | CAPACITY (cy) | COST PER CY | PARENT MATERIAL AND ROCK | BHNIP SILT[1] | FUTURE HARBOR MAINTENANCE[2] |
|---|---|---|---|---|---|
| Cabot Paint | 18,000 to MLW<br>99,000 to MHW | $278 | N/A* | N/A | X |
| Everett | 55,000 | $76 | N/A | N/A | X |
| Squantum Point | 210,000 | $37-$49 | N/A | N/A | X |
| Subaqueous B | 600,000 | $17 | N/A | N/ | X |
| Subaqueous E | 614,000 | $16 | N/A | N/A | X |
| Winthrop Harbor | 167,000 | $12 | N/A | N/A | X |
| Woburn | 158,600 | $61 | N/A | N/A | X |
| Wrentham | 785,500 | $50 | N/A | N/A | X |

*N/A - Not applicable

ES-16

[1]BHNIP silt material consists of approximately 1.3 million cubic yards. Additional material from the BHNIP includes approximately 130,000 cy of rock and 2.0 million cubic yards of parent material.

[2]Future harbor maintenance consists of maintenance dredging approximately 4.4 million cubic yards of material from the Main Ship Channel and 1.8 million cubic yards of material from the tributary channels. These volumes are estimated as the aggregate accumulation over the 50-year life of the project (as calculated beginning in 1997). These volumes are expected to be dredged intermittently over the life of the project as needed. Maintenance dredging of the tributary channels is not likley to be needed for at least 10-years after the BHNIP project, or not until the year 2007. Minor, spot dredging may be required in the President Roads Anchorage Area and Main Ship Channel, Outer Harbor, beginning in the year 2002 if shoaling conditions warrant. More extensive maintenance dredging of the outer channels is not expected to be needed until at least the year 2007.

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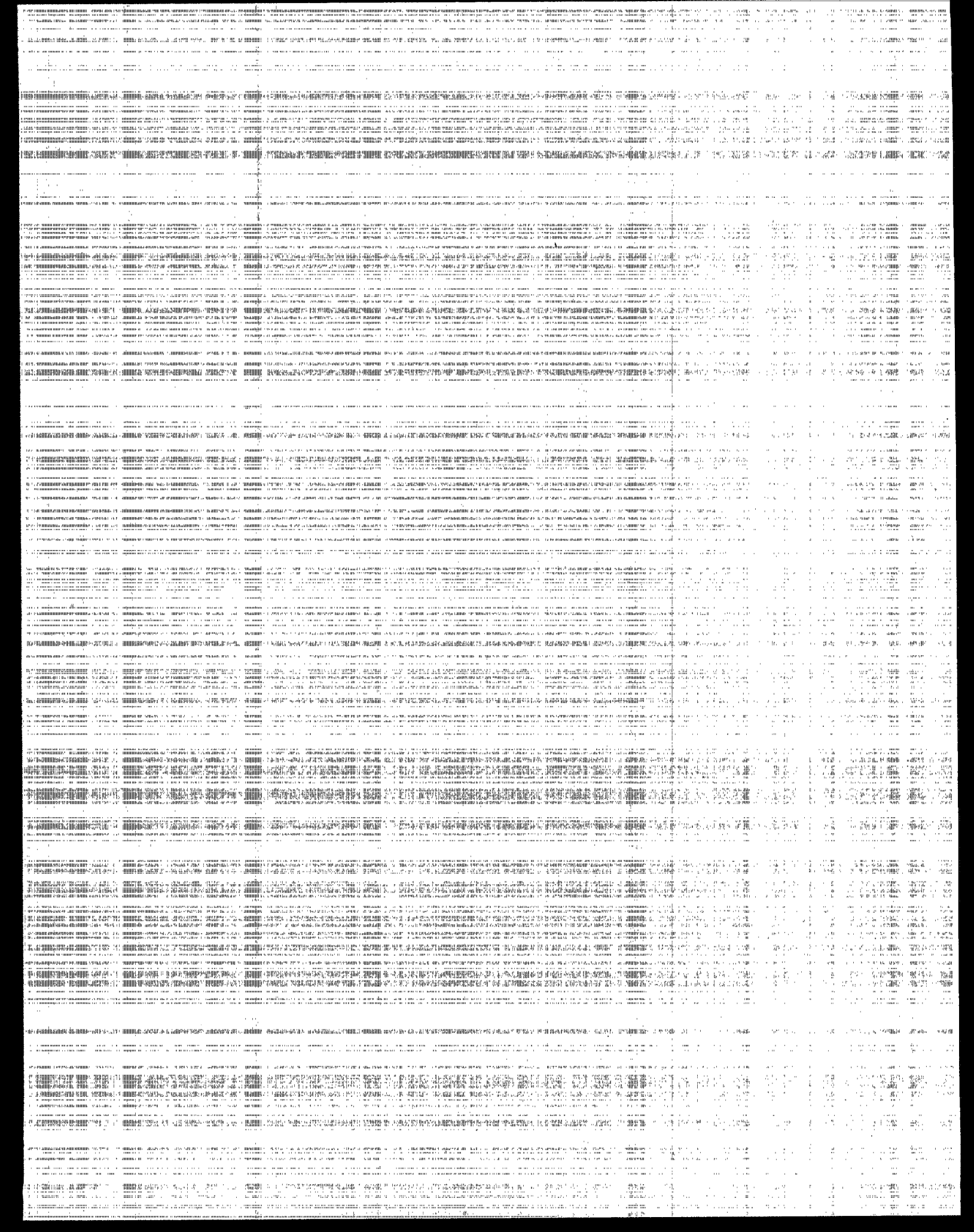
(31)



## 1.0 INTRODUCTION

Boston Harbor is one of New England's most important ports in terms of the movement of goods and the region's economic vitality. While Boston Harbor's principal entrance and main access channels are -40 feet mean low water (MLW) the three major tributaries, which include the Reserved Channel, Mystic River and Chelsea River, are only -35 feet MLW. (The Chelsea River is locally known as Chelsea Creek and will be referred to as such in this EIR/S). These shallower depths can place substantial restrictions on shippers by limiting vessel size and loading (Eldridge, 1994). These conditions can translate to increased safety hazards as well as environmental (e.g. spill) and economic risks to the harbor.

Congressional and local interests felt that modifications to Boston Harbor channels were needed due to the increase in traffic of bulk commodities flowing through the port and the delay time being experienced by increasingly larger vessels requiring a high tide to negotiate the existing restricted ship channels into the port. Local navigation interests, via two Congressional Resolutions (March 1, 1968 and September 11, 1969), requested the Army Corps of Engineers to review the present and projected navigation needs in Boston Harbor. The Army Corps of Engineers is given the authority to conduct General Investigations into improving the navigability of the waters of the U.S. under the Rivers and Harbors Act of 1899.

A Feasibility Report and Environmental Assessment was completed in 1988 by the U.S. Army Corps of Engineers for the navigation improvement project. The economically and environmentally favored alternative selected in the report was authorized by Congress in the Water Resources Development Act of 1990 (P.L. 101-640). The navigation improvement project involves the deepening of the Mystic and Reserved Channel from -35 feet to -40 feet MLW and the Chelsea Creek from -35 feet to -38 feet MLW. In addition to deepening, modifications are required in the Mystic River, the Inner Confluence and at the entrance to Reserved Channel to provide safe maneuvering areas. In the President Roads area, channels will be re-marked and designated along the southern reach of the roads connecting the outer confluence of the three entrance channels with the inner harbor Main Ship Channel. This will enlarge the anchorage area from about 375 acres to about 420 acres.

To realize the economic benefits from deepening the channels, six berth areas adjacent to these channels (Conley 11-13, Prolerized, Distrigas, Moran, Eastern Minerals and Gulf Oil) must also be deepened to the same depth as the channel. In addition to these berthing areas, other berthing areas within the project but not adjacent to the channel (Boston Army, Boston Edison Intake, Boston Edison Barge, Conley 14-15, Revere Sugar, Mystic Piers 1, 2, 49 and 50) would also be deepened at the same time as part of Massport's Berth Dredging Project. The Corps and Massport dredging projects are collectively termed the Boston Harbor Navigation Improvement Project (BHNIP) and will be treated as one project throughout this document except where otherwise noted.

This report is prepared as a joint Commonwealth of Massachusetts Environmental Impact Report and Federal Environmental Impact Statement (EIR/S) by the Massachusetts Port Authority (Massport) and the U.S. Army Corps of Engineers (Corps). A project is subject to review under the regulations of the Massachusetts Environmental Policy Act (MEPA) (301 CMR 11.00) if the project requires any state agency action, financial assistance, or permit. It was determined by the Secretary of Environmental Affairs on June 7, 1991 that an Environmental Impact Report (EIR) is required for the dredging of the berths. The U.S. Army Corps of Engineers determined that an EIS was required under the National Environmental Policy Act (NEPA) (42 USC 4321 *et. seq.*) due to the cumulative impacts of Federal actions (mainte-

nance dredging, navigation improvement dredging, and permitting of the associated berthing areas) and the significant public concern over disposal of the dredged material. The MEPA certificate and the NEPA scoping documentation are provided in Appendix A.

This EIR/S is designed to assess the anticipated environmental impacts associated with the Federal navigation improvement and maintenance project authorized by the Congress and associated dredging by Massport and others in Boston, Massachusetts. This document updates and expands on the 1988 Environmental Assessment and Feasibility Report for the subject project.

An additional element provided in the EIR/S is a discussion on potential long-term disposal options that may be appropriate for future projects and maintenance dredging of this project. These options require additional analysis and development. This additional aspect is provided in response to the MEPA certificate's acknowledgement that "Massport, as the lead agency for this dredging project, will develop a considerable data base and expertise. Thus, the agency may be able to contribute significantly to the success of the longer range dredging and disposal program."

## 1.1 GENERAL DESCRIPTION OF PROJECT AREA

The Port of Boston, Massachusetts, as shown in Figures 1-1a and 1-1b (Note: referenced figures and tables are at the end of each section), is located on the western side of Massachusetts Bay, approximately 50 miles from the tip of Cape Cod. Its outer and inner harbors include all the tidal waters bounded by a line drawn roughly from Point Allerton in Hull, northward to Point Shirley in Winthrop. The harbor comprises a water area of approximately 47 square miles.

Boston Harbor is home to one of the United States' oldest and most historic international trading centers, the Port of Boston. A source of jobs and commerce for the 13 million residents of the six-state New England region, the Port handles more than 25 million tons of cargo, worth more than seven billion dollars annually.

Deep water access to the harbor is provided by three entrance channels constructed by the Army Corps of Engineers. These channels are: the Broad Sound North Channel, in two lanes at depths of -35 and -40 feet; the Broad Sound South Channel at a -30 foot depth; and the Narrows Channel at a -27 foot depth all referenced to MLW. The main deep water harbor consists of the Main Ship Channel, Reserved Channel, Chelsea Creek and the Mystic River. The tributary channels have all been improved in the past by the Army Corps of Engineers to a depth of -35 feet MLW. These depths limit deeper draft traffic to tidal passage and therefore, the 40-foot improvements to the Broad Sound North Channel and Main Ship Channel are not being used efficiently. The three tributaries are surrounded by a dense urban and industrial environment. Reserved Channel supports the Black Falcon Terminal used by cruise lines, Boston Edison, the Conley Terminal, and other marine activities. The lower Mystic River provides access to the port's widest variety of terminal facilities. Chelsea Creek also supports marine piers and terminals. Nine of the port's eleven petroleum terminals are located along the Chelsea Creek channel.

## 1.2 PURPOSE AND NEED FOR ACTION

The purpose of the BHNIP project is to increase the navigational efficiency and safety of Boston Harbor for present types of deep drafted vessel traffic that are currently transiting the project area. The need for this dredging is evidenced by an economic analysis compiled by the New England Division (NED) Corps of Engineers that found that the

project has regional benefits that exceed project costs. The Port of Boston is one of New England's most important economic assets. More than 6,000 people have jobs directly related to the cargo industry and 3,000 jobs in the industrial service sector support cargo activity. As a result of its cargo handling activities, Massport was responsible for generating nearly $1.86 billion in economic benefits for the region in 1992. As one of America's oldest and most experienced ports, the Port of Boston is an important gateway for the international trade and commerce. It is also the energy lifeline of the region.

The existing Federal navigation project was originally constructed to serve the port's commercial terminals located along the main ship channel waterfront. Changing waterfront land use patterns have resulted in most of the port's active terminal facilities shifting from the Main Channel to the -35 foot MLW tributary channels. Changes in the world wide shipping fleet have resulted in vessels that are larger in length, beam, and draft.

A depth of -40 feet MLW is needed to accommodate the container ships and tankers that are a mainstay of the present day shipping business. Project benefits for deep draft navigation projects result from reductions in the cost of transporting goods for shippers. Factors influencing shipping costs are vessel characteristics such as size, speed, immersion factor, draft, cargo capacity and crew requirements; origin or destination of shipments, flag of vessels, and vessel operating costs. These are all elements of supplying goods to the New England region.

Larger vessels have higher operating cost, but their cost per ton shipped is lower. This results in the use of larger vessels by shippers to reduce transportation costs. Shippers can, and do, utilize vessels with drafts in excess of the channel depths. However, the vessels either incur tidal delay, have to be lightered or are light loaded. The cost of these practices reduce the benefits of using larger vessels and can result in higher product costs.

Vessel operating costs reflect double hull requirements for oil tankers. Double hull construction has increased vessel operating costs by approximately nine percent for small tankers and seventeen percent for the largest. Double hull tankers still carry the same cargo, but draw about a foot more in draft. Thus use of double hull tankers may decrease efficiency of transporting oil if the amount of tidal delay and lightloading is increased.

The economic analysis compiled by the Army Corps of Engineers, and contained in the September 1988 Feasibility Report, reviewed the modern port activity described above, and found that the project is justified economically by increasing navigation efficiency. The Project will also meet the port's needs. Project benefits are derived from utilization of more efficient, larger vessels which will transit the harbor during a wider range of tidal stages. The economic analysis was conducted using the policy established by the Army Corps of Engineers, Washington Headquarters. The economic analysis was also used to determine the most cost effective design (National Economic Development Plan). Based on the recommendations of the Feasibility Report and reports from the Board of Engineers for Rivers and Harbors and the Chief of Engineers, the project was Congressionally authorized in the Water Resources Development Act of 1990 (WRDA 1990).

Although the project was economically justified by comparing the "with project" and "without project" conditions, other benefits may accrue for the Port of Boston and the New England region from deepening the navigation channels, not included in the Army Corps of Engineers report. These benefits, described below, are based on the experience of Massport and the projected future of shipping in the region. New legislation (Oil Pollution Act of 1990; 101 Public Law 330) and the increase in the number and size of container ships have had an effect on ship use in Boston Harbor.

Delays and light loading increase the container ships' operating costs and discourage many ships from calling directly on the Port of Boston. At the present time, "Atlantic" and "Oceanus" class containerships schedule arrivals into Boston around the tide. The "Atlantic" class vessels do not call on Boston loaded to the maximum capacity. If they did, they would have to sojourn at the anchorage area to wait for a favorable tide. The increased operating costs arising from potential tidal delay not only discourages other shipping lines from using the port, but could possibly lead to the loss of existing services which support the carriers.

In addition to losing the existing services, not dredging the Port may mean not being able to attract new shipping business. The ability to bring in additional shipping lines with large container ships and frequent schedules is important for the future growth of the Port. Although many factors, such as a cargo base, an efficient over-land distribution system, frequent ship schedules, and the size of service area, influence the number of containers that a port can attract, deep water channels and berths are a prerequisite for the smooth flow of the cargo.

Petroleum shipping is affected similarly by silting of the harbor. Smaller tankers generally wait at the anchorage for the high tide. Larger tankers, drawing more than 34 feet, now occasionally off-load some or all of their cargo to barges ("lightering"), which then deliver the oil to the Port's terminals. The need to lighter increases shipping time, adds to the tankers' operating costs (which may be passed onto the consumer), and increases the risk of oil spills. Problems associated with lightering can be illustrated with the current conditions in Providence Harbor, Rhode Island. Dredging at Providence Harbor has been stalled for lack of a disposal site. This delay has resulted in shoaling which has reached a critical level. As a result, final deliveries require regular lightering and are subject to increasingly long tidal delays. The double handling of fuel has increased the cost of gasoline coming through the harbor by about 4½ cents per gallon (Interagency Task Force 1993). As with all lightering operations, the risks of oil spills increase with the increasing need to lighter. Although the Port of Boston has never experienced a major oil spill, the danger of such an occurrence is real, if lightering is not reduced, eliminated, or needs to continue indefinitely.

The vessel draft problem will be aggravated by the introduction of double-hull tankers between the years 1995 and 2015. These tankers, which will have the same carrying capacity as the old tankers, but with larger exterior dimensions, will replace the present tanker fleet serving the Port of Boston. Unless the depth of the shipping channels and berths is increased, more lightering will be required in the Port.

Improving the channel and berth depths in Boston Harbor will be the port's first major dredging project since 1982/1983 when 867,000 cubic yards of dredged material was removed from the Mystic River, Chelsea Creek and Presidents Roads. The only additional dredging completed since that time have been small quantity, individual maintenance of berths. Some examples include:

- Mobil Oil Corp. terminal berth in the Chelsea Creek approximately 1,500 cubic yards in 1991.
- Coastal Oil Corp. terminal berths in the Chelsea Creek and Reserved Channel, approximately 3,000 cubic yards in 1992.
- Moran Terminal in the Mystic River, approximately 10,000 cubic yards in 1993. Dredging a 1,000 foot berth at Moran Terminal, resulting in 16,600 cy of material, was originally included in the full BHNIP project. The reduced project performed in 1993 was designed to improve an 800 foot berth to accommodate a new cargo shipping line that was ready to add the Port of Boston to its service area. The 1993 reduced project was

subjected to independent environmental review and permitting. The 10,000 cy from the reduced project was disposed at an existing landfill. The BHNIP full project now includes only the remaining 200 feet of berthing area and approximately 6,600 cy of material requiring disposal.

The proposed dredging is critical, particularly in Chelsea Creek for the petroleum shipping, and in the Mystic River for the container shipping. Safe and efficient flow of cargo into and out of the harbor is a prerequisite for the growth and success of the Port of Boston, and to efficiently meet the heating and fueling needs of the major metropolitan area of New England.

In summary, the BHNIP is designed to serve a variety of interests associated with efficient port operations. These interests are:

1. Maintenance dredging of the Federal channels to accommodate the current container ships and tankers to keep the Port of Boston in the same port category of service.

2. Improve navigation by deepening certain Federal channels and associated berths and providing future maintenance of the improvements. Improvements in navigation will accommodate the future larger container ships and double-hull tankers with minimal tidal delays, vessel lightering and economic benefits occurring from the efficient flow of cargo.

3. Identify potential disposal options to serve future long-term maintenance requirements to meet regional needs including Boston Harbor.

## 1.3 PROJECT SPONSORS

Prior to the passage of the Water Resources Development Act of 1986 (WRDA 1986) (Pub. Law 99-662), commercial navigation improvements were constructed, operated and maintained with 100 percent Federal funding (except for land and relocation requirements). Now, a non-Federal cost sharing partner is needed to finance deep draft navigation improvement projects. The non-Federal cost sharing partner for the Boston Harbor Navigation Improvement Project is the Massachusetts Port Authority (Massport). Massport is also responsible for preparing the Environmental Impact Report (EIR) for the project berthing areas. Cost sharing for the BHNIP is dependent on two stages required to complete it: dredging of maintenance material and improvement dredging.

The tributary channels to be deepened in the project are existing channels which have been maintained to the authorized 35 foot depth. Silt has accumulated in these tributaries since the channels were last deepened and includes material which has filled in the over-depth areas (about -37 feet MLW). This silt, or maintenance material, must be removed prior to improvement (deepening), of the tributary channels. The cost of dredging the maintenance material will be 100% Federally funded.

In addition to the maintenance dredging, the authorized project would also deepen the navigation channels in the Mystic River, Chelsea Creek, and the Reserved Channel. In order to realize the benefit of this navigation improvement project in the Federal channels, "beneficiaries" of the project must also dredge berths to the same depth as the parent channels. The beneficiaries are the owners/operators or users of those berths that benefit directly from the channel deepening. These include shipping lines using Moran Terminal, Exxon USA, Inc., Distrigas of New England, Prolerized of New England and Boston Edison in the Mystic River channel. In Chelsea Creek, beneficiaries include Eastern Minerals,

Northeast Petroleum, Gulf Oil Co. and Coastal Oil of New England, Inc. In the Reserved Channel, beneficiaries are Coastal Oil of New England, Inc., and the shipping lines using Conley Terminal.

Section 101 of WRDA 1986, which describes cost sharing, requires that the local (non-Federal) sponsor bear a percentage of the harbor improvement construction costs for project components that are cost-shared (channel deepening, mitigation, etc.). This varies according to the range of water depths where the work is done (20 feet or less, greater than 20 feet but not in excess of 45 feet, and greater than 45 feet). For the BHNIP, 25% of the cost for channel deepening is paid during construction and includes the costs of planning, engineering and design, and construction management.

The non-Federal participants must assume an additional 10% of the channel deepening costs payable over a period of up to 30 years. The remaining costs of dredging, including dredging berths and utility relocation must also be assumed by non-Federal interests for this project. Utility relocations to be undertaken by Massport will be credited against the additional 10% share.

In addition to the cost sharing responsibilities, the local non-Federal sponsor (Massport) will be required to obtain appropriate Corps (and all other) permits for all berth areas.

Relocation and addition of navigation aids, for example at the President Roads Anchorage Area, is a Federal expense borne by the United States Coast Guard. Table 1-1 summarizes the percentage the local sponsor must finance for the BHNIP.

The requirements of non-Federal participation will be governed by the Project Cooperation Agreement (PCA) which is a legally binding document signed by the Federal government and the non-Federal sponsor prior to construction. Once the project has been constructed, the Federal government, through the U.S. Army Corps of Engineers, is responsible for maintaining Federal navigation channels. Berthing areas are maintained by the respective owners.

## 1.4 PUBLIC PARTICIPATION PROCESS

Prior to initiating environmental studies in support of the project, Massport recognized that large projects which may impact the public can no longer be accomplished unilaterally. There was a consensus that the success of the project depended on involving key groups effectively. This general principle had a number of important implications. Key parties needed to be identified which either had a stake in the outcome (regulatory agencies, environmental groups, and harbor users), or could provide useful information to Massport, its consultants and the Corps. Effective involvement of these parties required that they be consulted early, that they be provided timely information on the progress of the project, and that they have the opportunity to present diverse points of view. It was also recognized that meetings of these parties would be assisted by a professional facilitator whose objectives would be to ensure that all parties were heard and to help the parties resolve their differences where possible.

To that end, Massport and its consultant developed a public participation process which consisted of a broad-based Advisory Committee which was active throughout the project preceding distribution of the EIR/S. This Advisory Committee was supplemented by targeted, focus groups to assist project planners in particular technical areas. The following paragraphs explain the process and its operation and affect on the production of this EIR/S. Massport and the Corps appreciate the valuable expertise and insight, and most particularly, the generous contribution of time from these agency personnel and other private and public groups.

### 1.4.1 Advisory Committee

To initiate the public participation process Massport sent letters in March 1992, notifying the recipients of its plans for the Boston Harbor Dredging Project and inviting them to participate in an Advisory Committee composed of concerned agencies, interest groups, and political leaders. An initial meeting of the Advisory Committee was held on April 6, 1992. As described at that meeting, the function of the Committee would be to advise Massport and the Corps of Engineers in the conduct of its environmental studies and the preparation of the Environmental Impact Report/Statement. The Committee would be a forum in which participants would be encouraged to voice their concerns so that Massport, to the best of its ability, could attempt to resolve them. Suggestions were sought from attendees for other groups which should be invited or encouraged to participate.

Invitations to participate were sent to the following:

Bay State Cruise Company*
Boston Harbor Docking Pilots
Boston Line & Service Co., Inc.*
Boston Pilots
Boston Redevelopment Authority
City of Boston: Environment Dept., Public Works Dept.
Conservation Law Foundation
Mass. Audubon Society
Mass. Bay Transportation Authority
Mass. Bays Program
Mass. Coastal Zone Management
Mass. Dept. of Environmental Management-Waterways
Mass. Division of Marine Fisheries
Mass. Division of Solid Waste Management
Mass. Division of Water Pollution Control
Mass. Division of Wetlands and Waterways
Mass. Exec. Office of Environmental Affairs (MEPA Unit)
Mass. Highway Department
Mass. Water Resources Authority
Metropolitan Area Planning Council
Move MA 2000
National Marine Fisheries Service
New England Aquarium*
New England Fisheries Management Council*
Office of Senator Edward Kennedy*
Office of Senator John Kerry*
Patterson, Wylde & Co., Inc.
Save the Harbor/Save the Bay
The Boston Harbor Association
The Boston Shipping Association
The Gillette Company
The Sierra Club
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

* Invited but did not participate.

The Advisory Committee met seven times over the course of the studies and preparation of the EIR/S. To assist with particular detailed technical issues, the Committee formed two Technical Working Groups, as described below, from which it received periodic reports, enabling the Committee to focus on the large policy questions. Minutes of meetings were distributed to all persons on the mailing list for their review and approval (see Appendix B). Occasional new members joined the Committee over its period of operation.

Input from the Advisory Committee as well as the two Technical Working Groups provided significant direction to the project. As discussed below in further detail, the many recommendations of the Technical Working Groups were incorporated into the ultimate testing design and alternatives analyses. This process was flexible and dynamic, evolving as information became available.

Advisory Committee meetings typically were very interactive. The facilitator sought reactions and advice from all participants. Through group discussion, Massport and other participants were able to evaluate the advice and to decide on an appropriate course of action. The EIR/S reflects the dynamic nature of the project concept and development and the expert advice of the Advisory Committee.

### 1.4.2 Technical Working Groups

Two Technical Working Groups were formed by the Advisory Committee to provide it with support on certain highly technical matters associated with the project. While there was often much overlap with the membership of the Advisory Committee, the Working Groups drew technical personnel as appropriate from state and federal agencies. All members of the Advisory Committee were invited to participate in either or both Technical Working Groups.

The Sediment Characterization Technical Working Group met eight times to carry out a variety of complex tasks. Early meetings dealt with the design of a sediment sampling plan for berths to determine impacts from dredging, impacts from material disposal and post-construction impacts. Issues addressed during development of the sampling plan included selection of sampling locations to achieve statistical validity, substances to be tested for, appropriate laboratory testing procedures and detection limits, and a reliable Quality Assurance/Quality Control program. All these components were incorporated in a Sediment Sampling and Laboratory Analysis Plan approved by the Working Group. Later meetings reviewed the bulk chemical analyses and made recommendations for conducting amphipod toxicity tests. Final meetings were dedicated to making recommendations on testing clams and marine worms for bioaccumulation of selected contaminants and reviewing those results. The plan and results are presented in Appendix C.

Throughout its period of operation, the Sediment Characterization Technical Working Group consistently provided constructive guidance to Massport and the Advisory Committee for the studies which would be most useful to regulators and the interested public. In numerous instances, one or more members of this Working Group pressed for an expansion of sediment sampling and analysis beyond the requirements of the MEPA scope. Massport accepted most of these recommendations, including a large increase in the number of sediment samples taken, testing for additional chemical constituents, and conducting additional bioaccumulation tests. In general, these modifications contributed to the reliability of the sediment characterization results. Determinations of suitability for ocean disposal focussed on bulk sediment chemical levels and amphipod tests in addition to the bioaccumulation of contaminants in the tissue of clams and marine worms.

A second working group was convened to ensure that the EIR/S would be based on the full range of project, disposal and treatment alternatives, and that appropriate criteria would be used in the evaluation of those alternatives. Early meetings of the Disposal Options Technical Working Group focussed on identifying the generic disposal and treatment options that should be considered, site requirements for each of the options, and the development of exclusionary criteria to screen out clearly inappropriate sites. Later, this Working Group reviewed a list of potential disposal sites for its completeness. After the exclusionary criteria had been applied, the Working Group then reviewed the resulting subset of sites and treatment technologies to see if any options had been dropped prematurely or if any of the remaining options should have failed the initial screening. Group members were asked for any information which might be useful in evaluating any of the sites remaining on the short list. The Group's input resulted in modifying, somewhat, the typical "funneling" approach of site selection; that is, some sites



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were identified and added/evaluated subsequent to a previous screening stage, if so directed by the Group.

This Working Group also made numerous recommendations, some of which went beyond the expected requirements of the MEPA scope. In the interest of accommodating these recommendations, Massport complied with requests to address options with respect to specific sites instead of generic characteristics and also to carry the evaluation of options nearly to the point at which a preferred alternative could be selected in the draft EIR/S phase. In contrast, the MEPA certificate only required that the Draft EIR focus on "... sediment testing, an assessment of sediment compatibility with the universe of alternatives, and a generic evaluation of alternative feasibility."

### 1.4.3 Federal Scoping Meeting

Shortly after Massport's formation of the Advisory Committee, the Corps issued its formal Federal Register Notice of Intent to prepare an EIS for its portion of the project. Consistent with the requirements of the National Environmental Policy Act (NEPA), the Corps advertised and conducted a public scoping meeting to solicit comments about the types of issues which should be included in the EIS. No issues were raised which had not previously been identified in the Corps' Environmental Assessment and/or in the Secretary of Environmental Affairs' Certificate in response to the Environmental Notification Form (ENF). A transcript of these scoping meetings is contained in Appendix A. Section 5.0 of the EIR/S more fully details the Federal coordination and scoping process.

## 1.5 COMPLIANCE WITH MEPA AND NEPA REQUIREMENTS

As discussed earlier, this combined EIR/S must meet the requirements of MEPA and NEPA in terms of scope and format. The MEPA certificate (see Appendix A) sets out five major issues in its scope for the EIR. These consist of a project description, sediment characterization, dredging methodology and dredging impacts, feasibility of disposal alternatives and mitigation measures. Central to the NEPA requirements are considerations of alternatives to the project presented so that a clear basis for choice among options is provided.

Further, 40 CFR 1502.10 provides guidance on a recommended format for NEPA documents. Similar guidance for MEPA submittals is provided in 301 CMR 11.07. Format guidance provided in these sections are largely compatible but combining them required minor modifications from the individual recommended formats. All required substantive material is included and arranged as follows:

- A summary, as required by NEPA, (herein provided in the Executive Summary at the beginning of this document) of the project description, major environmental effects of the project and its alternatives and major conclusions.

- A project description (MEPA requirement) including purpose, need and objectives of the project (NEPA requirement), and a description of the physical characteristics of the project. This information has been provided in the preceding paragraphs of Section 1.

- Both MEPA and NEPA require an alternatives analysis of the proposed project and a description of alternatives to the proposed project and a clear explanation of the selection and screening process for the evaluation. This requirement is contained in Section 2.0 and Section 3.0 of this EIR/S. Section 2.0 presents a complete discussion of alternatives to the project design, including No Build options, and identifies a preferred dredge (or build) alternative. The second half of Section 2.0 consists of a description of the design, pro-

cess and results of the sediment characterization studies specifically required by the MEPA scope which, in addition to the project design alternatives, forms the basis for determining potential disposal options.

Section 3.0 provides a complete description of the process of disposal alternatives identification and the product of screening the alternatives in a multi-phase approach.

Attachment 1, Volume 1 of this EIR/S contains an evaluation of the affected environment for the dredging and disposal sites. This section also includes the environmental consequences of the disposal activities. Section 4.5 provides the environmental impacts expected from dredging operations.

- The MEPA scope called out specifically for a Dredging Management Plan separate from the preceding NEPA requirement for a discussion of the affected environment. Section 4.0 of this EIS/R consists of a draft plan incorporating concerns as to type of dredging technology likely to be employed, project phasing and mitigation of impacts during dredging and disposal operations.

The remaining sections of this EIR/S consist of NEPA required information including regulatory compliance in Section 5.0, a list of preparers (which follows), and the distribution list for this document in Section 6.0. References (Section 7.0), a glossary of terms used in this report (Section 8.0) and an index (Section 9.0) complete this volume. Much of the substantive discussion presented in the technical chapters is supported by data and analysis provided in Attachment 1 to Volume 1 or in Appendices appearing in Volume 2, as identified and referenced throughout the document as appropriate.

## 1.6 LIST OF PREPARERS

This EIR/S is the product of a joint effort by the local project sponsor, Massport, and the Corps of Engineers, New England Division. The Corps, as the lead federal agency, took primary responsibility for ensuring that the document complies with the requirements for EISs as set forth in the National Environmental Policy Act and associated federal regulations. Massport and its consultants, concentrated their efforts on compliance with the EIR as required by the Massachusetts Environmental Policy Act.

Key preparers of the document and their qualifications are summarized in Table 1-2.



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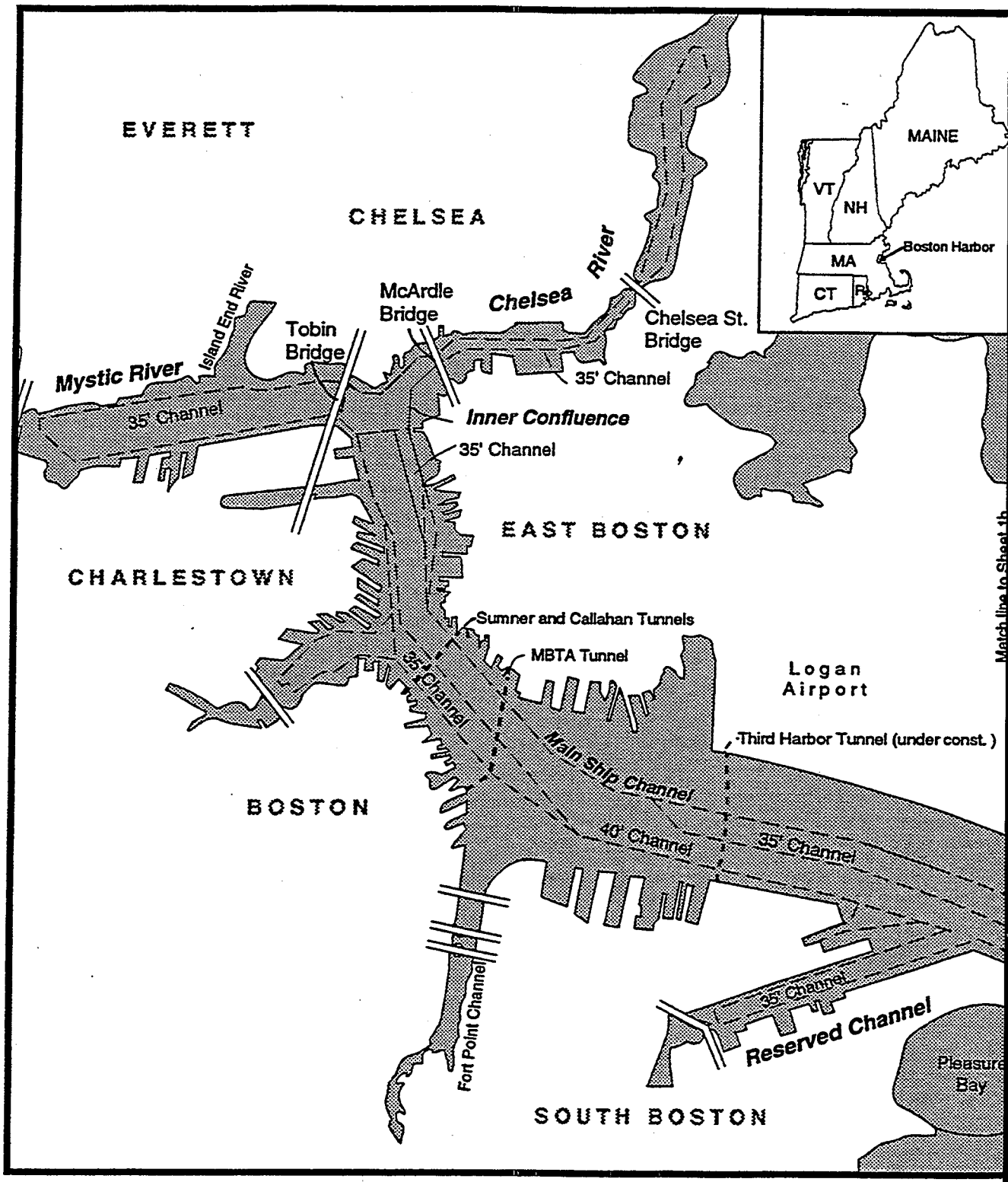
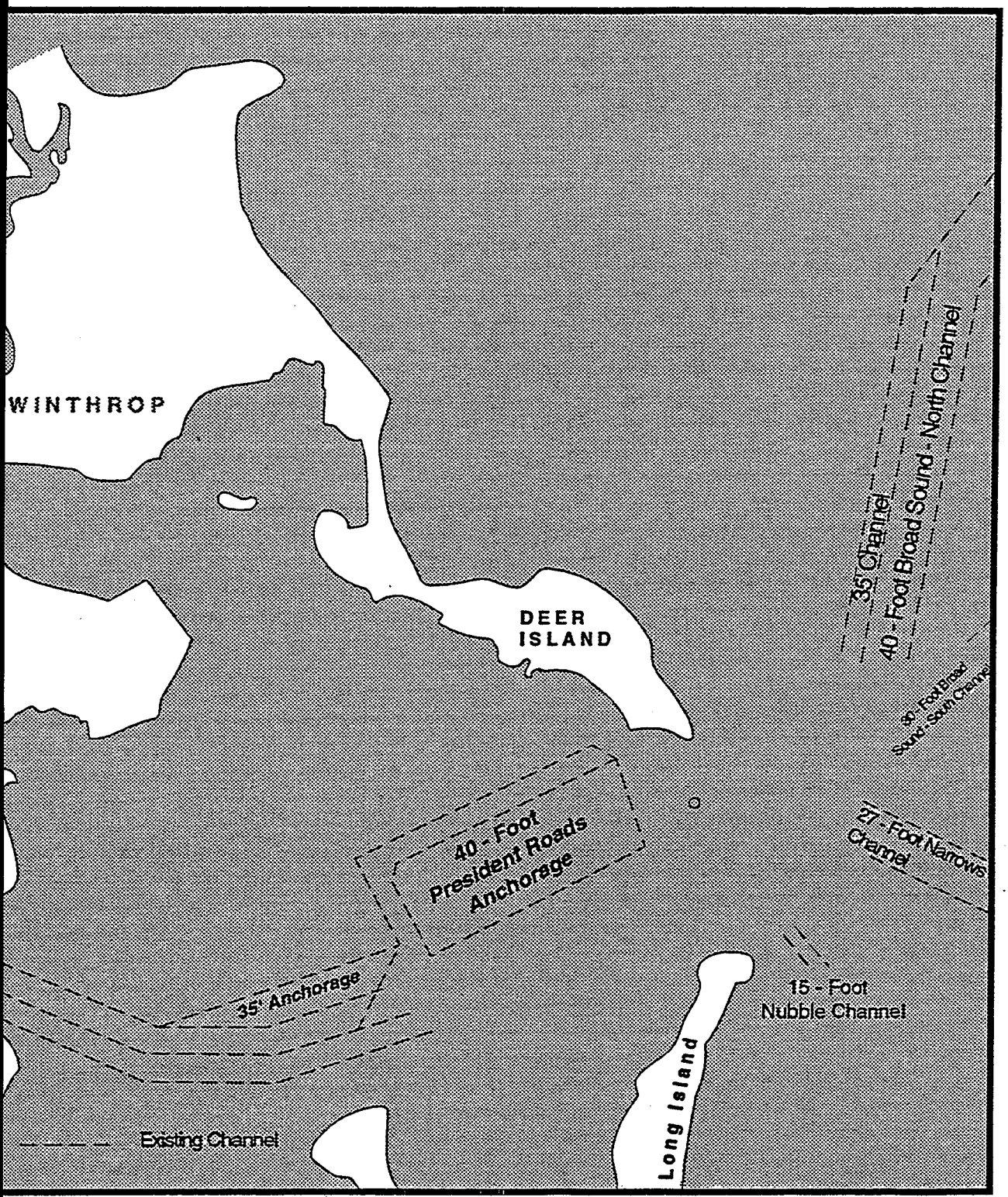



| Boston Harbor Dredging Project EIR/S | *Figure 1-1a* **Boston Harbor Locus Map** ==== Limits of Federal Channel |
|---|---|
| N *Scale:* 0 2000' 4000' Scale in Feet | *Source:* New England Division, Corps of Engineers |




| Boston Harbor Dredging Project EIR/S | *Figure 1-1b* **Boston Harbor Locus Map** ==== Limits of Federal Channel |
|---|---|
| N *Scale:* 0 2000' 4000' Scale in Feet | *Source:* New England Division, Corps of Engineers |

TABLE 1-1. COST SHARING FOR BHNIP: NON-FEDERAL SHARE PERCENTAGES

| | |
|---|---|
| Improvement Dredging | |
| Channel Deepening | 35%* |
| Aids to Navigation | -0- |
| Berthing Area Dredging | 100% |
| LERRD** | 100% |
| Operation and Maintenance Actions | |
| Channel Dredging | -0- |
| Aids to Navigation | -0- |
| Berthing Area Maintenance | 100% |

*Consisting of 25% paid during construction and the remaining 10% paid out over a maximum of 30 years. The 10% share may be reduced by credits given for utility relocation undertaken by Massport.

**LERRD - Lands, Easements, Rights-of-way, Relocations and Dredged Material Disposal areas.

TABLE 1-2. LIST OF PREPARERS

| PERSONNEL | TITLE | QUALIFICATIONS |
|---|---|---|
| MASSPORT | | |
| Ms. Janeen Hansen | Project Manager | M.C.R.P. in City and Regional Planning from Harvard University. 13 years experience in transportation analysis and policy planning. |
| Dr. Norm Faramelli | Director, Transportation & Environmental Planning | B.S. in Chemical Engineering from Bucknell University and Ph.D. from Temple University. 10 years consulting experience and 16 years at Massport in transportation and environmental planning. |
| U.S. ARMY CORPS OF ENGINEERS | | |
| Mr. Peter Jackson | Project Manager | M.S. in Civil Engineering from Stanford University. 25 years of experience with the Corps of Engineers in San Francisco District and New England Division in engineering and managing water resources projects. |
| Ms. Catherine Demos | Marine Ecologist | M.S. in Coastal Zone Management/Biology from University of West Florida. 7 years experience with the Corps. Has written several environmental assessments and EIS for coastal and marine projects. |
| Mr. Robert Meader | Engineering Manager | B.S.C.E. from Worcester Polytechnic Institute, M.C.R.P. from Rutgers. Over 18 years experience with Corps of Engineers in study management of inland and coastal navigation projects. |
| Dr. Thomas Fredette | Marine Scientist | Ph.D. in Marine Science from the Virginia Institute of Marine Science at The College of William and Mary. 10 years of experience in the area of environmental impact research, assessment, and monitoring. Program Manager of New England Division's Disposal Area Monitoring System (DAMOS). |

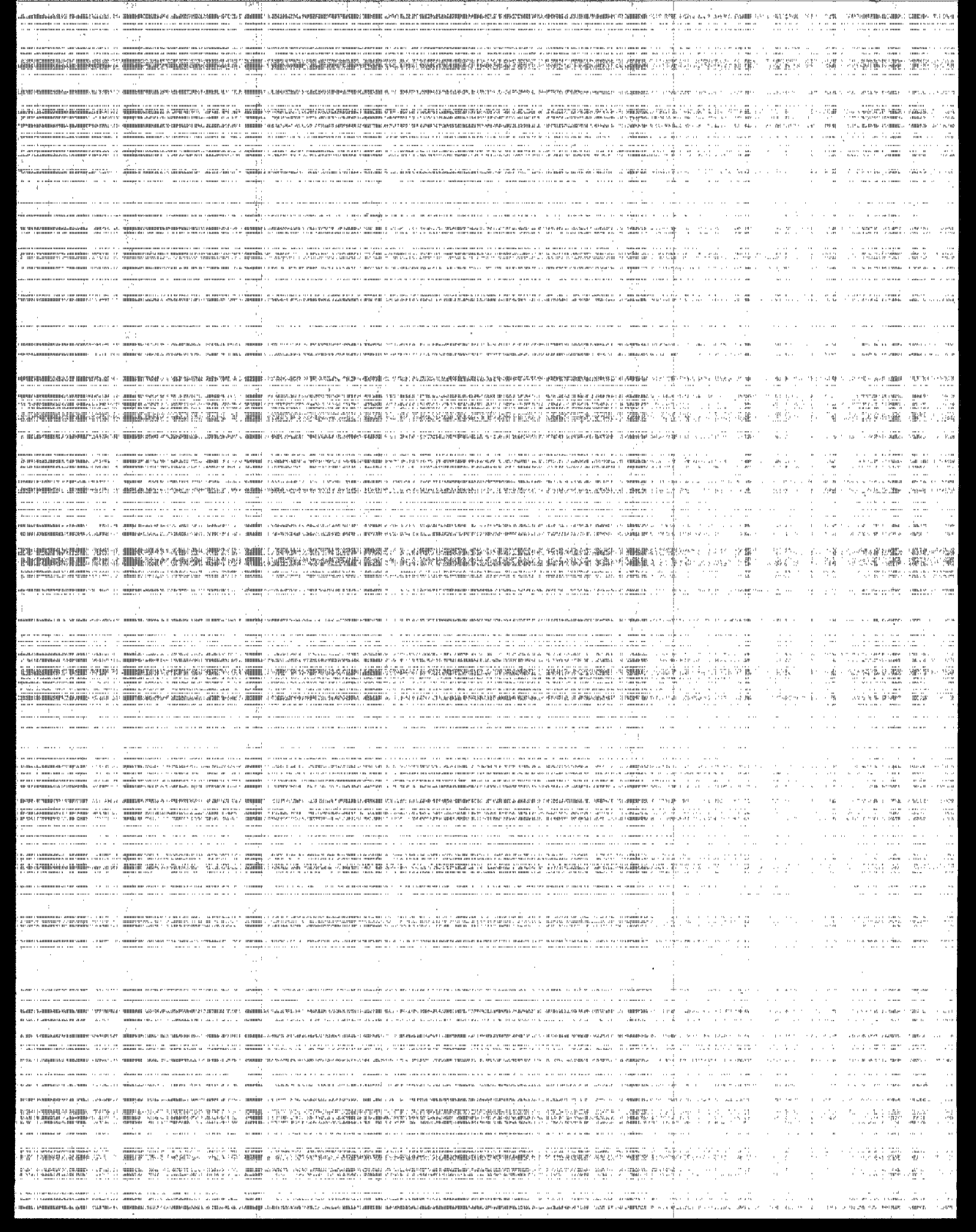
TABLE 1-2. (CONTINUED)

| PERSONNEL | TITLE | QUALIFICATIONS |
|---|---|---|
| NORMANDEAU ASSOCIATES INC. | | |
| Ms. Virginia Treworgy | Project Manager | M.A. in Government and Public Policy from Harvard University. 16 years experience in environmental impact assessment, permitting, and management of Remedial Investigation and Feasibility Studies at state and federal hazardous waste sites. |
| Ms. Ann Pembroke | Chief Editor and Marine Ecologist | M.S. in Marine Biology from University of Delaware. 12 years experience with the firm. Project manager and senior report author for numerous assessment projects dealing with marine issues. |
| Mr. John Shipman | Managing Corporate Officer, Senior Marine Ecologist | M.A. in Marine Biology from University of South Florida. 19 years experience with firm. Manages Marine Sciences Group and NAI's Biology Laboratory. Has managed numerous large marine and estuarine environmental studies. |
| Ms. Sarah Allen | Wetland & Wildlife Ecologist | M.S. in Wetland Ecology from University of Rhode Island. Over 11 years in natural resource research and consulting. Specializes in wetland delineation and junctional assessments, and botanical and wildlife surveys. |
| Ms. Mary Small | Wildlife Biologist | M.S. in Wildlife Management form University of Maine with emphasis in bird and small mammal ecology. 9 years experience life sciences. |
| Mr. James Bajek | Dredged Material Specialist | B.A. in Biology from University of North Florida. 17 years experience in the planning, material evaluation, and permitting of dredging projects. |
| Ms. Patty Marajh-Whittemore | Marine Ecologist | M.A. in Marine Affairs from University of Rhode Island. 7 years experience in evaluating the impacts of contaminants on marine and coastal environments. |

(continued)

TABLE 1-2. (CONTINUED)

| PERSONNEL | TITLE | QUALIFICATIONS |
|---|---|---|
| Mr. Jeff King | Water Resources Specialist | M.S. in Water Resources from University of Vermont. 5 years experience in assessing water quality impacts, especially from non-point pollution sources. |
| BOELTER & ASSOCIATES | | |
| Ms. Alice Boelter | Principal Port Planner | Master in Public Policy Studies from the University of Michigan. Over 20 years experience in urban planning and project permitting. |
| THE BSC GROUP | | |
| Ms. Ingeborg Hegemann | Environmental Planner | M.R.P. in Regional Planning from University of Pennsylvania. 14 years experience in project impact analysis, wetland science and permitting. |
| COMMONWEALTH RESOURCES MANAGEMENT CORPORATION | | |
| Mr. Thomas Yeransian | Principal Solid Waste Management | B.S. Chemical Engineering and B.A. Economics from Tufts University. 11 years experience in the solid waste management and environmental engineering/permitting fields. Specializes in evaluating alternative environmental treatment technologies for numerous applications. |
| WADE RESEARCH, INC. | | |
| Dr. Michael J. Wade | Principal Scientist, Marine Organic Geochemist | Ph.D. in Marine Geochemistry from University of Rhode Island. Dr. Wade provides chemical oceanographic consulting services to government and industrial clients. He is an organic geochemist with over 20 years technical and management experience in a variety of research programs, with special emphasis on pollutant fluxes in the environment. |



## 2.0 PROJECT DESIGN ALTERNATIVES ANALYSIS

This section of the EIR/S focuses on the project design alternatives and the likely environmental consequences of each. The second half of this section presents the results of the sediment characterization effort undertaken to determine the physical, chemical and biological nature of the material to be dredged in the BIHNIP. The project design alternatives and the sediment characterization study form the basis for the selection and design of appropriate disposal options for the project described in Section 3.0. It is the combination of these two factors that result in the identification of the most practicable alternatives for present disposal needs of silt and parent material as well as for future maintenance material needs.

Settling on a preferred disposal alternative is fraught with the difficulty of weighing the relative potential impacts to various environments. The public, and their regulatory and congressional representatives, have potentially conflicting goals. Federal and state regulations, and the agencies that oversee these regulations, can easily be in conflict as the maximum protection for each resource is sought. The potential for "gridlock" seems high. It is the project sponsor's objective to show, through the information developed throughout the following two sections, what compromises may be necessary to complete this project in an environmentally and socially responsible manner.

while still complying to the law.

## 2.1 PROJECT DESIGN ALTERNATIVES

The project design alternatives evaluated for the BIHNIP include taking no action, completing the full project to the proposed depths, reducing the project, and postponing the project. Both the MEPA certificate and NEPA guidance require that the EIR/S provide a discussion of the consequences of not carrying out the project, often referred to as the "No Action" alternative. The BIHNIP has been evaluated in terms of two scenarios under the "No Action" alternative. The first considers no improvement or maintenance dredging. The second considers no improvement dredging but with maintenance dredging to maintain current conditions.

### 2.1.1 No Action, No Maintenance Dredging

This alternative assumes that no dredging activity, including no maintenance dredging, would take place. Silty material is continually deposited in the navigation channels and berthing areas by rivers and tidal action. Organic material is deposited from combined sewer outfalls (CSO's) and the outfall pipe at Deer Island. Sediment deposited in the channels and berthing areas since they were last dredged will be referred to as "silt" in this report, to differentiate it from underlying material, rock and parent material (blue clay, gravel, etc.), proposed to be dredged in the BIHNIP.

Boston Harbor was last maintained in 1983 when dredged material was disposed at the Massachusetts Bay Disposal Site. On average the Reserved Channel and turning areas, Mystic River and the Inner Confluence, and Chelsea Creek have a siltation rate of less than 0.2 inches, 0.2, and 0.8 inches per year, respectively. This average rate, however, does not account for specific areas that shoal much faster and which require dredging more frequently. Areas within the tributaries that tend to shoal at substantially higher rates than the average eventually control navigation through the tributaries. Not maintaining the channels to the authorized depths would reduce Boston Harbor to a minor port unable to accommodate deeper draft container ships and petroleum tankers. These vessels draw at least 36 feet to 37 feet if loaded for a minimally economical operation. Some transits, particularly in the Chelsea Creek, must be made in daylight hours. There are limited opportunities for such transits at high tide, especially during the winter months. Limited tidal operations are not

this kind of argument needs more explanation.

consistent with efficient shipping, cargo handling or scheduling.

Ultimately, more material would have to be shipped into Boston via barges, necessitating more trips, higher costs, and greater exposure to risks of accidental spills. Impacts associated with this alternative are discussed in more detail in Section 2.1.6.

Maintaining, at least, existing constructed dimensions of the channels and related berths will reduce congestion at higher tide stages and enable the port to remain viable for deeper draft, and safer, more efficient shipping operations.

Leaving the top layer of silt material in place continues to expose marine organisms that live in or use the area, to contaminants. This material is also subject to continual resuspension in the water column during vessel transits in shallower areas. Removing the material to a more confined area, in either open water or upland, reduces this risk of exposure. The environmental or economic benefits accrued by leaving the material in place are few. MWRA (1993) has reported that with the reduction of toxics and solids in their discharge, cleaner sediments will settle over the older, more contaminated sediment, making dredging an unnecessary mitigation step in their clean-up program. Non-point source pollution, such as urban runoff, does contribute to the contaminant load. Also, several years would be needed to cover the existing sediments with the cleaner material. However biological processes and weather events can still turn these sediments over. Therefore benefits are provided by dredging the silt before new deposition occurs.

### 2.1.2 No Action, with Maintenance Dredging

The No Action, with Maintenance Dredging (to -35 feet MLW) alternative, would allow the Boston Harbor Federal Channels and the project berths to remain in their existing configurations. Table 2-1 lists dates and volumes of material last removed from each tributary (not including berths) as well as projections of annual and project life (50 yrs.) accumulation. As in Section 1, tables and figures referenced throughout the following text are located at the end of each section. The No Action, with Maintenance Dredging alternative would be analogous to maintaining the currently authorized depths, as shown on Figure 2-1a and 2-1b. This consists of three main entrance channels, -27, -30 and -35/40 feet MLW converging at the Outer Confluence in President Roads. A -40 foot MLW anchorage is located adjacent to the channel at President Roads. From President Roads to East Boston the Main Ship Channel has two 600 foot lanes. The inbound lane is -35 feet MLW and the outbound lane is -40 feet MLW. The 40 foot depth continues upstream at an average width of 700 feet to the -35 feet MLW Inner Confluence Area at the mouths of the Mystic River and Chelsea Creek. Three active deep draft tributary channels, the Reserved Channel, Mystic River and Chelsea Creek are provided with 35 foot depths. This alternative however, precludes the regional economic benefits of the authorized improvement project. Environmental impacts associated with the maintenance alternative include temporary disturbance from dredging and disposal activities. Maintenance dredging would remove primarily silty materials that have been transported into the channels since they were last dredged (Table 2-1). Dredging impacts include temporary and localized water quality degradation from turbidity and release of contaminants into the water column.

Disposal impacts would be dependent on the site selected. Water-based sites would have a temporary increase in turbidity and release of contaminants. Since the uncontaminated parent material to be dredged for the improvement project would be unavailable in this option, cap material from some alternative source would need to be identified before disposal can occur in the water. Land based sites

may need to be lined or the material treated to be acceptable for disposal.

### 2.1.3 Full Project - Three Channels, All Berths

Over the past decade various dredging alternatives, which fulfill the project purpose and need, have been investigated to identify their economic and environmental implications. The results of these investigations are contained in the 1988 Feasibility Report. The recommended plan, authorized in 1990, include the following features: deepen Reserved Channel and Mystic River from -35 feet to -40 feet MLW and Chelsea Creek from -35 feet to -38 feet MLW. Also included are non-structural modifications in the Presidents Roads area. Project berths located in these three tributaries would also deepen their areas to the same depths as the adjacent channel to accommodate deeper draft ships (see Figures 2-1a and 2-1b).

Deepening Boston Harbor will involve the removal of approximately 2.9 million cubic yards of silt, clay, and rock (Table 2-2). Short-term impacts from dredging will include localized turbidity, and when silty material is dredged, a temporary release of contaminants to the water column. Rock blasting will also have an impact on the biota in the area immediately surrounding the blast site. The long-term benefit from the project is the removal and sequester of silty material from biological resources. As the water in Boston Harbor becomes cleaner from additional sewage treatment, the removal of contaminated sediment will also enhance the biological health of this harbor. Potential disposal impacts associated with water based sites include turbidity, potential release of contaminants (depending on the material disposed), and benthic impacts. Upland disposal impacts could include habitat degradation, if the site is not a landfill.

Engineering design of the project must consider safety factors. For this reason a ship handling simulation study was conducted and evaluated to determine the impact of channel improvements on the docking masters perception of safety. The summary report is included in Appendix D. The objectives of the simulation were to provide an "as-near-to-reality-as-possible" real-time simulation of the proposed changes and to record the actions and opinions of docking masters currently working in the harbor. Existing channel conditions and vessel operations were tested and compared with the project channels and vessel operations of the same vessels loaded to greater drafts. Environmental and physical conditions were held constant except for forces acting on the more heavily laden ships. The results of the ship simulation study ensured the safety of the improved Harbor and minimized the area to be dredged.

Based on the ship simulation study and the economic analyses, the preferred navigation improvement project, as authorized, consists of the following components:

1. RESERVED CHANNEL - The existing 430-foot wide Reserved Channel will be deepened to -40 feet MLW from its existing -35 foot MLW with the exception of its upper 1,340 feet which will remain at -35 feet MLW (Figure 2-2). The width of the project channel will vary. The northern limit will be relocated inward by 15 feet for the entire length of the deepened channel, the southern channel limit will be relocated inward by 32 feet from the confluence with the main ship channel, along the Conley Terminal (Berths 11, 12 and 13) to the upstream limit of Conley Berth 11 resulting in a width of 383 feet for a distance of approximately 2,950 feet. Upstream from Berth 11 the existing southern channel line will be relocated 15 feet inward to the upstream limit of the deepened channel resulting in a width of 400 feet. The 32-foot wide reduction in the width of the existing channel along the

Conley Terminal Berths 11, 12 and 13 will be deauthorized and become berth area. The channel will be widened to provide maneuvering area at the confluence of the Reserved Channel, Main Ship Channel and Drydock Channel, and deepened to -40 feet MLW, relocating the established harbor lines accordingly. A trapezoidal area of the -35 foot main ship channel, opposite the Reserved Channel, will be deepened to -40 feet to provide required maneuvering area.

Approximately 159,700 cubic yards (cy) of silty (maintenance) material and 438,800 cy of parent (new) material will be removed from the channel. Approximately 34,100 cy of rock will be blasted and removed in the maneuvering areas at the mouth of the Main Ship Channel. Approximately 45,900 cy of material will be removed from the Conley Terminal berthing area 11-13 to deepen it to -40 feet MLW. The Coastal Oil berth has been deepened recently and does not require dredging. Boston Edison Intake and Barge Berth, Conley (Berths 14-15), and Boston Army will remove about 152,800 cy of total material. Dredging of the North Jetty berth on the Main Ship Channel will generate about 16,200 cy of material. The total amount of dredged material to be removed from Reserved Channel and associated work in the Main Ship Channel, including rock, is about 847,500 cy. The volumes are detailed in Table 2-2.

2. MYSTIC RIVER CHANNEL - About 5,670 feet of the existing 6,570-foot long -35 foot MLW Mystic River Channel would be deepened to -40 feet MLW (Figure 2-3). The Mystic River Channel is 580 feet wide through the Tobin Bridge, 740 to 700 feet wide from the bridge upstream to the Island End River, widening to 930 feet at the Island End River, widening further to 960 feet at the Exxon Terminal then narrowing to 440 feet at the Distrigas pier continuing upstream to the Prolerized Wharf to a depth of -40 feet MLW. Areas of the channel not requiring deepening would remain at their authorized depth of -35 feet MLW.

Also included with the Mystic River channel design is the Inner Confluence area. The existing 35-foot deep Inner Confluence Area would be deepened to -40 feet MLW as well as about 2,500 feet of the -35 foot Main Ship channel downstream of the Inner Confluence. This will improve the maneuverability of larger vessels as part of the modification to improve the approach to the Mystic River Channel.

In the Inner Confluence and Mystic River approximately 471,900 cy of silt, 791,800 cy of parent material and 54,000 cy of rock will be removed from the Channel. This includes deepening a part of the -35 MLW Main Ship Channel just south of the Inner Confluence.

Three of the berth areas will be deepened to -40 feet MLW with the following approximate amounts of material removed: Distrigas, 13,800 cy; Prolerized, 7,600 cy; and Moran Terminal, 6,600 cy. The Revere Sugar berth will also be deepened to -40 feet removing 12,800 cy as will the Mystic Piers Berths (1, 2, 49, 50) with 62,800 cy removed.

3. CHELSEA CREEK CHANNEL - The existing -35 foot MLW Chelsea Creek Channel will be deepened to -38 feet MLW, 200 to 225 feet wide downstream of the Chelsea Street Bridge, 250 to 430 feet wide upstream of the bridge and widened to the fenders at the bridge openings. Chelsea Creek was investigated for deepening to -40 feet MLW but this depth was found to be unjustified economically. The incremental cost of

deepening the channel from -38 feet to -40 feet was not offset by the additional benefit a deeper channel would provide. The significant cost was the relocation or protection of the subsurface utility crossings, primarily the Boston Gas siphon (see Figures 2-4 and 2-5). Utilities in the Chelsea Creek Channel will be modified to accommodate the deepened channel. These include: Boston Edison Cables (moved), MWRA Water Tunnel (removed), MBTA Cables (moved), and the Boston Gas Siphon (protected).

Approximately 230,000 cy of silt and 320,100 cy of parent material will be removed from the Channel. The Gulf Oil berthing area will be deepened to -38 feet MLW resulting in the removal of 12,300 cy of material. Eastern Minerals will deepen their berthing area to -38 feet MLW and remove approximately 39,900 cy of material.

4. MAIN SHIP CHANNEL - In addition to the project tributaries, three berthing areas along the main ship channel will also maintenance dredge their berths. They include: Boston Army Base (1-3) which will remove about 40,000 cy of dredged material (of the 128,500 total for Boston Army 1-9), about 16,200 cy of dredged material will be removed from North Jetty, and 17,600 cy of dredge material will be removed from Mystic Pier 1 (see Figure 2-6).

5. NON-STRUCTURAL IMPROVEMENTS AT PRESIDENTS ROADS - Specific Federal channel limits will be designated through President Roads to connect the Entrance Channels at the Outer Confluence with the Main Ship Channel limits. This will increase the size of the President Roads Anchorage from 350 to 420 acres. The area will be surveyed and several navigation buoys relocated to ensure a safe navigation channel. No dredging is required.

All told, the full project (including channels, beneficiary berths, other berths, and related areas) will remove about 1,100,000 cy of silt, 1,680,000 cy of parent material, and 88,000 cy of rock, all measured in place. Because of expansion during removal and handling, the corresponding volumes required for disposal are approximately 1,320,000 cy of silt, 2,020,000 cy of parent material, and 132,000 cy of rock.

Future maintenance dredging of the tributaries in the Full Project is anticipated to yield 95,000 cy for the Reserved Channel, 1,300,000 cy for the Mystic River, and 365,000 cy for the Chelsea Creek over a 50-year economic project life. Approximately 1,760,000 cy of silty material from the tributaries will require removal and disposal at various times over the next 50 years.

In addition to the tributary channels, maintenance of the Main Ship Channel and the anchorages is required to maximize the benefits of all the interdependent projects that support the Port of Boston. This maintenance would require removal of about 4,365,000 cy of material over the 50-year design life. Maintenance volumes are listed in Table 2-1.

### 2.1.4 Reduced Project

The Navigation Improvement Project is made up of improvements to three tributary channels. The economic feasibility analysis prepared for the feasibility report and subsequently updated, viewed each tributary channel and its berth areas as individually justified. Each tributary channel can therefore be treated as a separate project or in any combination with other project tributaries.

A reduced project could result from economic justification failing for one or more of the tributaries

as a result of increased cost or reduced benefits to the project. Economic justification is reviewed periodically up to the time of construction. Corps project evaluation procedures require that a project have benefits at least as great as project costs, or expressed differently, have a ratio of benefits to cost that is greater or equal to one.

Another reduction in the project, a temporary reduction, could occur if there is a delay in one or two of the tributaries due to changes in the project area that might require reformulation of the authorized plan. An example would be the replacement of the Chelsea Street Bridge by the City of Boston. There is interest in reviewing the navigation channel to consider widening and deepening to accommodate larger vessels. Changes of this magnitude would require reformulation of a plan because the benefits would change and may require authorization by Congress to implement. Such a delay in the Chelsea Creek portion of the project would not impact the Mystic and Reserved portions of the project which could move ahead independently. Once reformulated, the Chelsea Creek improvement could proceed. Minor changes to channel lines and berths would not delay the project.

A reduced project may also result from reductions in the dimensions of the project such as minor realignment of channel lines, berth areas etc. Unless these changes have substantial impact on the economic justification of the project or require reformulation and reauthorization they should not delay or reduce the project to any great degree. It is anticipated that a number of these minor reductions and possible enlargements to the project will occur as the design is finalized.

### 2.1.5 Delayed Action

The present timetable is for the Boston Harbor Dredging Project to begin early in 1996. Any substantial delays (>4 years) in this schedule could noticeably impact shipping interests in the Port of Boston. Continued siltation will steadily reduce the useable channel and ship berth depths and could eventually create unusable and, in some instances hazardous, conditions for the larger vessels.

Reductions in the useable draft for the project channels and berths could limit usage by more vessels to high tide and increase the need for lightering. Also, this may result in a reduction in the size of vessels transiting Boston Harbor, increasing the overall number of vessels needed for handling the same quantity of goods. Vessel maneuverability could also be impaired for larger vessels such as the LNG (Liquified Natural Gas) tankers that turn in the inner confluence. Constraints on the size of vessels that could utilize the harbor may reduce cargo volumes and overall port employment.

A reduction in flexibility of ship schedules could ultimately result in the diversion of cargo to other ports. This loss in the cargo market would have a negative impact on the Port of Boston.

The authorized depths in the port of Boston are difficult to maintain since it is the upper "maintenance" silty material that contains the higher contaminant concentrations that would cause the delay. The harbor was last dredged in 1983 and maintenance dredging of this and other channels is now already overdue. Delaying the project another 5-10 years could have substantial impacts, by increasing the quantity of material that will eventually require dredging. A greater quantity of material coupled with inflation will increase the cost of dredging. The increased quantity will also lengthen the duration of dredging once it finally begins and could affect the project schedule further if the increase in time conflicts with environmental dredging windows.

A delayed project will also result in a continuation of having a large area of silt and associated contaminants on the bottom of Boston Harbor in direct contact with marine biota. Storms and prop wash

regularly resuspend silts. Once dredged, clean parent material will be exposed for benthic recruitment.

### 2.1.6 Comparison of Project Design Alternatives

The project alternatives and their environmental consequences are summarized on Table 2-3. Disposal alternatives are discussed in later sections and are not included in this analysis.

Three major factors differentiate the project alternatives: quantities to be dredged, areas to be maintained or improved, and the timing. The quantities of sediment to be dredged affects:

- duration of dredging
- duration of turbidity plume
- amount of habitat affected
- duration of interference with navigation.

The No Action without Maintenance alternative would, of course, result in no dredging and therefore would have none of these effects. In turn, the alternative would have other environmental and economic impacts. The No Action with Maintenance alternative would remove only unconsolidated silt and leave the cohesive parent material in place, resulting in virtually the same turbidity, plume and footprint, but reduced duration of dredging compared to the Full Project or the Delayed Project. Because the Delayed Project would encompass dredging a larger component of silt, dredging would take longer and result in a prolonged period of increased turbidity compared to the Full Project.

The physical limits (both horizontal and vertical) of the dredging alternatives affect:

- socioeconomic benefits
- navigation safety.
- potential improvements to bottom sediment quality

Doesn't compare reduced project



If they're going to claim econ. benefits from waiving BH compatible, they have to examine the impacts

The changing world fleet requires deeper ports to minimize double-hauling of cargos. The two No Action alternatives would allow shipping to continue in Boston Harbor but would eventually lead to greater and greater reliance on partially loaded vessels, lightering or feeder barges. The No Action with Maintenance dredging alternative has all the potential impacts of the Full Project but without the economic benefits of the full project. Deepening of any of the channels would improve this outlook for specific components of the Port's activities. Petroleum shipping would be affected by dredging in Chelsea Creek, Mystic River and Reserved Channel. LNG shipment would be affected by activities in the Mystic River. Container shipping would be affected by deepening the Mystic River or Reserved Channel. Thus the Full Project has the greatest potential to benefit shipping in Boston Harbor. These benefits would be reduced for the Delayed Project. Delaying the project could reduce the economic benefits if port costs or navigation conditions cause current port users to use other ports.

The Full Project is the preferred, and congressionally-authorized, alternative for the dredging project. In addition to the removal of all unconsolidated silts required for maintenance, parent material would be dredged to project depths. The purpose and need for the Full Project has been documented (ACOE 1988; and Section 1.2). It offers the greatest benefits to the port of Boston; the impacts associated with the dredging are, as with the other alternatives, temporary. The preferred project alternative can reduce the cost of product shipped through Boston, reduce associated shipping costs, and maintain a workforce engaged in maritime support services.

## 2.2 SEDIMENT CHARACTERIZATION

Boston Harbor is bordered by a group of outlying islands and the peninsula areas of Winthrop and Hull. The harbor is the largest port in the New England region, covering approximately 47 square

miles. It supports shipping, commercial, industrial, fishing and recreational interests.

In general, much of the environmental quality of Boston Harbor can be characterized by its water and sediment quality which improve from the Inner Harbor seaward. The Harbor areas that are planned to be dredged are all classified as "SC" waters (314 CMR 4.05, (4)(a) and (4)(b) and (4)(c). Such waters are designated as habitat for fish, other aquatic life and wildlife, for secondary contact recreation, aesthetic enjoyment, and industrial cooling and process use. Boston Harbor water is used for several of these purposes. Recreational vessels however, are limited due to the restricted number of berthing areas for these types of boats.

Boston Harbor is an urbanized working port. It is surrounded by several port activities along the three previously described tributaries and the main ship channel. Downtown Boston is also located in the Inner Harbor area along the south shore just below the Inner Confluence. The Reserved Channel supports a cruise terminal, Boston Edison and docking facilities. Berthing areas for oil terminals and liquid natural gas storage tanks occur along the Chelsea Creek and several types of port activities occur along the Mystic River. There are limited residential establishments around the Harbor. The residential development generally occurs away from the shoreline in condominium complexes and compact two or three family houses.

The Outer Harbor areas, except for Broad Sound Channels, are classified SB waters. The classification of SB implies acceptability for aesthetic enjoyment, habitat for indigenous wildlife and forage and game fish, and the harvesting of shellfish with depuration. The waters in the Broad Sound areas are classified as SA. These waters are designated as excellent habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas these waters can be suitable for shellfish harvesting without depuration.

In all dredging projects, the issue of greatest concern is the sediment quality of the dredged material and how it will affect the surrounding water quality, briefly described above, during dredging and at the proposed disposal site(s). Therefore, as directed by the MEPA certificate, an intensive study was undertaken to assess sediment quality under existing conditions using a testing protocol developed as part of the Sediment Characterization Working Group and Advisory Committee process described in Section 1.4 (see Appendix C-1).

### 2.2.1 Sediment Characterization: Overview and Approach

Parent material which is expected to be dredged was tested and found suitable under Section 103 exclusionary criteria of the Marine Protection Research and Sanctuaries Act. Sediment Characterization described in the following sections refer to the silt material only.

The sediment sampling and testing program for the BHNIP silt was actually comprised of two separate characterization effects: one for the Federal project and the second for the Massport sponsored berth area dredging. Both programs however, were designed to be consistent with the three tiered evaluation approach outlined in the national "Green Book" 1991 guidelines, and U.S. EPA Region 1/U.S. Army Corps of Engineers (ACOE) regional protocol entitled "Guidance for Performing Tests on Dredged Material to be Disposed in Open Waters," May, 1990. The three tier analytical approach that has been developed for marine sediment characterization is graphically represented in Figure 2-7. As depicted, the focus of this approach is on evaluating the suitability of dredged material from Boston Harbor for ocean disposal. However, the test results can also be utilized to evaluate disposal at other open water disposal sites as well as upland disposal.



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Tier I of this process consists of a review of existing literature, environmental data and the physical characteristics of the area to determine the potential for contamination and the need for chemical testing (Tier II). In Tier II, bulk chemical analysis of the material is performed to determine whether contaminants are present at concentrations that have the potential for environmental impacts. Tier III uses biological testing (acute toxicity and bioaccumulation) to determine the potential impacts of dredged material disposal on marine organisms. The results of these analyses are used to determine if the material is suitable for unconfined ocean disposal. The feasibility of capping dredged material not meeting the requirements for unconfined disposal can also be evaluated from the results.

### 2.2.2 Federal Channel Sediment Testing Program

During preparation of the 1988 Environmental Assessment and Feasibility Report for the Federal project, 18 sediment samples were collected for bulk chemical analysis in 1986 from Mystic River, Chelsea Creek and Reserved Channel. Using the 1986 test results as a basis, two stations from each of the three areas were resampled in 1990 for additional chemical and biological testing. Analyses were performed for all chemicals listed in the regional protocol (see Appendix C-2). In addition to metals and PCBs, sediments were analyzed for pesticides, volatile and semi-volatile organics, dioxin and furan homologs. Further details of the Corps sampling and testing program are presented in Appendix C-2.

The following is a summary of the results of the three tier analytical approach that was used for the Federal project marine sediment characterization.

#### 2.2.2.1 Tier I - Review of Existing Data

The Tier I evaluation began by performing a literature review of the sediment quality within Boston Harbor. Results showed that sediments in Boston Harbor are predominantly glacial materials with the organic fraction of the sediments resulting from industrial and sewage discharges, and transport of contaminants into the Harbor by rivers. The most prevalent harbor sediment is a plastic clay of glacial origin, know locally as the Boston blue clay. This layer has been identified throughout the harbor in various seismic investigations (Edgerton, 1963 and 1965). The clay is often overlain by more recent sediments, including silts and sands that serve as repositories for contaminant associated particulates. In several areas, finer grained recent sediments contain considerable quantities of gas, predominantly $C0_2$, $CH_4$, and $H_2S$. Sasaki Associates (1983) summarizes the chemical characteristics of the harbor sediments based on studies by the Corps of Engineers, Massachusetts Division of Water Pollution Control, the New England Aquarium and other private groups.

#### 2.2.2.2 Tier II - Chemical Evaluation of the Dredged Material

The literature review, together with the Corps data, indicated that certain types and concentrations of contaminants with the potential for biological impacts were present in the sediment. In 1986, eighteen sediment samples were collected from three areas to be dredged as part of the Federal project (the Mystic River, Chelsea Creek and Reserved Channel). The Mystic River had elevated levels of arsenic, lead, and zinc. The Chelsea Creek and Reserved Channel had elevated concentrations of lead. Elevated levels of PCBs were found in one sample from the Mystic River and moderate concentrations in one sample from the Reserved Channel. It was determined that these results adequately characterized the chemical nature of the sediments to be dredged for the Federal

project. However, further chemical and biological testing was required to determine the suitability of the dredged material for unconfined ocean disposal.

The 1986 Corps sediment test results were used as a basis for conducting the 1990 bulk chemistry testing. Two stations each from the Mystic River, Chelsea Creek and Reserved Channel were resampled in 1990. Table 2-4 shows the metal concentrations in the Mystic River, Chelsea Creek and Reserved Channel for 1986 and 1990. For both sampling periods arsenic, chromium, lead, and zinc were detected at Level III in the Mystic River and Chelsea Creek. Level III is defined as a concentration similar to the Massachusetts DEP Category III (Table 2-5). In the Reserved Channel arsenic, chromium, and zinc were detected at high levels in 1986 and 1990. In the 1986 samples elevated concentration of PCBs found in one sample from the Mystic River and moderate concentration from one sample in the Reserved Channel. PCBs were not detected in any of the 1990 samples. In general, there is good agreement for metal concentrations for samples collected in 1990 and 1986.

Polycyclic aromatic hydrocarbon (PAH) concentrations in the Reserved Channel, Chelsea Creek and Mystic Channel are listed in Table 2-6. The total PAH concentrations in the lower Chelsea Creek (Station E) was detected at level III, and in the Mystic River (Station B) it was detected at Level II for the 1990 samples.

The semi-volatile compound Bis(2-ethtylhexyl)-phthalate was detected in all of the samples. Phthalates are used in the manufacture of plastics. Elevated sediment phthalate concentrations are commonly the result of sample contamination. The plastics operation in the upper Mystic River could also explain the more elevated levels found in this reach.

Four volatile organic compounds were detected in several of the samples. Most of these were at low concentrations. Acetone was found in all samples at a relatively high level. The source of acetone to these samples is unknown. Acetone is a natural by-product of microbial respiration in sediments. It is also a commonly used laboratory solvent and therefore laboratory contamination cannot be ruled out as a source. Volatiles would most likely be lost during the dredging process and are not a major concern.

Sediment samples were tested for dioxin and furan compounds in 1990. All the compounds tested were below detection limits except total Hepta-chlorodibenzo dioxins (HpCDD) and total Octa-chlorodibenzo dioxins (OCDD). One sample (Mystic A) showed test results below detection limits for total HpCDD. HpCDD and OCDD are not considered as toxic as the other compounds such as Tetrachlorodibenzo dioxins (TCDD) (McFarland, pers. comm. 1993).

The only pesticide which was detected in all of the samples was endrin aldehyde. This compound was also present in the blank, suggesting lab contamination as the source. The remaining pesticides were either not detectable or present only at low levels. The semi-volatile, volatile, and pesticides data are presented in Appendix C-2.

#### 2.2.2.3 Tier III - Biological Evaluation of the Dredged Material

Bioassay: Solid phase bioassays were performed in 1990 on sediments from six locations in Boston Harbor. This involved a 10-day static toxicity testing for the amphipod (*Ampelisca abdita*) and a 28-day flow through bioassay for a deposit-feeding clam (*Macoma nasuta*) and the sandworm (*Nereis virens*). The amphipod tests were flawed and run again using one sediment sample from each reach. The results of these analyses are summarized in Table 2-7.

The clams exposed to the test samples had good survival ranging from 84% to 95%, except for Mystic A, where the survival average was 44%. The refer-

ence and control sediment had 93% and 99% survival respectively. The test worms had a high survival ranging from 93% to 98%. Survival in the reference and control were 93% and 95% respectively. Ninety percent survival or greater is considered satisfactory for control sediments.

The regional protocol for assessing acute toxicity potential requires a comparison of the mean values for survival rates of test animals exposed to the test and reference sediments. Test animals exposed to test sediments that show a statistically significant reduction in survival, and a difference in mean values of greater than 20% for the amphipods and 10% for the clams and worms, are considered to exhibit acute toxic response. Conversely, those means that are either not statistically different or less than the 20% and 10% difference thresholds may be considered to have low toxic response to the prospective dredged material. The test sediments for this project showed statistically significant mortality effects (defined by a probability of more than 95%, expressed as the inverse of probability ($p \leq 0.05$)) and exceedance of the 20% threshold for amphipods at all proposed dredging locations. The test sediments also showed significant mortality effects and exceedance of the 10% threshold for clams exposed to the Mystic A test sediments.

Bioaccumulation:- The purpose of the bioaccumulation studies was to determine the potential for uptake of contaminants of concern in representative benthic marine organisms. Bioaccumulation tests were performed on clams and worms surviving the acute toxicity bioassay to determine the potential uptake of contaminants by the organisms. The parameters measured for bioaccumulation were based on the results of the bulk chemical analysis of sediments. The test results are presented in Appendix C-2. The data were statistically analyzed using the Corps, New England Division SAL (Statistical Analysis of Dredged Material) program. No statistically significant differences were found for uptake of heavy metals by the worms. The bioaccumulation testing showed substantial uptake by the clams for cadmium from Mystic A sediment and chromium and lead from the Chelsea Creek and the Reserved Channel. No statistically significant uptake of PCBs, pesticides, or PAHs was observed for any of the clam or worm tests exposed to Boston Harbor sediment from any of the six stations when compared to the reference results.

### 2.2.3 Massport Sponsored Sediment Testing Program

The Sediment Characterization Technical Working Group for the Massport sponsored portion of the Project met on a number of occasions to assist in developing the sampling and testing strategy for the berths. A stratified random sediment sampling design was established that allocated three samples at each of the fifteen dredging sites. Sampling locations at each dredging site was randomly selected using a 40-foot grid and random number table. One terminal, Boston Army Base, was divided into two sites (for sampling) because of its size and configuration (it extends from the Reserved Channel into the Main Ship Channel over a length of 4870 feet).

The chemical parameters for Tier II (bulk chemical) testing followed EPA analytical methods and detection limits for heavy metals, PCBs, pesticides, PAHs, TOC, and grain size (Table 2-5). These procedures and detection limits meet the regional testing protocol established by the U.S. EPA and Army Corps of Engineers. The samples for the Tier II bulk chemical analysis were collected in June-July, 1992. Tier III analysis began with amphipod acute toxicity tests on sediment from the sites that had elevated sediment contaminant levels (Levels II and III). Due to the length of time needed to conduct sampling at all sites, two separate amphipod toxicity test series were conducted in July and September 1992. The solid phase bioassay with clams and worms was conducted in November 1992. Details of the sampling and

testing protocols and results are discussed in Appendix C-3.

The following is a summary of the results of the three tier analytical approach that was used for the proposed Massport-sponsored berth dredging in Boston Harbor.

#### 2.2.3.1 Tier 1 - Review of Existing Data

In this first screening step all existing site related information, including dredged material volumes for each area, results from previous physical, chemical and biological testing, known physical and hydrodynamic characteristics of the sites, spill histories, and prior dredging history were reviewed. There was little existing sediment chemistry information of value in characterizing the sites. Less than half of the 15 sites had historical information collected within the last 10 years on sediment chemistry (Appendix C-3). In general, there were insufficient historical data relating to heavy metals, PAHs and PCB concentrations for evaluation of the prospective dredging sites. Therefore, further chemical and biological testing was required to determine the suitability of the dredged material for upland or ocean disposal.

#### 2.2.3.2 Tier II - Results of Bulk Sediment Chemical Analyses

Table 2-8 is a summary of the bulk chemical test results for metal concentrations by site. Arsenic, lead, and zinc all were found to be at Level III at Prolerized, Distrigas, and Revere Sugar. Mystic Piers and North Jetty showed Level III for lead and zinc only, and Moran had Level III for arsenic and lead only. Eastern Minerals had Level III for lead only. Mercury was found to be only as high as Level II at Prolerized, Distrigas, Mystic Piers, Moran, North Jetty, Eastern Minerals, Army Base and Conley. Cadmium was at Level II at Prolerized, Boston Edison Intake and Boston Edison Barge berth.

Table 2-9 and Table 2-10 are summaries of the bulk chemical test results for total PAHs and total PCBs. Total PAHs and total PCBs were found to high levels at Prolerized, Distrigas, Revere Sugar, Boston Edison intake, Moran, North Jetty, Eastern Minerals, and Conley. Mystic Piers showed high levels for total PAHs and Level II for total PCBs.

#### 2.2.3.3 Tier III - Bioassay/Bioaccumulation

**Amphipod Test Results**

Two sets of amphipod tests were conducted, each with its own reference test results.

The July 24-August 3, 1992 amphipod tests: This series involved nine test sediments with five replicates each. As shown in Table 2-11, the survival after 10 days ranged from 3% to 63% in the test sediments. The reference and control sediments had 82% and 93%, survival respectively. The Conley test sediment showed a survival rate of 63% and a reference-test difference of 19%. All other sites tested in this series showed a reference-test mortality difference greater than 20%.

The September 5-15, 1992 amphipod tests: This testing was conducted in the same manner as the first series. Of the five sites tested, two sites (Gulf Oil and Edison Barge Berth) showed survival of 55% and 63%, respectively (Table 2-11). The other sites had survival that ranged from 21 to 47%. The control had 92% survival and the reference site had 74% survival. The mortality difference (reference-test) for the Gulf Oil and Boston Edison Barge berth sites were 19% and 11% respectively. All other sites tested in this series showed a reference-test morality difference greater than 20%.

**Results for Solid Phase Bioassay**

The bioassay results showed that clam and marine worm survival were high for all sites tested (most > 95 %, none < 90 %). Survival data for the eight sites produced by solid phase bioassays with clams and worms are presented in Table 2-12. Survival of the worms was 90 to 97%. Clam survival for all sites was 94 to 99%. This is considered very good survival and does not indicate any acute toxicity to the organisms tested. Ninety percent survival or greater is considered satisfactory for control sediments. The test sediments did not cause any statistically significant mortality compared to the reference sediments which was 93% survival for worms and 97% for clams. The control tests had mean survival of 95% for worms and 98% for clams, indicating healthy organisms and a proper test system were used in the assay.

**Bioaccumulation**

The bioaccumulation tests were performed on clams and marine worms surviving the bioassay to determine the potential uptake of contaminants by organisms. The parameters measured for bioaccumulation were based on the results of the bulk chemical analysis of sediments; metals, PAHs, and PCBs were measured. Appendix C-3 includes the bioaccumulation test results for all parameters and all sites tested.

The chemical means of the bioaccumulation testing were first compared to the corresponding means established for the reference exposures. Results for each chemical parameter analyzed for bioaccumulation where the test mean exceeded the reference mean were first subjected to Levene's test for homogeneity of variances. Those with homogenous variances were tested with analysis of variance (ANOVA), comparing each site's replicate values with the corresponding reference site values. Dunnett's test was used to evaluate significant results in order to determine which site(s) showed a significant difference from the reference site. A logarithmic transformation was utilized to reduce heterogeneity of variance. An ANOVA on $\log_{10}$ transformed data was performed in cases where log transformation led to homogeneous variances as revealed by Levene's tests. A nonparametric analysis of variance (Kruskall-Wallis test) was performed on those parameters that did not have a homogeneous variance structure even with transformation. If this test revealed significant differences between reference and project sites, a nonparametric analogue of the t-test (Wilcoxon's summed rank test) was performed comparing each site with the reference site.

Determinations of significance were made at the 0.05, 0.01, and 0.001 levels, although it is recognized that the EPA and Corps regulatory decisions are based on the 0.05 confidence level. It should be noted that many of the significant results occurred near the detection limits of a particular chemical, and those findings of significance could be an artifact of the nonvariability of the reference replicate results which were found to be below detection limits. In those cases, the detection limit was used for the statistical evaluation. Table 2-13 is a summary of the mean concentration of parameters significant at the $p \leq 0.05$ confidence level at each site tested for bioaccumulation.

### 2.2.4 Summary of Findings

Based on the above results, the 2.9 million cubic yards of dredged material from the navigation improvement dredging will consist of approximately 1.7 million cubic yards of "clean" parent material including rock. The remaining 1.1 million cubic yards of silty material will have the general chemical characteristics as summarized above and in Appendices C-2 and C-3.

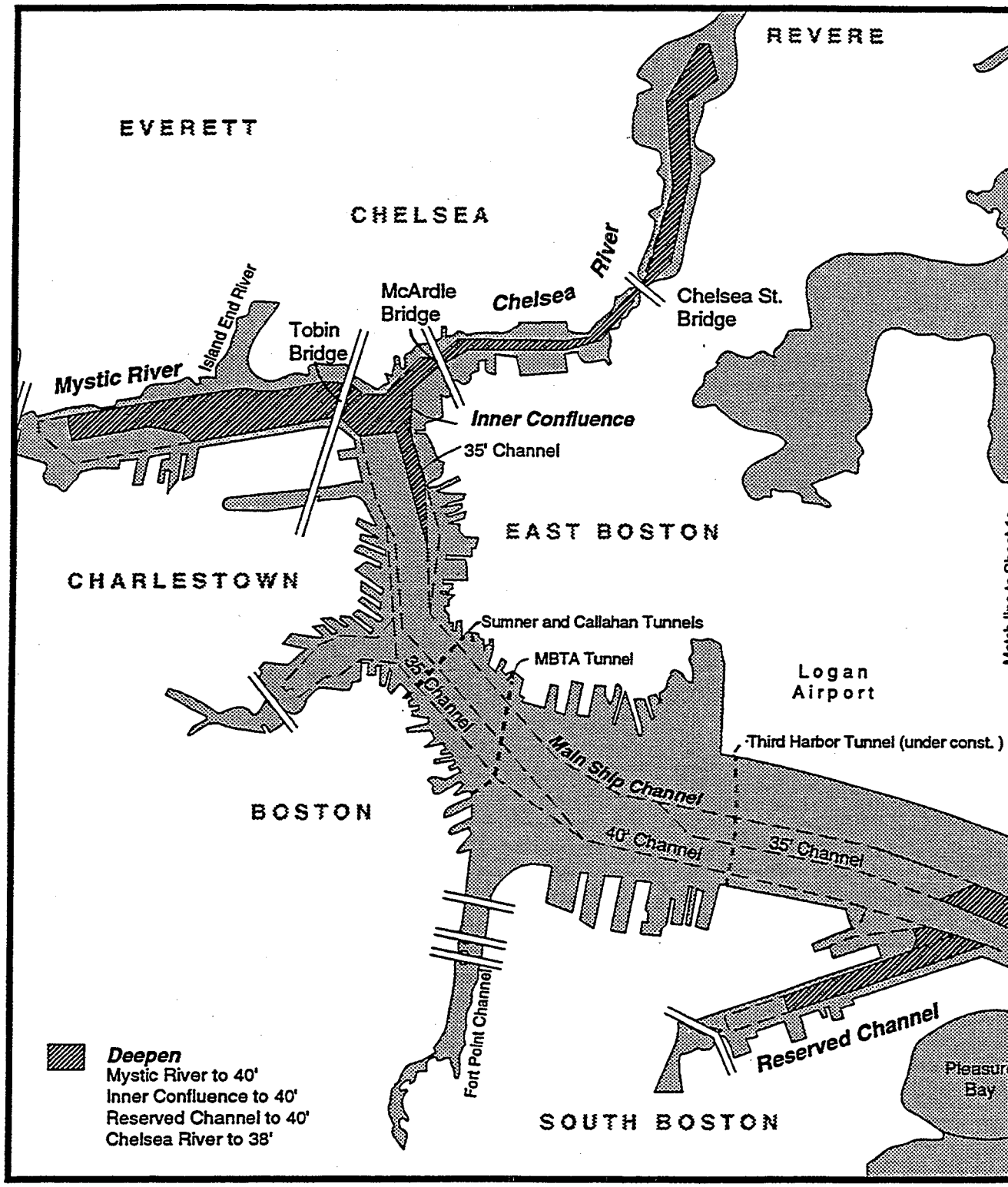
Based on these results, the U.S. Army Corps of

Engineers has determined that all the maintenance material (silt), except 160,000 cy from Reserved Channel, and 200,000 cy from the berth areas of Gulf Oil, Army Base, Conley Terminal, and the Edison Barge berth, is unsuitable for unconfined open water disposal. Conversely, all of the silt material is considered to be unsuitable for unconfined open water disposal by the U.S. Environmental Protection Agency.

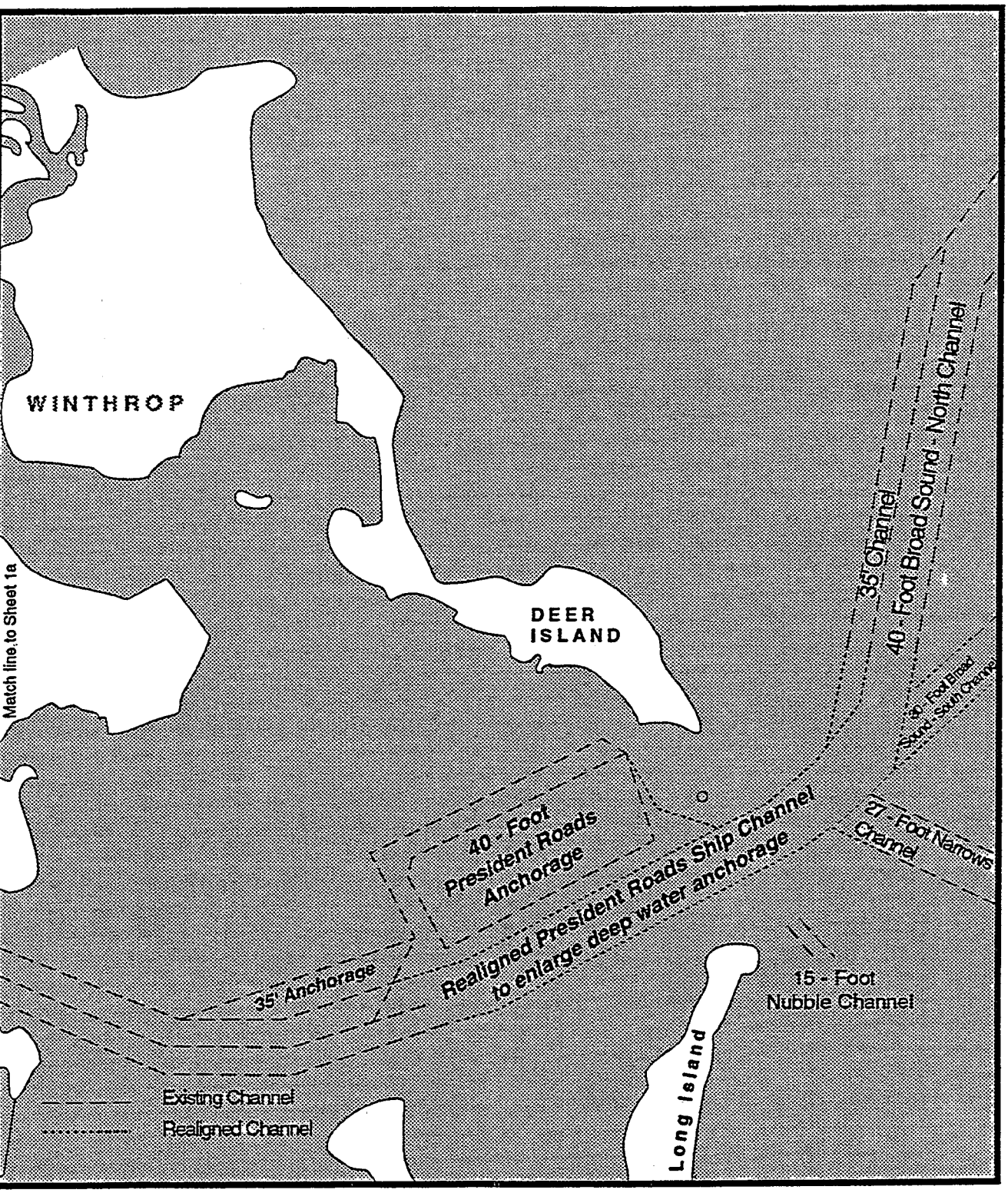
The implication of these results in developing options for the dredged material disposal are discussed in Section 3.0. Due to the divergence of opinion regarding the suitability of the silt for ocean disposal Section 3.0 details options for assuming no ocean disposal of silt as well as alternatives which consider ocean disposal of 360,000 cy of material deemed suitable by the U.S. Army Corps.



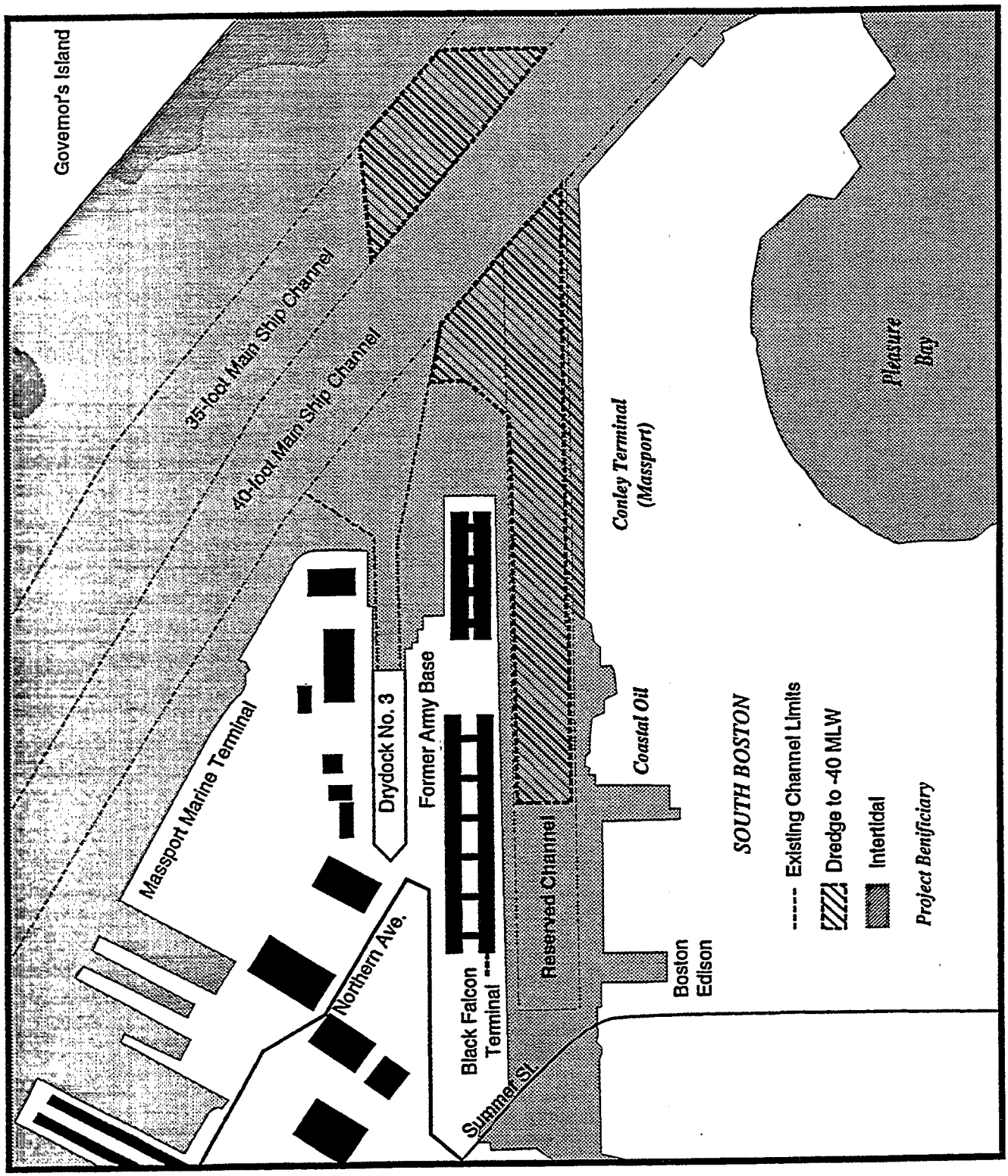
G2




| Boston Harbor Dredging Project EIR/S | *Figure 2-1a* Boston Harbor Navigation Improvement Project General Plan |
|---|---|
| N *Scale:* 0 2000' 4000' Scale in Feet | *Source:* New England Division, Corps of Engineers |



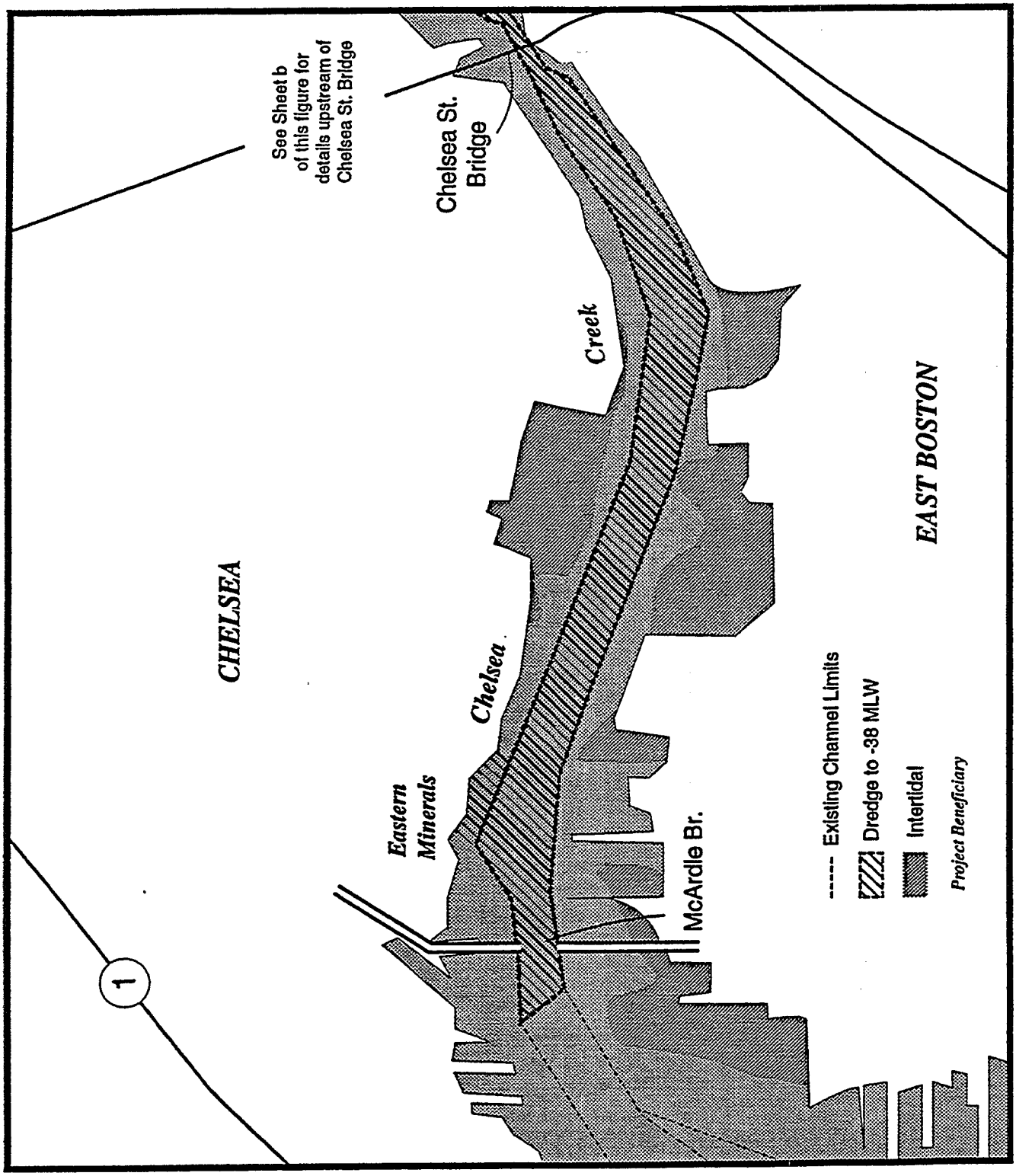

| Boston Harbor Dredging Project EIR/S | *Figure 2-1b* Boston Harbor Navigation Improvement Project General Plan |
|---|---|
| N | *Scale:* 0 2000' 4000' Scale in Feet |
| | *Source:* New England Division, Corps of Engineers |



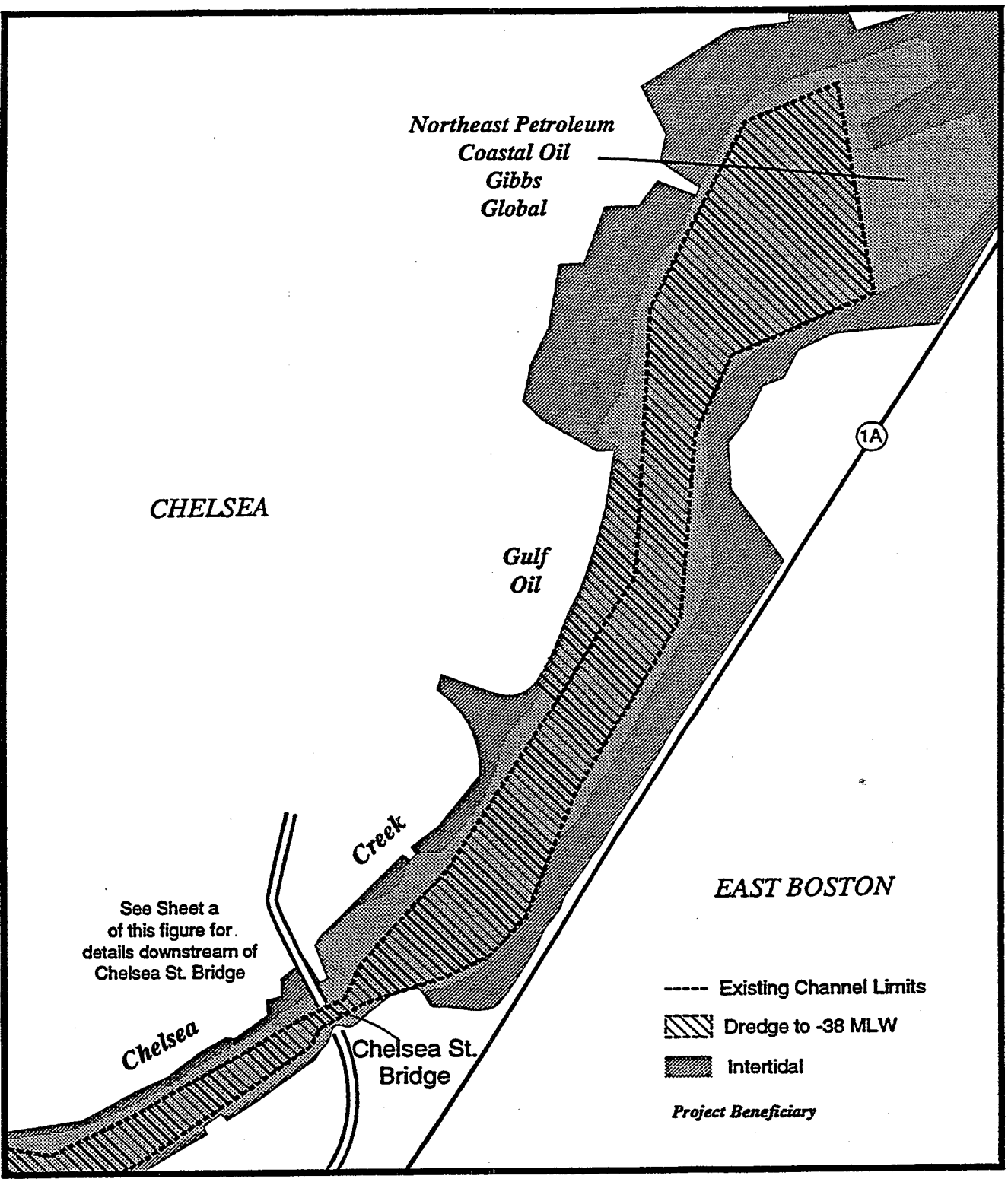

| Boston Harbor Dredging Project EIS/R | *Figure 2-2* Navigation Improvement Project **Reserved Channel** |
|---|---|
| N *Scale:* 0 100 200 Scale in Yards | *Source:* Boston Inner Harbor Navigation Chart |

2-16A

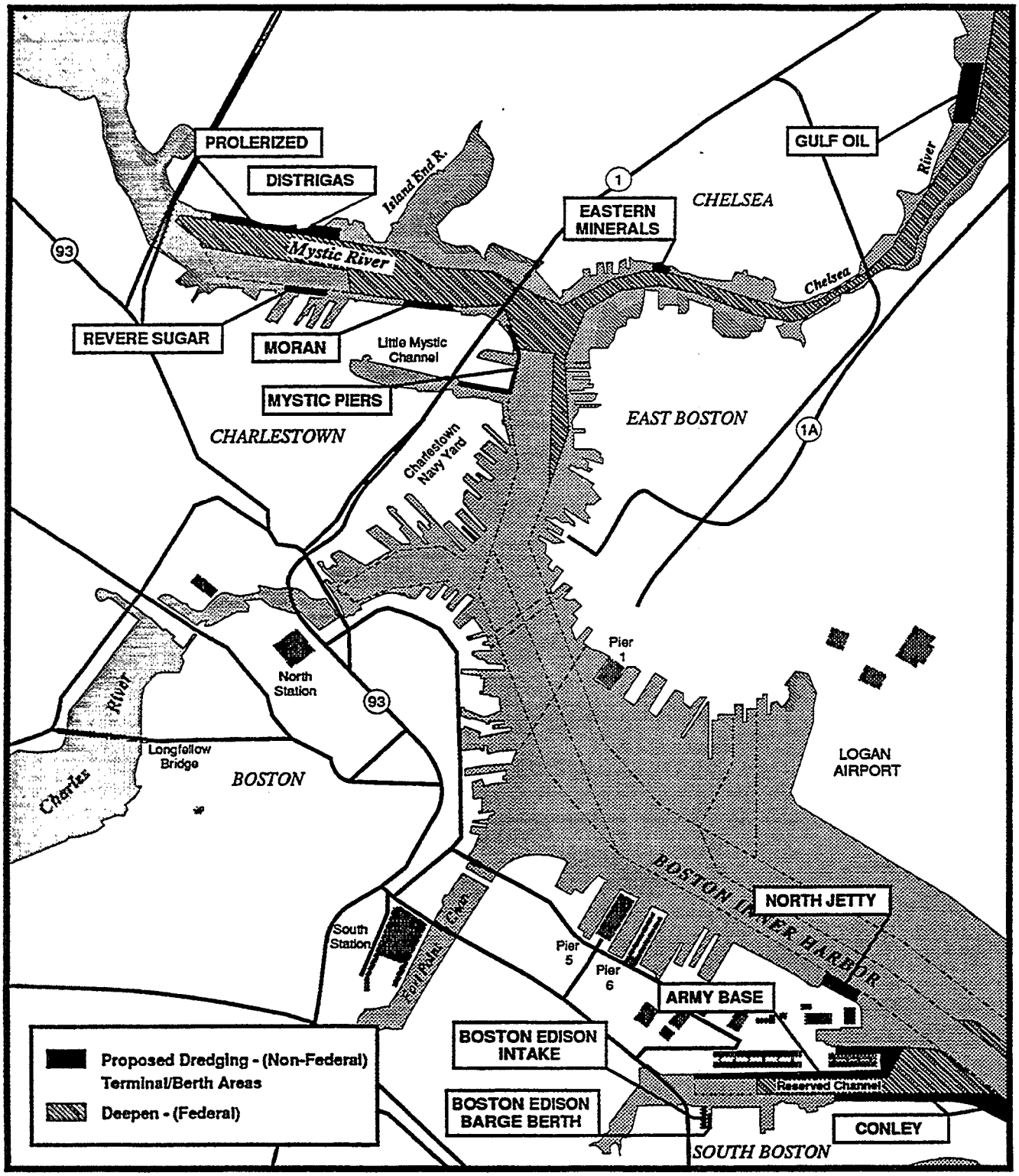
| Boston Harbor Dredging Project EIR/S | *Figure 2-3* Navigation Improvement Project **Mystic River** |
|---|---|
| N *Scale:* 400 200 Scale in Yards | *Source:* Boston Inner Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | *Figure 2-4* Navigation Improvement Project<br>**Chelsea Creek**<br>**Downstream of Chelsea St. Bridge** |
|---|---|
| N<br>*Scale:*<br>0 400 800<br>Scale in Yards | *Source:*<br>Boston Inner Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | Figure 2-5 Navigation Improvement Project<br>Chelsea Creek<br>Upstream of Chelsea St. Bridge |
|---|---|
| N<br>Scale: Scale in Yards | Source: Boston Inner Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | *Figure 2-6* Location of Federal Channel and berth area dredging |
|---|---|
| N | *Scale:* 0 400 800 Scale in Yards |
| | *Source:* Boston Inner Harbor Navigation Chart |

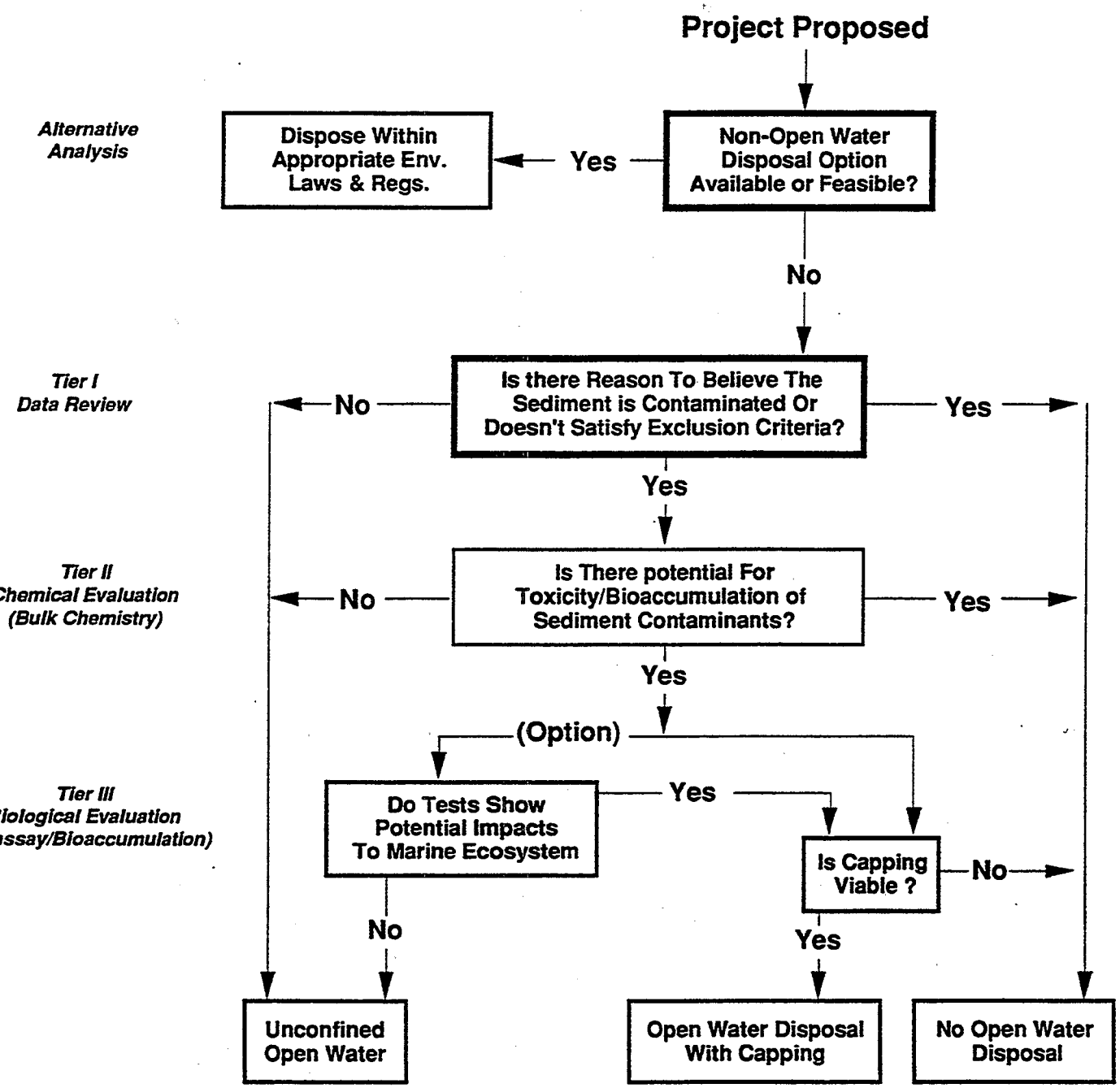



Figure 2-7. Tiered testing & decision protocol for open water disposal of dredged material.

TABLE 2-1. MAINTENANCE DREDGING PROJECTIONS FOR THE TRIBUTARY CHANNELS AND THE MAIN SHIP CHANNEL.

| CHANNEL | DATE LAST MAINTAINED | ESTIMATED ANNUAL RATE OF ACCUMULATION (cy/year) | ESTIMATED 50 YEAR[1] TOTAL (cy) |
|---|---|---|---|
| TRIBUTARIES | | | |
| Reserved Channel | None since deepened in 1966 | 1,900 | 95,000 |
| Mystic River | 1983 | 26,000 | 1,300,000 |
| Chelsea Creek | 1983 | 7,300 | 365,000 |
| TOTAL for Tributaries | | | 1,760,000 |
| MAIN SHIP CHANNEL | | | |
| 40-foot Main Ship Channel | 1974 | 43,900 | 2,195,000 |
| 35-foot Main Ship Channel | 1968 | 14,300 | 715,000 |
| President Roads Anchorage | 1983 | 29,100 | 1,455,000 |
| TOTAL for Main Ship Channel | | | 4,365,000 |

1A fifty (50) year project life is used for economic evaluation and starts at the timing of completion of the project. This table does not include future maintenance requirements of the berths.

TABLE 2-2. VOLUME OF MATERIAL PROPOSED FOR DREDGING FROM CHANNELS AND ASSOCIATED PROJECT BERTHS FOR THE BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT.

| | | DREDGE VOLUMES (Cubic Yards) | | | |
|---|---|---|---|---|---|
| CHANNEL | AREA | TOTAL | ROCK | PARENT | SILT[a] |
| Main Ship Channel/ Reserved Channel | Federal Channel | 632,600 | 34,100 | 438,800 | 159,700 |
| | Conley 11-13 | 45,900 | 0 | 18,000 | 27,900 |
| | North Jetty | 16,200 | 0 | 7,800 | 8,400 |
| | Boston Army 1-9 | 128,500 | 0 | 0 | 128,500 |
| | Boston Edison Intake | 1,100 | 0 | 0 | 1,100 |
| | Boston Barge Berth | 16,100 | 0 | 10,800 | 5,300 |
| | Conley 14-15 | 7,100 | 0 | 2,800 | 4,300 |
| Inner Confluence/ Mystic River | Federal Channel | 1,317,700 | 54,000 | 791,800 | 471,900 |
| | Prolerized | 7,600 | 0 | 5,500 | 2,000 |
| | Distrigas | 13,800 | 0 | 10,000 | 3,800 |
| | Moran | 6,600 | 0 | 0 | 16,600[d] |
| | Revere Sugar | 12,800 | 0 | 3,100 | 9,700 |
| | Mystic Piers 2, 49, 50 | 45,200 | 0 | 28,700 | 16,500 |
| | Mystic Pier 1 | 17,600 | 0 | 8,400 | 9,200 |
| Chelsea River | Federal Channel | 550,100 | 0 | 320,100 | 230,000 |
| | Eastern Minerals | 39,900 | 0 | 32,700 | 7,200 |
| | Gulf Oil | 12,300 | 0 | 5,400 | 6,900 |
| Subtotal | Federal | 2,500,400 | 88,100 | 1,550,700 | 861,600 |
| | Berths | 370,700 | 0 | 133,200 | 237,500 |
| TOTAL[c] | In-situ | 2,871,000 | 88,000 | 1,684,000 | 1,099,000 |
| | After removal[b] | 3,471,000 | 132,000 | 2,021,000 | 1,319,000 |

Projected through 1996:

[a]Silt volumes assume 0.5 foot of overdredge to ensure all silt is removed.

[b]Expansion factor (20% for silts and parent materials, 50% for blasted rock) added for use in computing disposal site requirements for aquatic disposal sites. Material would be dewatered to in-situ volume for disposal in upland sites.

[c]Rounded to nearest 1,000 cy.

[d]Includes 10,000 cubic yards already removed in 1993 under a reduced project design at Moran. See Section 1.2.

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2-3. SUMMARY OF ALTERNATIVE PROJECT DESIGNS AND THEIR ENVIRONMENTAL CONSEQUENCES.

| RESOURCE | NO ACTION W/O MAINTENANCE OF CHANNELS | NO ACTION W/ MAINTENANCE OF CHANNELS | FULL PROJECT[a] | REDUCED PROJECT[a] | | | DELAYED PROJECT |
|---|---|---|---|---|---|---|---|
| | | | | RESERVED | MYSTIC | CHELSEA | |
| Navigation | No removal of silt; no improvement. | Removal of silt; no increase in depth. | Reserved Channel to -40 ft MLW, 1B/5NB berths; Mystic Channel to -40 ft MLW, 3B/3NB berths; Chelsea Channel to -38 ft MLW, 2B berths | Removal of silt and increase in depth for one or two channels and associated berths.<br><br>Non-beneficiary (NB) berths might not be dredged unless Federal Project takes place. | | | Same as full project but delayed 5 to 10 years after proposed project. |
| Sediment Characteristics | | | | | | | |
| • material to be dredged[b] | No sediments removed. | Removal of up to 861,600 cy silt over burden. Maintenance dredging would occur only when problems developed. | RC: 335,200 cy silt; 478,200 cy parent; 34,100 cy rock.<br>MC: 513,200 cy silt; 847,500 cy parent; 54,000 cy rock.<br>CC: 244,100 cy silt; 358,200 cy parent (includes channels and all berths). | As under full project. | | | As in full project but volume of silt in channels expected to increase by 28,000 cy/year. |
| • material to be exposed | Exposed material is silt and associated contaminants. | Parent material. | Parent material. | Parent material. | | | Parent material but not until 2000+. |
| Duration of Dredging[c] | 0 days | 5.5 months | Reserved Channel: 6 months<br>Mystic Channel: 8 months (but may use 2 dredges)<br>Chelsea Channel: 4 months | | | | Increase 7 days for each year delay after 2000. |

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(Continued)

TABLE 2-3. (CONTINUED)

| RESOURCE | NO ACTION W/O MAINTENANCE OF CHANNELS | NO ACTION W/ MAINTENANCE OF CHANNELS | FULL PROJECT[a] | REDUCED PROJECT[a] | | | DELAYED PROJECT |
|---|---|---|---|---|---|---|---|
| | | | | RESERVED | MYSTIC | CHELSEA | |
| Water Quality | Continued resuspension of silt in berth areas from prop wash and siltation into channels. | Resuspension of silt during dredging but minimized by use of closed bucket; reduction of turbidity to normal harbor conditions after dredging of silt complete; dredging of parent material expected to induce little turbidity. | | | | | Continued resuspension of silt in berth areas until dredging complete; resuspension of silt during dredging minimized by use of closed bucket; reduction of turbidity after dredging. |
| Marine Resources/ Habitats | Benthic resources will continue to be dominated by pioneer species; no change in present substrate. Continued exposure of demersal fish and epibenthos to contaminants in sediments. | Temporary defaunation of dredged areas until newly exposed sediments are colonized. Temporary increase in suspended sediments would deter some finfish from dredging area and increase exposure of those who remain until dredging of silt is complete; then significantly reduce risk of exposure to contaminants. | | | | | |
| | | | Mortality of finfish during blasting. | | | | |
| Wetland | No change to Land Under Ocean/Tidal Waters | Alteration in substrate and depth to Land Under the Ocean/Tidal Waters. No loss of wetland habitat. | | | | | |
| Threatened/ Endangered Species | No impact. | | | | | | |

(Continued)

TABLE 2-3. (CONTINUED)

| RESOURCE | NO ACTION W/O MAINTENANCE OF CHANNELS | NO ACTION W/ MAINTENANCE OF CHANNELS | FULL PROJECT[a] | REDUCED PROJECT[a] | | | DELAYED PROJECT |
|---|---|---|---|---|---|---|---|
| | | | | RESERVED | MYSTIC | CHELSEA | |
| Historical/ Archeological Resources | No impact. | | Chelsea St. bridge is only structure of historic significance in project. No impact anticipated. | No impacts. | | Chelsea St. bridge is only structure of historic significance in project. No impact anticipated. | |
| Socio-economics/ Land Use | Rapid decline in ability of port to service world fleet; increased port-of-call costs; reduced loads or increased lightering; increased risk of accidents. Increased cost of consumer goods. | Gradual decline in ability of port to service world fleet; increasing costs; reduced loads and increased lightering; increased risk of accidents. | Economic benefit of full navigation improvement project demonstrated. Increased competitiveness with Eastern Seaboard ports; will enable one area of cost control for regional petroleum, LNG industry. | Reserved Channel is Boston's Port of the Future; no dredging in Mystic or Chelsea would lead to higher costs for heating and fuel industries. | Economic benefits to container and LNG berths; no benefit for petroleum industry. | Economic benefits for fuel industry; no benefits to container shipping. | Delay of entire project could have same effects as No Action without Maintenance; increased project costs due to higher volume of silt for disposal. |
| Traffic/ Navigation | Increased risk of collisions; increased vessel traffic if cargo volume is maintained, smaller vessels; eventually reduced traffic. | No significant change in vessel traffic. | Improved navigation safety; larger ships; total number of ships may not change. | Improvement in navigation safety restricted to the areas deepened. Little change in total number of ships | | | Eventually, same effects as full project. |

[a]Main Ship Channel modification included with Reserved Channel; Inner Confluence included with Mystic River.
[b]Chemical and physical characteristics summarized in Section 2.2; quantities do not include bulking factor.
[c]Assumes round-the-clock dredging, one dredge.
B = Beneficiary berths
NB = Non-beneficiary berths

TABLE 2-4. (CONTINUED)

CHELSEA RIVER

| | 1986 Samples (Environmental Assessment) | | | | | | | 1990 Samples (Bioassay/accumulation) | | | MASS REGS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | A | E | REF | I -III |
| An | | | | | | | | 86 | 55 | 120 | |
| As | 5.1 | 5.9 | 5.9 | 7.3 | 7.2 | 6.0 | 7.1 | 12[2] | 10[2] | 12[2] | 10-20 |
| Ba | 900 | 1500 | 1000 | 1800 | 1400 | 850 | 1400 | 80 | 50 | 74 | |
| Cd | <4 | <3 | <4 | <4 | <4 | <4 | <3 | 1.6 | 1.1 | 0.17 | 5-10 |
| Cr | 160[2] | 138[2] | 146[2] | 142[2] | 134[2] | 88 | 185[2] | 210[2] | 160[2] | 95 | 100-300 |
| Cu | 71 | 41 | 64 | 89 | 67 | 52 | 139 | 110 | 64 | 20 | 200-400 |
| Pb | 158[2] | 80 | 124[2] | 262[3] | 179[2] | 125[2] | 283[3] | 120[2] | 140[2] | 45 | 100-200 |
| Hg | 0.61[2] | 0.40 | 0.45 | 0.53[2] | 1.16[2] | 0.61 | 1.14[2] | 0.71[2] | 0.31 | <0.06 | 0.5-1.5 |
| Ni | <64[2] | 45 | 66[2] | <26 | <28 | 56[2] | 37 | 24 | 17 | 29 | 50-100 |
| Se | | | | | | | | 0.65 | <0.5 | 0.04 | |
| Ag | <8 | <8 | <8 | <8 | <8 | <8 | <7 | <10 | <10 | <10 | |
| Th | | | | | | | | <0.5 | <0.5 | <0.5 | |
| Zn | 197 | 153 | 152 | 215[2] | 164 | 145 | 276 | 260[2] | 180 | 120 | 200-400 |
| Cy | | | | | | | | <0.005 | <0.005 | <0.005 | |
| V | <720 | <120 | <720 | <700 | <710 | <710 | <710 | | | | 75-125 |

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TABLE 2-4. SEDIMENT METAL CONCENTRATIONS (ppm) MYSTIC RIVER

MYSTIC RIVER

| | 1986 Samples (Environmental Assessment) | | | | | 1990 Samples (Bioassay/Bioaccumulation) | | | MASS REGS |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | B | C | D | A | B | REF | I - III |
| An | | | | | | 120 | 110 | 120 | |
| As | 21.7[3] | 11.7[2] | 28.4[3] | 4.8 | - | 24[3] | 27[3] | 12[2] | 10-20 |
| Ba | 840 | 1200 | 1200 | 940 | 500 | 110 | 110 | 74 | |
| Cd | <3 | 4 | <4 | <3 | <3 | 2.6 | 2.9 | 0.17 | 5-10 |
| Cr | 77 | 180[2] | 102[2] | 42 | 37 | 140[2] | 170[2] | 95 | 100-300 |
| Cu | 112 | 218[2] | 124 | 35 | 39 | 140 | 180 | 20 | 200-400 |
| Pb | 213[3] | 342[3] | 289[3] | 23 | 94 | 210[3] | 190[2] | 45 | 100-200 |
| Hg | 0.69[2] | 1.35[2] | 1.17[2] | 0.14 | 0.53[2] | 1.1[2] | 1.0[2] | <0.06 | 0.5-1.5 |
| Ni | 29 | 75[2] | 52[2] | 37 | <2 | 39 | 38 | 29 | 50-100 |
| Se | | | | | | 0.69 | 0.88 | 0.64 | |
| Ag | <7 | <8 | <8 | <7 | <7 | <10 | <10 | <10 | |
| Th | | | | | | 0.50 | <0.5 | <0.5 | |
| Zn | 242[2] | 435[3] | 381[2] | 102 | 81 | 420[3] | 380[2] | 120 | 200-400 |
| Cy | | | | | | 0.025 | <0.005 | <0.005 | |
| V | <660 | <710 | <700 | <610 | <580 | | | | 75-125 |

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TABLE 2-4. (CONTINUED)

RESERVE CHANNEL

| | 1986 Samples (Environmental Assessment) | | | | 1990 Samples (Bioassay/Bioaccumulation) | | | MASS REGS |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | B | D | REF | I - III |
| An | | | | | 93 | 97 | 120 | |
| As | 8.8 | 5.4 | 6.9 | 7.2 | 12[2] | 13[2] | 12[2] | 10-20 |
| Ba | 810 | 1200 | 680 | 720 | 91 | 99 | 74 | |
| Cd | <3 | <4 | <3 | <3 | 1.9 | 1.9 | 0.17 | 5-10 |
| Cr | 186[2] | 93 | 82 | 109[2] | 150[2] | 180 | 95 | 100-300 |
| Cu | 161 | 73 | 100 | 67 | 130 | 130 | 20 | 200-400 |
| Pb | 221[3] | 84 | 105 | 109[2] | 95 | 100 | 45 | 100-200 |
| Hg | 1.48[2] | 0.55 | 1.54 | 0.41 | 0.59[2] | 1.0[2] | <0.06 | 0.5-1.5 |
| Ni | 58[2] | 56[2] | 37 | 37 | 34 | 33 | 29 | 50-100 |
| Se | | | | | 0.64 | 0.70 | 0.64 | |
| Ag | <7 | 8 | <7 | <8 | <10 | <10 | <10 | |
| Th | | | | | <0.5 | <0.5 | <0.5 | |
| Zn | 264[2] | 178 | 137 | 136 | 220[2] | 250[2] | 120 | 200-400 |
| Cy | | | | | <0.005 | <0.005 | <0.005 | |
| V | <700 | <700 | <620 | <670 | | | | |

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TABLE 2-5. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION BULK SEDIMENT CHARACTERIZATION LEVELS FOR BOSTON HARBOR DREDGE MATERIAL.

| | LEVELS | | |
|---|---|---|---|
| | I | II | III |
| Arsenic (ppm) | <10 | 10-20 | >20 |
| Cadmium (ppm) | <5 | 5-10 | >10 |
| Chromium (ppm) | <100 | 100-300 | >300 |
| Copper (ppm) | <200 | 200-400 | >400 |
| Lead (ppm) | <100 | 100-200 | >200 |
| Mercury (ppm) | <0.5 | 0.5-1.5 | >1.5 |
| Nickel (ppm) | <50 | 50-100 | >100 |
| Zinc (ppm) | <200 | 200-400 | >400 |
| PCBs (Total) (ppm) | <0.5 | 0.5-1.0 | >1.0 |
| Silt/Clay (%) | <60 | 60-90 | >90 |
| PAHs (ppm) | <5 | 5-10 | >10 |

TABLE 2-6. POLYCYCLIC AROMATIC HYDROCARBONS

Boston Harbor, MA

| PAH, ppb, by GC/MS | Reserve "B" | Reserve "D" | Chelsea "A" | Chelsea "E" | Mystic "A" | Mystic "B" | MBDS Reference |
|---|---|---|---|---|---|---|---|
| Napthalene | | | | 790 | J380 | J430 | |
| Acenaphthylene | | | | J280 | J170 | J370 | |
| Acenapthene | | | | J120 | | | |
| Fluorene | | | | J180 | J210 | | |
| Phenanthrene | J130 | J130 | | 800 | J260 | J330 | |
| Anthracene | | | | J470 | J210 | J280 | |
| Fluoranthene | J360 | J270 | J300 | 1700 | J580 | 1100 | |
| Pyrene | J270 | J250 | J290 | 2000 | 770 | 1200 | |
| Benzo(a)anthracene | J140 | J160 | J150 | 1200 | | J630 | |
| Chrysene | J180 | J220 | J220 | 1700 | J340 | 690 | |
| Benzo(b)fluoranthene | | | | 1500 | | | |
| Benzo(k)fluoranthene | J310 | J310 | J360 | | J260 | 1400 | |
| Benzo(a)pyrene | | J100 | J140 | 1100 | J260 | 670 | |
| Indeno(1,2,3-cd)pyrene | | | | J570 | | | |
| Dibenz(a,h)anthracene | | | | J120 | | | |
| Benzo(g,h,i)perylene | | | | J560 | | | |
| Total PAHs | 1390 | 1440 | 1460 | 13090 | 3440 | 7100 | |

*Estimate value less than detection limit but a definite peak.

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TABLE 2-7. PERCENT SURVIVAL OF AMPHIPOD, CLAMS AND WORMS IN THE TOXICITY TEST - Federal Project

1990

| LOCATION | AMPHIPOD % ** SURVIVAL | CLAMS % SURVIVAL | WORMS % SURVIVAL |
|---|---|---|---|
| Reserved Channel B | 21 | 95 | 97 |
| Reserved Channel D | 41 | 87 | 97 |
| Mystic A | 14 | 44 | 98 |
| Mystic B | 24 | 84 | 92 |
| Chelsea A | 24 | 86 | 93 |
| Chelsea B | 18 | 89 | 97 |
| Reference | 85 | 93 | 93 |
| Control | 92 | 99 | 95 |

** Data unreliable due to test procedures used.

PERCENT SURVIVAL OF AMPHIPOD IN THE TOXICITY TEST - Federal Project - 1991

| Location | AMPHIPOD % SURVIVAL |
|---|---|
| Reserved Channel | 90 |
| Mystic Channel | 63 |
| Chelsea Creek | 17 |
| Reference | 94 |
| Control | 94 |

TABLE 2-8. AVERAGE METALS CONCENTRATIONS BY SITE AND MASSACHUSETTS DEP CLASSIFICATION LEVELS FOR MASSPORT DREDGING PROJECT.

| | Arsenic | | Cadmium | | Chromium | | Copper | | Iron | | Lead | | Mercury | | Nickel | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Level | Mean | Level | Mean | Level | Mean | Level | Mean | Level | Mean | Level | Mean | Level | Mean | Level | Mean | Level |
| Army Base | 10.11[1] | II[2] | 2.73 | I | 146.83 | II | 125.27 | I | 33533.33 | | 111.18 | II | 0.99 | II | 38.58 | I | 212.83 | II |
| Conley | 9.03 | I | 3.47 | I | 188.50 | II | 169.50 | I | 32850.00 | | 140.53 | II | 0.52 | II | 39.38 | I | 258.17 | II |
| Distrigas | 27.73 | III | 3.59 | I | 149.33 | II | 225.33 | II | 106066.7 | | 657.33 | III | 0.78 | II | 40.47 | I | 568.33 | III |
| Eastern Minerals | 10.86 | II | 3.20 | I | 241.67 | II | 179.33 | I | 24133.33 | | 220.67 | III | 0.56 | II | 33.40 | I | 376.00 | II |
| Edison Barge Berth | 13.09 | II | 6.29 | II | 173.33 | II | 230.00 | II | 23866.67 | | 175.67 | II | 0.21 | I | 68.53 | II | 239.00 | II |
| Edison Intake | 5.38 | II | 4.46 | I | 185.13 | II | 158.67 | I | 38800.00 | | 108.00 | II | 1.01 | II | 90.43 | II | 236.00 | II |
| Gulf Oil | 8.18 | I | 3.10 | I | 134.67 | II | 90.33 | I | 19100.00 | | 155.67 | II | 0.36 | I | 19.87 | I | 223.33 | II |
| Moran | 24.23 | III | 2.53 | I | 99.97 | I | 159.00 | I | 37866.67 | | 349.67 | III | 0.58 | II | 25.33 | I | 255.33 | II |
| Mystic | 19.13 | II | 4.02 | I | 163.71 | II | 212.43 | II | 23171.43 | | 299.29 | III | 0.65 | II | 35.33 | I | 402.86 | III |
| North Jetty | 12.10 | II | 3.59 | I | 189.33 | II | 164.27 | I | 36033.33 | | 321.33 | III | 0.68 | II | 44.23 | I | 579.33 | III |
| Prolerized | 28.93 | III | 6.42 | II | 151.33 | II | 234.33 | II | 123833.3 | | 476.00 | III | 0.73 | II | 66.47 | II | 676.33 | III |
| Revere Sugar | 23.30 | III | 3.68 | I | 177.67 | II | 244.67 | II | 53900.00 | | 501.33 | III | 0.47 | I | 50.27 | II | 451.00 | III |

(1) Concentrations expressed in ppm, dry wt.

(2) Bulk sediment characterization levels as described in Sediment Sampling and Laboratory Analysis Plan for Boston Harbor Improvement Dredging Project prepared for Massport by Normandeau Associates Incorporated, June, 1992.

TABLE 2-9. POLYCYCLIC AROMATIC HYDROCARBONS AVERAGE CONCENTRATIONS BY SITE AND MASSACHUSETTS DEP CLASSIFICATION LEVELS FOR MASSPORT DREDGING PROJECT.

| | Acenaphthene | Acenaphythylene | Anthracene | Benzo(a) anthracene | Benzo(a) pyrene | Benzo(b) fluoranthene | Benzo(ghi) perylene | Benzo(k) fluoranthene |
|---|---|---|---|---|---|---|---|---|
| | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean |
| Army Base | 0.02 | 0.13 | 0.17 | 0.32 | 0.33 | 0.48 | 0.44 | 0.47 |
| Conley | 0.29 | 0.28 | 0.41 | 0.80 | 1.66 | 1.24 | 0.48 | 1.19 |
| Distrigas | 0.81 | 0.61 | 3.40 | 2.24 | 2.34 | 2.11 | 0.94 | 2.13 |
| Eastern Minerals | 0.03 | 0.07 | 0.31 | 0.64 | 0.47 | 2.18 | 1.36 | 0.95 |
| Edison Barge Berth | 0.03 | 0.08 | 0.16 | 0.15 | 0.72 | 0.83 | 0.32 | 0.85 |
| Edison Intake | 0.37 | 0.07 | 0.16 | 1.35 | 1.04 | 1.02 | 0.45 | 1.01 |
| Gulf Oil | 0.04 | 0.02 | 0.38 | 0.20 | 0.53 | 0.90 | 1.58 | 0.57 |
| Moran | 0.71 | 0.63 | 2.12 | 1.81 | 0.83 | 2.46 | 0.95 | 2.57 |
| Mystic | 0.02 | 0.10 | 0.30 | 0.94 | 1.65 | 1.20 | 1.27 | 1.08 |
| North Jetty | 0.13 | 0.34 | 0.39 | 1.26 | 0.71 | 0.68 | 0.03 | 0.69 |
| Prolerized | 0.88 | 0.80 | 3.57 | 3.32 | 2.87 | 3.64 | 0.51 | 3.50 |
| Revere Sugar | 0.98 | 0.90 | 2.62 | 0.97 | 1.71 | 3.38 | 0.12 | 3.32 |

(1) Concentrations expressed in ppm, dry wt.

(2) Bulk sediment characterization levels as described in Sediment Sampling and Laboratory Analysis Plan for Boston Harbor Improvement Dredging Project prepared for Massport by Normandeau Associates Incorporated, June, 1992.

TABLE 2-9. (CONTINUED).

| | Chrysene | Dibenzo(a,h) anthracene | Fluoranthene | Flurorene | Ideno(1,2,3-cd) pyrene | Napthalene | Phenanthrene | Pyrene | Total PAHs | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Level |
| Army Base | 0.78 | 0.17 | 0.77 | 0.29 | 0.18 | 0.20 | 0.65 | 0.93 | 6.27 | II |
| Conley | 0.84 | 0.10 | 1.66 | 0.34 | 0.10 | 0.27 | 0.63 | 1.76 | 12.00 | III |
| Distrigas | 2.33 | 0.31 | 5.77 | 4.42 | 0.28 | 4.08 | 3.06 | 8.11 | 42.91 | III |
| Eastern Minerals | 1.07 | 0.38 | 1.90 | 0.10 | 0.39 | 0.04 | 0.67 | 1.76 | 12.29 | III |
| Edison Barge Berth | 0.36 | 0.08 | 1.28 | 0.03 | 0.08 | 0.02 | 0.26 | 1.34 | 6.51 | II |
| Edison Intake | 1.79 | 0.21 | 4.95 | 0.12 | 0.59 | 0.03 | 0.67 | 5.06 | 18.85 | III |
| Gulf Oil | 0.73 | 0.08 | 3.27 | 0.08 | 0.11 | 0.05 | 0.55 | 0.87 | 9.91 | II |
| Moran | 3.39 | 0.57 | 5.37 | 1.22 | 0.58 | 1.38 | 3.36 | 6.78 | 34.69 | III |
| Mystic | 1.57 | 0.14 | 3.47 | 0.16 | 0.21 | 0.11 | 0.58 | 2.13 | 14.87 | III |
| North Jetty | 0.93 | 0.16 | 1.32 | 0.75 | 0.17 | 0.22 | 0.56 | 1.86 | 10.18 | III |
| Prolerized | 2.77 | 0.14 | 4.53 | 2.92 | 0.13 | 2.00 | 4.21 | 8.97 | 44.77 | III |
| Revere Sugar | 3.62 | 0.25 | 5.57 | 1.81 | 0.31 | 1.04 | 4.07 | 5.85 | 36.51 | III |

(1) Concentrations expressed in ppm, dry wt.
(2) Bulk sediment characterization levels as described in Sediment Sampling and Analysis Plan for Boston Harbor Improvement Dredging Project for Massport by Normandeau Associates Incorporated, June, 1992.

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TABLE 2-10. PCBs(TOTAL) AVERAGE CONCENTRATIONS BY SITE AND MASSACHUSETTS DEP CLASSIFICATION LEVELS FOR MASSPORT DREDGING PROJECT.

| | PCBs (Total) | |
|---|---|---|
| | Mean | Level |
| Army Base | 0.63 | II |
| Conley | 1.05 | III |
| Distrigas | 4.83 | III |
| Eastern Minerals | 1.65 | III |
| Edison Barge Berth | 0.46 | I |
| Edison Intake | 0.79 | II |
| Gulf Oil | 0.43 | I |
| Moran | 1.79 | III |
| Mystic | 0.90 | II |
| North Jetty | 2.36 | III |
| Prolerized | 7.64 | III |
| Revere Sugar | 4.47 | III |

(1) Concentrations expressed in ppm, dry wt.
(2) Bulk sediment characterization levels as described in Sediment Sampling and Laboratory Analysis Plan for Boston Harbor Improvement Dredging Project prepared for Massport by Normandeau Associates Incorporated, June, 1992.



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TABLE 2-11. PERCENT AMPHIPOD SURVIVAL FOR JULY - AUGUST 4, 1992 AND SEPTEMBER 5-15, 1992 - MASSPORT DREDGING PROJECT

| LOCATION | JULY-AUGUST 4, 1992 % SURVIVAL | LOCATION | SEPTEMBER 5-15, 1992 % SURVIVAL |
|---|---|---|---|
| Prolerized/ Distrigas | 3 | Mystic Pier | 21 |
| Revere Sugar | 29 | Eastern Minerals | 47 |
| Moran | 43 | Gulf oil | 55 |
| North Jetty | 51 | Boston Edison Barge Berth | 63 |
| Army Base | 49 | Boston Edison Intake | 25 |
| Conley | 63 | | |
| Reference | 82 | Reference | 73.3 |
| Control | 93 | Control | 92 |

TABLE 2-12. PERCENT SURVIVAL OF CLAMS AND WORMS, SEPTEMBER 5-15, 1992. MASSPORT DREDGING PROJECT.

| LOCATION | % CLAM SURVIVAL | % WORM SURVIVAL |
|---|---|---|
| Conley | 97 | 90 |
| Army Base | 98 | 97 |
| Moran | 97 | 96 |
| North Jetty | 99 | 92 |
| Eastern Minerals | 96 | 96 |
| Mystic Piers | 96 | 96 |
| Boston Edison Barge Berth | 95 | 93 |
| Gulf Oil | 94 | 97 |
| Reference | 97 | 93 |
| Control | 98 | 95 |

TABLE 2-13. MEAN CONCENTRATION (ppm WET WEIGHT) OF PARAMETERS SIGNIFICANT AT THE p>0.05 CONFIDENCE LEVEL FROM BIOACCUMULATION TESTING FOR HASSPORT DREDGING PROJECT.

| | MBDS REFERENCE BIOASSAY | | MYSTIC PIERS | | MORAN | | NORTH JETTY | | EASTERN MINERALS | | GULF OIL | | ARMY BASE | | CONLEY | | BOSTON BARGE | EDISON BERTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS | CLAMS | WORMS |
| Lead | 0.800 | <0.500 | | | | | | | | | | | 1.6 | | | | | |
| Mercury | 0.015 | <0.010 | | 0.022 | | | 0.035 | 0.033 | | 0.030 | | 0.028 | | 0.033 | 0.026 | | | 0.020 |
| PCBs (Total) | <0.010 | <0.010 | 0.068 | 0.072 | 0.088 | 0.054 | 0.092 | 0.044 | 0.080 | 0.038 | 0.054 | | 0.052 | | | | 0.130 | 0.072 |
| Anthracene | <0.020 | <0.020 | 0.032 | | | | | | 0.030 | | | | | | | | | |
| Benzo(a) anthracene | <0.020 | <0.020 | 0.072 | 0.048 | | | 0.036 | | | | 0.040 | 0.036 | | | | | 0.036 | |
| Benzo(a) pyrene | <0.020 | <0.020 | 0.032 | | 0.040 | | | | 0.032 | | | | | | | | | |
| Benzo(b) fluoranthene | <0.020 | <0.020 | 0.058 | 0.044 | 0.040 | | 0.050 | 0.034 | | | 0.036 | 0.034 | | | | | | 0.030 |
| Benzo(k) fluoranthene | <0.020 | <0.020 | 0.056 | 0.038 | | | 0.036 | | 0.034 | 0.026 | 0.040 | 0.036 | 0.034 | | 0.036 | | 0.040 | 0.030 |
| Chrysene | <0.020 | <0.020 | 0.050 | | | | 0.048 | | 0.042 | 0.036 | | | | | | | | 0.028 |
| Dibenzo(a,h) anthracene | <0.020 | <0.020 | 0.032 | | | | | | | | 0.034 | 0.026 | | | | | | |
| Flouranthene | <0.020 | <0.020 | 0.062 | 0.050 | | | 0.048 | 0.034 | 0.064 | 0.048 | 0.038 | 0.030 | | | 0.034 | | 0.046 | 0.042 |
| Ideno(1,2,3-cd) pyrene | <0.020 | <0.020 | 0.036 | | | | 0.040 | | | | | | | | 0.032 | | | |
| Napthalene | <0.020 | <0.020 | 0.044 | 0.036 | 0.038 | | 0.060 | 0.026 | 0.046 | | | | | | | | 0.030 | |
| Phenanthrene | <0.020 | <0.020 | 0.034 | | | | 0.062 | 0.034 | 0.056 | 0.030 | 0.026 | | | | | | | |
| Pyrene | <0.020 | <0.020 | 0.070 | 0.050 | 0.036 | | 0.042 | | 0.062 | 0.038 | 0.040 | 0.038 | 0.034 | | 0.042 | | 0.040 | 0.032 |

## 3.0 DISPOSAL SITE ALTERNATIVES ANALYSIS

The MEPA and NEPA scopes provide direction for the analysis of dredged materials handling alternatives. Dredged material handling and disposal are vital issues in port and harbor planning since the lack of suitable disposal alternatives have delayed port improvements not only in New England but nationwide. It is anticipated that maintenance dredging of the tributary channels alone, will generate 1.8 million cy of silt in the 50 years following this project. Maintenance of the Main Ship Channel and President Roads Anchorages will add an additional 4.4 million cy of silt. Other dredging projects are also anticipated. Thus, the MEPA scope required that the BHNIP evaluate disposal alternatives suitable not just for the current project but which could provide a solution for future projects. The first priority of the BHNIP evaluation is a disposal solution for its own dredged materials. However, future maintenance of the channels is closely linked to the BHNIP; therefore, the disposal alternative analysis also identified alternatives that could be useful for future dredging.

As stated in the previous section of this EIR/S, the project will generate some 2.9 million cubic yards of material (as measured in-situ) requiring disposal. This quantity was shown to be comprised of a combination of material characterized as suitable for unconfined ocean disposal, potentially suitable for confined ocean disposal, and unsuitable for ocean disposal. The disposal alternatives analysis builds on these requirements of quantity and material quality and involved a stepwise progression from conceptual alternatives to the selection of feasible disposal options. The entire process is documented in Appendix E.

This section of the EIR/S begins with a summary of the disposal alternative identification and screening process. As stated in Section 1, the Disposal Options Working Group (DOWG) was critically important in the identification of potential sites, the selection and interpretation of evaluation criteria and in providing technical data used to characterize individual sites.

This section of the EIR/S also includes a summary of the dredged material treatment technologies which may allow the use of material previously deemed unsuitable for a particular disposal option. In addition, beneficial uses of the rock, maintenance material and parent material are considered.

Section 3.0 concludes with the identification of a short list of practicable alternatives, a description of each and the environmental impacts associated with their use. Practicable alternatives are defined as those that are "... available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.10 (a)(2)).

The MEPA scope identified several generic types of disposal options for consideration and screening. These generic types are discussed herein as well as additional subtypes identified during the screening process. NEPA requires that all reasonable alternatives are rigorously explored and objectively evaluated. For alternatives which were eliminated from detailed study, reasons for their elimination should be briefly discussed.

Disposal sites used for beach nourishment or fill landward and within three miles seaward of the territorial sea base line are evaluated under 404 (b)(1) guidelines under the Clean Water Act. Other disposal sites are evaluated under Section 103 of the Marine Protection, Research and Sanctuaries Act which states that ocean disposal is permitted after certain factors are considered such as other feasible alternatives (40 CFR 227.15 and 227.16). The material which follows satisfies the requirements offered in the MEPA and NEPA guidance.

This EIR/S goes beyond the requirements of the MEPA scope for analysis of disposal alternatives.

The MEPA scope placed the primary focus of the EIR/S on the sediment testing and the assessment of compatibility with the universe of alternatives. Generic evaluation of disposal alternatives feasibility was recommended, with presentation of specific sites included in the FEIR/S. The Working Group process enabled and encouraged the project to accelerate this analysis so that specific sites could be evaluated in the DEIR/S. Preliminary screening of potential upland and aquatic sites was available from several sources (Appendix E), so that, for most alternative disposal types, specific sites were identifiable. In addition, the concern existed that absence of specific site analysis in the draft would not allow for sufficient public review and commentary under the regulatory process. As a result, the decision was made to identify and evaluate specific sites for each practicable alternative.

## 3.1 THE EVALUATION PROCESS

The process for identifying disposal sites and alternatives involves a complex mixture of data collection, analysis, synthesis and judgment. As described in Section 1.4, to assist in this process, and to develop a satisfactory selection process, Massport established a Disposal Options Working Group, whose members represent federal, state, and local agencies and special interest groups. The working group assisted and reviewed the methodology and findings of every stage of the site selection process. In interacting with the working group, several key interests which the disposal site selection process needed to address were identified, including:

1. Recognizing the need for responsible expenditure of public funds as reflected in the number of sites assessed, the level of detail required in data collection to assess the sites, and the development of disposal options which maintain a benefit-to-cost ratio greater than or equal to one for parent material and the least costly, environmentally acceptable practicable alternative for silt.

2. Meeting federal, state, regional and local environmental laws and regulations.

3. Meeting the objectives set forth in the Massachusetts Environmental Policy Act (MEPA) and National Environmental Policy Act (NEPA) scoping guidance.

4. Providing disposal alternatives flexible enough to allow for changes in the project stemming from public comments, differences in dredging quantities, alterations in project limits, considerations regarding project requirements for phasing of dredging, and the length of time for handling the marine sediments.

5. Satisfying project requirements in terms of site availability, volume (for BHNIP) and duration.

6. Attempting to contribute benefits to long-term regional dredged material disposal needs. The Commonwealth of Massachusetts and various federal and state entities have established a goal of developing a long-term dredged materials management plan to simplify the process for disposing of sediments that are not suitable for unconfined ocean disposal. This plan is in the developmental stages, however, and will not be implementable for the Boston Harbor dredging project. The BHNIP can support the overall goals of the long-range plan by providing a screening process for site selection, by providing baseline information on sites potentially suitable for marine sediment disposal and by providing excess capacity for future projects, such as future maintenance dredging in Boston Harbor.

7. Demonstrating a wise use of over 2 million yards of clean marine sediments by identifying benefits for both the short term needs of Boston Harbor clean-up and long term dredged material management disposal needs.

The Boston Harbor Navigation Improvement Project (BHNIP) will generate up to 3.5 million cy of marine sediment and rock (as measured after removal) under the preferred development option. The materials assessment and characterization (Appendix C) indicated that the parent material and rock are acceptable for unconfined ocean disposal while the silt may require other options. To ensure that disposal alternatives evaluated would provide sufficient capacity, it has been assumed, for sizing purposes only, that all silt would not be suitable for unconfined ocean disposal.

The determination of sediment quality relative to guidelines for unconfined open water disposal is a typical first step in evaluating disposal options for marine or estuarine dredged materials. The MEPA scope identified ocean disposal at MBDS as the preferred disposal option for marine sediments of acceptable quality from dredging projects and the alternative against which other alternatives would be judged. Because of the large quantity of material to be dredged, it is assumed that parent material not earmarked for beneficial uses would be disposed at the MBDS. The disposal options evaluation focussed primarily on the silty maintenance and berth sediments. The remainder of this section describes the process for identifying alternative disposal sites and disposal options for the approximate 1.3 million cubic yards of this silt material.

The MEPA Scope (Appendix A) identified, in general terms, three disposal alternatives: upland, nearshore and open water. Where possible, specific sites in each of these categories were to be identified and evaluated for their suitability for dredged material disposal. For disposal alternatives where no sites were identifiable, an evaluation of the generic concept was to be presented.

As a starting point for identifying disposal alternatives, a wide range of sites were developed from a number of sources to create a "universe" of sites from which potential disposal areas could be extracted. The sources for the universe of sites included potential disposal sites from the Central Artery/Tunnel Project, the MWRA Residuals Management Facilities Plan (Black and Veatch 1987), Massachusetts Bay Disposal Site Designation, an EPA study on nearshore disposal facilities (Metcalf and Eddy 1992) and conversations with local, state and federal agencies. The process through which these conceptual disposal alternatives were evaluated and by which specific sites were identified and evaluated is detailed in Appendix E. A summary of the process is provided herein.

The BHNIP disposal site evaluation process consisted of three phases. The Phase I screening process was limited to identifying fatal flaws of particular sites (see Tables E-1 through E-9). These fatal flaws included water supply wells located on a site, sites within a sole source aquifer, sites within the estimated habitat of rare and endangered species, sites in or abutting state parks, sites within Areas of Critical Environmental Concern (ACECs), sites containing a 21E hazardous waste property, and (for upland sites) sites with less than 15 acres of developable land. Landfills were first screened against requirements for accepting dredged material and for being permitted for use until at least 1996. Disposal and stockpiling capacity and distance from the dredging locations were also used as screening criteria on these landfills which met the first two criteria.

Sites were categorized into land-based and aquatic sites. Land-based sites included inland and coastal sites and landfills. Aquatic sites included shoreline facilities, subaqueous depressions, borrow pits, in-channel trenches and existing open water disposal sites. The universe of sites in all categories that made

up the first phase screening process consisted of the following:

- 312 land-based inland and coastal sites;
- 21 landfills; and
- 21 aquatic sites

An additional 22 sites within the various categories were identified in consultation with the DOWG and agency personnel (see Table E-4, Appendix E). This consultation also resulted in limiting disposal site selection to sites within the Commonwealth. It was deemed important to use the information gained in this project to help resolve the regional long-term dredging disposal needs. As such, out-of-state, long distance sites were not evaluated as disposal options.

The Phase I screening resulted in the elimination of sites with the following number of sites remaining as potentially suitable for disposal purposes:

- Land-based inland - 14 (Table E-5)
- Land-based coastal - 12 (Table E-6)
- Landfills - 4 (Table E-8)
- Aquatic shoreline - 10 (Table E-4)
- Subaqueous depressions - 6 (Table E-4)
- Borrow pits - 4 (Table E-9)
- In-channel trenches - Not identified or screened in Phase I
- Existing open water sites - 2 (Table E-9)

The list of sites remaining after the first phase site screening (Table 3-1) were presented at a meeting of the DOWG on January 25, 1993.

Phase II consisted of evaluating potentially acceptable disposal sites against objective criteria relevant to the environment and physiography of the site. Criteria were used that reflected regulatory guidelines (e.g., 404(b)(1) dredge and fill guidelines; Clean Water Act, Massachusetts Coastal Zone Management regulations) and requirements, (especially Massachusetts's Wetlands Protection Act and Site Suitability Criteria for Solid Waste Site Assignments). Criteria recommended by Disposal Options Working Group participants or identified in other dredged material disposal site screening documents (e.g., Metcalf and Eddy 1992) were also included. (See Tables E-10 through E-12).

While each criterion is important, certain criteria stand out from the list as having the potential to be a deciding factor in the site screening process. Each criterion was assigned a "P" (priority) or an "S" (standard) classification. "Priority" criteria are those that require compliance (e.g. based on regulatory criteria). Inability to meet priority criteria could become a fatal flaw. "Standard" criteria are important to the overall evaluation of a site's suitability but do not rise to the level of the most stringent standard or, conversely, a potentially fatal flaw. Categorizing the criteria into P and S groupings enabled a semi-quantitative screening in addition to the standard qualitative analysis.

Phase II criteria were applied to all sites identified as potentially feasible after Phase I, as well as several sites identified after Phase I was complete (see Table 3-1). Quantitative evaluation of sites was performed for each disposal site category. Within each disposal site category, site "scores" were compared (see Appendix E for details) to focus attention on the most promising sites. Criteria that were not met were examined carefully to evaluate whether the concern could be avoided or reduced through site planning and management or readily mitigated. Data for all sites were examined both quantitatively and qualitatively before determining whether a site should be short-listed.

The results of the Phase II screening are presented in Appendix E and were presented to the Disposal Options Working Group on April 15, 1993. Discussion at this meeting and subsequent investigations revealed additional information and issues regarding many sites that resulted in further modification of the short-list (Table 3-1).



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The evaluation of Rowes Quarry as an additional site raised considerable comment in Working Group meetings because this site had been short-listed by MWRA for landfilling of sludge from the Deer Island wastewater treatment facility. Issues that MWRA felt constrained use of this site included its proximity to Rumney Marsh ACEC and the tendency for leachate to flow towards the marsh, the need for extensive filling to bring the quarry floor five feet above the normal water table (as required by State landfill site location regulations) before constructing a liner and the proximity of residences to the quarry (M. Virda, MWRA, pers. comm.). Rowe's Quarry is an ongoing business. The owner has consistently expressed his unwillingness to sell the property. While the leachate and fill/liner issues could be dealt with through site design, Massport prefers to avoid disrupting active businesses. It would be very difficult to relocate an active quarry operation and costly to take it by eminent domain. Rowes Quarry was therefore not carried onto the short list of potential disposal sites.

Phase III involved the development of additional site-specific information for the short-listed sites through site visits, aerial photographs, and discussions with appropriate resource agencies. The short-listed sites were re-evaluated against Phase II criteria in light of the additional information resulting in a revised short list (see Table 3-1).

This draft document provides a forum for presenting the public with the proposed list of disposal sites so input can be received and evaluated. Combining sites into disposal options to acquire sufficient capacity for disposal of the silty dredged material yields hundreds of potential combinations. The existing conditions and potential impacts of using representative options are discussed in the following sections. A single preferred disposal option has not been selected at this stage since it was felt that it was most appropriate to open the process to public review before completing the option analysis.

## 3.2 SEDIMENT/SITE MATCHING

As stated in the MEPA scope, ocean disposal (Massachusetts Bay Disposal Site) is the preferred disposal option for uncontaminated marine sediments of acceptable quality and is the option against which other alternatives should be judged. A substantial component of this project has focussed on the issue of quantifying the levels of metals and organics in project sediments. Review of these results has indicated a wide range of chemical concentrations in sediments throughout the project area (Section 2.2 and Appendix C). Characterization of sediments for disposal options relies on interpretation of the results of bioassessment in terms of ecological significance, and is, therefore, not a clearcut decision. The USEPA and USACOE have joint responsibility for making this determination. The silt from the Reserved Channel area was the only material for which a consistent opinion was not reached. To ensure that the disposal option alternatives analysis would identify sufficient space, it was assumed that alternatives to unconfined ocean disposal would have to be sought for all silt materials from the project.

Potential impacts arising from use of different disposal alternatives vary among the generic alternatives. These differences are reflected in testing requirements and required control measures (Table 3-2). All disposal types evaluated require bulk chemical analysis of most parameters identified in the "Green Book" (U.S. EPA and U.S. ACOE, 1991). Unconfined open water disposal, lined and unlined landfills each have identified thresholds for a suite of parameters that must be met for disposal to be permitted (Table 3-3). Thresholds for non-landfill upland disposal are not currently established; however, site suitability was evaluated assuming that such a facility would be lined and that the Category A (lined) landfill criteria would be appropriate. Similarly, regulatory thresholds for in-harbor or coastal containment have not been defined. Both alternatives would provide isolation of the disposed material from the surrounding environment once disposal is

complete. The in-harbor containment alternative provides the opportunity for isolation during disposal. It was assumed that there were no sediment quality thresholds necessary for in-harbor containment or open-water containment, but that either alternative would be dependent on achieving acceptable water quality conditions as demonstrated by acceptable water quality modelling results or monitoring. Stability of the disposed material after emplacement on the bottom would also have to be addressed.

Site-specific sediment data (see Section 2.2 and Appendix C) were compared to thresholds for each disposal alternative (Table 3-4). Clay and rock from all dredging areas were acceptable for any type of disposal, provided capacity was available. Silt from most areas of the harbor was viewed as appropriate for disposal at any type of site being evaluated except unconfined open water. The following section discusses how silt material could be managed for each of the generic disposal options, including special handling or design features required for disposal, with the least environmental impact.

## 3.3 SUITABILITY OF GENERIC TYPES OF DISPOSAL ALTERNATIVES FOR DREDGED SILT

The types of impacts associated with disposal of dredged materials can be categorized generally as habitat loss or alteration, water quality degradation, emigration (physically or biologically) of contaminants from the disposal site, and socioeconomic concerns (primarily land use and traffic) and are related to site preparation and management activities. The following paragraphs summarize the site preparation and management requirements needed for each generic disposal alternative to minimize these impacts. The findings are summarized on Table 3-5.

### 3.3.1 Land-Based Alternatives

#### Inland and Coastal Sites

In general, upland sites would have to be cleared and graded before construction of a silt containment facility. The containment facility would include a liner, diked disposal cells constructed in sequence, runoff and leachate controls, and access roads (Table 3-5). Closure of the site would include capping and landscaping. Configuration of the containment facility would be designed to minimize impacts to critical environmental features.

Locations of upland sites are shown in Figure 3-1. Access to inland sites is restricted to truck or rail transportation. Coastal sites could be accessible by barge, although this could require dredging of access channels.

Potential impacts associated with developing an upland (either inland or coastal) disposal facility are, in contrast to landfills, relatively severe (Table 3-6). While it would be desirable to focus on previously degraded sites, areas that have received other waste materials are not always suitable for disposal facility development without remediation first. While chemically-degraded sites may be suitable for a long-term future regional facility after remediation, sites that have experienced habitat alteration (clearing,excavation and mining) are themost likely candidates available for the BHNIP. Development of a disposal facility on such a site could result in loss and/or alteration of terrestrial habitat (particularly Wrentham (W-495) and Woburn (WOB-11)), possibly including wetlands. Loss of vegetated wetland habitat (Table 3-7) would occur with development of the Wrentham (9 acres), Woburn (1 acre) and Squantum Point (QUI-03) (0.3 acres) sites. Everett (EVR-04), Squantum Point and Wrentham all provide habitat for state-listed species of special concern (Table 3-7).

Development of the coastal sites (Everett and Squantum Point) would affect marine resources due to dredging. Prevention of water quality impacts

would depend on site design features including design criteria to minimize the risk of exposure of freshwater resources to elevated chloride levels (inland sites only) or contaminants. Marine waters could experience locally-elevated turbidity and contaminant concentrations at the dewatering site (Mystic Pier or North Jetty) for inland sites, but this would be limited by proper design and monitoring. Depending on site access, use of coastal sites could affect marine water quality during site preparation (dredging for barge access) or dewatering (for truck transportation). Both inland and coastal sites offer some risk of contaminant emigration due to the prolonged period required for drying the sediments before capping. Although the disposed materials would remain azoic, the containment area would appear pondlike and may be attractive to birds.

Both types of sites could have socioeconomic impacts - displacement or alteration of land use and high truck traffic volumes. None of the shortlisted sites are currently in use except Woburn which has a closed, but uncontained, municipal landfill onsite. Due to its large capacity, Wrentham would experience the highest truck volume but its proximity to major highways would minimize the neighborhood effects of this traffic. Rail access could become available for Woburn. Barge transport would be likely for Everett and Squantum Point.

Disposal of silty sediments from Boston Harbor in an upland area would remove this associated chemical load from the harbor environment (Table 3-8). A regional facility might be able to use a chemically-degraded area, but the remedial actions necessary to develop such a site would be greater than a single project (even a large one) could bear. Thus, such sites were not shortlisted although any upland site that demonstrated merit for potential development would require a preliminary assessment, as a minimum, for hazardous materials. Parent material (clay) could be used in construction of the site, although the silt would then have to be stockpiled during construction. There would be potential for enhancement of terrestrial habitats once the facility was closed. Any landscaping would have to preserve the integrity of the cap, probably eliminating the planting of trees.

**Landfills**

Existing landfills can provide disposal space for marine dredged materials under two scenarios - use for daily cover or burial. In the case of the BHNIP, the surficial silts would have to be mixed with clean materials to meet the regulatory thresholds for daily cover.

No special site modifications would be required for landfills, although all the short-listed landfills have odor limitations. Three existing landfills (Figure 3-1), Plainville/Laidlaw, East Bridgewater and Fitchburg/-Westminister, were identified as having the ability to accept marine sediments in the approximate time frame for the BHNIP.

From a qualitative perspective, use of lined landfills for disposal of dredged materials provides the least environmentally damaging alternative (Table 3-6) because the natural environment has already been disturbed to develop the landfill. However, competition for space at landfills is a key issue. Landfill space is fast approaching capacity, and while various landfills are capable of handling marine sediments, this type of use could displace other, higher-priority uses. Of the 122 landfills currently permitted to accept municipal solid waste in Massachusetts, 114 are scheduled for closure by 1996 (MADEP, January 1993 active MSW landfill list). The three sites shortlisted have limited capacity for burial of dredged material (Table 3-7). The exception is that there continues to be a need for daily cover and final closure material. Dredged material can be suitable for these purposes under some circumstances. To be used for daily cover, sediment must have contaminant levels within a range that, after mixing with a "reasonable" amount of clean material, would meet

TCLP regulatory levels (Table 3-3). Maximum need for daily cover that could be provided by BHNIP dredged materials ranges from 50 cy/day (Plainville/ Laidlaw) to 250 cy/day (Fitchburg/Westminister) (Table 3-7). Only clean material that would contribute to construction of an impermeable layer could be used for a cap. Marine clay can be suitable for this purpose (S. Lipman, MADEP, 1993, pers. comm.). The limited available capacity for dredged materials at these landfills would minimize the traffic burden associated with the BHNIP.

The benefits (Table 3-8) of using landfills for disposal of marine sediments are relatively high, primarily because this alternative utilizes existing facilities. Again, however, this apparent benefit must be weighted against the constraint of competing uses for a limited resource.

### 3.3.2 Aquatic Alternatives

#### Shoreline Facilities

There are two fill alternatives proposed for the Mystic Pier sites, Revere Sugar, Amstar and Cabot Paint (see site locations Figure 3-1). The first alternative is for partial fill which would result in a final elevation (including cap) of mean low water. The total fill alternative elevation would be mean high water (or higher where adjacent land elevations would allow it). For both alternatives, a bulkhead would be constructed to isolate the site from the harbor during disposal. The bulkhead would remain in place after disposal in the total fill alternative but be cut off at MLW after the cap was secured for the partial fill alternative.

Two fill alternatives were considered for these sites since the cost of disposal site development can only be offset by maximizing the disposal site capacity. However, the total fill option creates an irretrievable loss of subtidal habitat by replacing it with fast land. The partial fill option is designed to allow for the establishment of intertidal habitat.

Little Mystic Channel and Reserved Channel (Figure 3-1) would require maintenance of aquatic habitat. Little Mystic Channel would be filled to a final elevation (including cap) of -6 to -3 ft MLW. Fill in the Reserved Channel would encompass either the entire area west of Summer Street or only the western end of that area. The western end would, in either case, be filled to a final grade (including cap) of +9 ft MLW, a suitable elevation for establishing salt marsh vegetation. The eastern portion would be filled to a final elevation of -6 ft MLW. Both sites would be bulkheaded during disposal.

Both shoreline fill scenarios would result in loss of marine habitat, although in the partial fill scenario loss would be temporary (Table 3-6). Permanent habitat losses would be highest at Cabot Paint (total fill). Temporary habitat losses would be highest at Reserved Channel (if entire area used) or Little Mystic Channel (Table 3-9). There were no marked differences in benthic infauna among the six potential disposal sites, but the pier areas (Amstar, Cabot Paint, Mystic Piers and Revere Sugar) may provide slightly better finfish refuge potential than the channels (Little Mystic, Reserved) because of the pilings. Ultimately, in the partial fill alternative, marine habitat could be altered from fine-grained substrate to vegetated or rocky substrate of potentially higher productivity (Reserved Channel, Little Mystic Channel).

Temporary localized water quality impacts could be minimized by appropriate site management (e g., dredging and disposal methodology, disposal behind bulkheads, use of silt curtains, disposal timing) for both total and partial fill alternatives. In both scenarios, the disposal site would be essentially isolated from the rest of the harbor. The partial fill scenario could pose a slightly higher risk of emigration of silty sediments in the long term than the total fill. Since the shortlisted shoreline sites are in relatively quies-



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cent parts of the harbor, and thus relatively safe from erosional currents, other forces (e.g.; boats, biological activity) are unlikely to disrupt the cap of the partial fill.

Land use impacts would be site dependent. Any fastlands created would have to be used for a water-dependent activity. Alterations in current use would be greatest at Amstar because of MWRA's newly constructed floating dock (for transport of Deer Island workers). Other pier areas are not presently in use. Filling in the eastern portion of Reserved Channel could interfere with the existing marina operations. Traffic impacts would be minimal at pier sites since sediments would be transported by barge. It could be necessary to use a barge and truck combination for Little Mystic Channel and Reserved Channel because of low clearance bridges across the entrance of each site.

Each of these fill alternatives could result in environmental or socioeconomic benefits (Table 3-8). All of the shoreline sites are likely to have or have been demonstrated currently to contain, contaminated sediments with elevated chemical constituents. Either the total or partial fill alternative would isolate these contaminants from the Boston Harbor environment. The partial fill scenario has the potential to enhance the environmental quality of the site by providing clean substrate for benthic organisms (all sites), or plantings to increase primary productivity (especially Reserved Channel and Little Mystic Channel). Totally filled sites could be developed for port-related activities. Clay from the improvement dredging could be used in capping these sites, reducing the need to transport material to MBDS.

Subaqueous Depressions

Use of the outer harbor subaqueous sites B and E (Figure 3-1) would rely on existing bathymetric conditions to keep disposed sediments in place. Sediments would be transported by bottom-dumping scow. After disposal of silt is complete, the area would be capped by depositing dredged parent material over the sediments.

Use of the subaqueous depressions would result in temporary habitat losses until capping was complete (Table 3-6). The disposal site footprint would be smallest at the Winthrop Harbor site (8 acres). Subtidal habitat would be altered by changes in substrate texture and depth. Some fine-grained sediments and associated contaminants would remain in suspension and be transported away from the disposal site. ADDAM'S model results indicate that the plume could extend a distance of approximately 4,500 ft from the disposal site and on a flood tide potentially carry contaminants (which may exceed water quality criteria by 2x) outside the disposal site. Commercially harvested clam beds on the Snake Island flats and the Basin could be sensitive to sediments with elevated contaminants dispersed from a Winthrop Harbor disposal site. Disposed sediments would be exposed to currents for the duration of disposal activities, presenting a risk for further emigration and bioaccumulation. The model results imply that water quality exceedences should not extend up-channel beyond Chelsea Point in Winthrop, so the Belle Isle Main ACEC should not be at risk (Table 3-10). Subaqueous B and E are exposed to higher current velocities than Winthrop Harbor; areas of potential exposure include the Governor's Island flats and Deer Island flats. There would be no land-based traffic impacts to any of these sites, although some impacts to navigation would occur. Restrictions would be temporary in Winthrop Harbor and Subaqueous B. Seasonal recreational boating could restrict disposal operations in Winthrop Harbor. Small boat use of the channel passing across Subaqueous E could also cause seasonal restrictions on use of the site.

Using subaqueous depressions for material disposal would isolate dredged contaminants from the harbor ecosystem. Another benefit associated with

the subaqueous disposal alternatives is the ability to use project parent material for the cap (Table 3-8).

**In-Channels and Borrow Pits**

Both In-Channel and Borrow Pit alternatives would require additional dredging of *in-situ* parent material plus the quantity needed to cap the silty sediments. Sufficient surficial material dredged from each disposal site would be stockpiled to use as final capping material to restore the site to pre-existing substrate conditions. Native clay from channel deepening would be used for the initial cap.

In-Channel alternatives would include Chelsea Creek, Inner Confluence and Mystic River navigational channels. Borrow pit alternatives include Meisburger 2 and 7 and Spectacle Island CAD (see Figure 3-1). This latter site is located in the shallow (-10' MLW) subtidal area east of the Island and is totally disassociated from the Island itself and the CA/T project work in progress.

Both the In-Channel and the borrow pit alternatives would temporarily remove marine subtidal habitat from production. There would be a greater impact at the previously undisturbed Meisburger sites than the In-Channel alternatives. Surface substrates at borrow pit sites could be altered somewhat but substrate in the In-Channel sites would not be noticeably different from the planned post-dredging conditions. Containment of sediments during disposal for inshore alternatives is an issue requiring mitigation to lessen the resulting turbidity plume. ADDAM'S model results indicate that water quality criteria exceedences would not occur at the offshore (Meisburger) sites while mitigation measures may be necessary to contain sediment dispersion at the Spectacle Island CAD site. Sediments would be exposed for the duration of the disposal operation, resulting in some potential for emigration through current transport or biological activity. The smaller capacities of the In-Channel alternatives would result in shorter periods of exposure than the borrow pits. However, ADDAM's model results, for the Subaqueous E site, indicate that there could be water quality criteria exceedences during flood tide after four hours; and silt/clay plumes were predicted to extend as much as 4,500 ft upstream of this in-harbor disposal site. Because of shallower water near the Spectacle Island CAD site, dilution to below water quality criteria was predicted at greater distances, but reached that distribution level in less than four hours.

Biological impacts could vary among the In-Channel alternatives primarily because of the Mystic River's value to anadromous fish although seasonal restrictions on disposal in the Mystic River Channel could avoid these impacts. The offshore borrow pit sites, Meisburger 2 and 7, support high benthic productivity and fisheries resources are relatively abundant. The outer harbor Spectacle Island CAD appears to support substantially lower benthic production. Its location in the general vicinity of the proposed Central Artery/Tunnel fish reef mitigation project, however, would mean that disposal methods and/or mitigation efforts would need to account for the protection to this resource if it is in place by the time the Harbor is dredged. Additionally, special plans to avoid or mitigate for fishing gear losses (lobster, pots, etc.) from barge traffic or construction activities may be necessary at the Meisburger and Spectacle Island sites.

The In-Channel alternative could utilize dredged clay for capping material (Table 3-8). Clay could be incorporated into the borrow pit cap. Sediments (sand and gravel) dredged from the borrow pit sites during site preparation could be used for beach nourishment or construction, if the need exists. Otherwise, this sediment would have to be disposed at MBDS. The In-Channel alternative has the advantage of being located in an already impacted area (i.e., the navigational channels).



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Existing Disposal Sites

Previously-used dredged material disposal sites, MBDS and Boston Lightship (Figure 3-1), could be utilized for the project for silt disposal, with capping. At MBDS disposal of contaminated material with capping is prohibited unless such a demonstration is made; with respect to the BLDS, the Corps has successfully demonstrated effective capping at sites with similar depths elsewhere in New England. A containment area would be prepared by configuring parent material in a specific area. Silt would be point-deposited by accurate positioning of the barge. Once disposal was complete, additional parent material would be deposited over the silt to form the final cap.

Disposal of silty dredged materials at a previously-used disposal site would have impacts generally similar to use of a borrow pit (Table 3-6). Since disposal of the silty sediments at the Massachusetts Bay Disposal Site is currently prohibited by EPA without further testing, a field program to demonstrate the effectiveness of capping, if it is needed, would likely push this site out of a reasonable time frame for use on the current project. Agency concerns associated with capped disposal at MBDS have largely focussed on emigration of contaminants/sediments during disposal and long-term integrity of the cap (see Appendix G). In a recent study by EPA (1993) ADDAM'S models were run for the MBDS using this project's data and no water quality exceedences were predicted outside the site during the disposal phase (Table 3-11). These results were used to conclude that disposal activities from this project (BHNIP) would not add to impacts from the MWRA ocean outfall at a level to cause a risk to threatened and endangered species in the area. ADDAM'S model results for the Boston Lightship also indicate that water quality criteria would not be exceeded outside that disposal site which is half as deep and twice as close to Boston as MBDS. In the foreseeable future BHNIP is the only project that could provide its own capping material, perhaps representing the only opportunity to cap silty sediments of this volume and provide a demonstration of this option's effectiveness. This scenario would provide beneficial use of all parent material dredged from the project. Capping at the MBDS may represent a practicable alternative for the future maintenance material as it is not considered implementable at this time due to the EPA and CZM requirement for a demonstration of its efficacy. Its use for future maintenance material would hinge on such a demonstration, if those sediments are found unsuitable for unconfined ocean disposal.

## 3.4 DEVELOPMENT OF DISPOSAL OPTIONS

As discussed previously, there are few alternative disposal sites that have the capacity to handle all the dredged material, parent, silt and rock, for this project. In addition, disposal considerations must include the requirement of future disposal of maintenance (silt) material. In order to address both the present and future capacity needs individual disposal sites have been combined into disposal options which attempt to balance environmental consequences with practicability concerns.

The volume of material requiring disposal from the proposed BHNIP was conservatively estimated to ensure sufficient capacity will be provided at disposal options. Table 2-2 presented the estimated volumes of rock, parent and silt material requiring disposal. The volumes shown assume a 0.5 foot overdredge to ensure all silt material is removed. The volumes also factor in a 20% expansion of silt and parent material over in-situ volumes to account for the water entrained in the dredging process. Rock was assumed to expand by 50% over in-situ conditions due to the blasting fractures. Based on the measured in-situ volumes and expansion factors the BHNIP will generate approximately 132,000 cy of rock, 2 million cy of parent material and 1.3 million cy of silt. These quantities represent one consideration used in

developing potential disposal options. As discussed in Section 3.2 and summarized on Table 3-4, sediment quality must also be taken into account in considering disposal sites. Environmental impacts of using undeveloped sites for disposal, presented in Section 3.3, are also a factor in developing disposal options, particularly related to contaminated dredged material. Finally, practicability considerations of costs, technology and logistics which are reasonably related to project needs must be factored into the development of disposal options.

These four factors: volume, sediment quality, environmental impact and practicability, were used to formulate several disposal options by combining land-based and aquatic sites. The following sections described options in four categories developed through the process defined above. Each option assumes that dredged parent material and rock will be used for beneficial uses to the maximum extent possible and that these uses will be identified and expanded throughout the EIR/S process. The remaining quantity of this material after beneficial uses are accomplished will be disposed at the MBDS.

Options for disposal of silt material considered potentially unsuitable for unconfined ocean disposal (Table 3-12) are the primary focus of the next section. Options defined as group "A" include combining land-based sites for silt disposal. The "B" group options focus on combining aquatic sites while "C" group options include combinations of land-based sites and aquatic options. The "D" group options consider aquatic sites previously used for offshore disposal and which have the capacity to receive all the project material.

Tables 3-13 through 3-18 and 3-20 are provided for use in determining the relative costs of alternative disposal options described in the following paragraphs. The objective of preparing these tables was to determine relative unit costs by estimating the total cost to dredge the silts, process the dredged material, transport the material to the disposal site, construct any required features at the disposal site and any other costs associated with the dredging and disposal of silts. The costs are based on October 1993 price levels.

The unit costs should not be used to estimate a project cost. Project costs, once a disposal site is selected, will be computed based on optimal use of equipment, distribution of silts to other disposal sites if applicable, and other factors that can not be estimated until a final disposal plan is selected and the cost of disposal of the parent material is determined. Also cost for mobilization would have to be added as well as associated design and construction management costs required for the selected plan.

Assumptions used are listed on each table. Existing information was used when available. Experience from other projects was used when specific site data was unavailable. These assumptions should be carefully reviewed since, in some cases, significant cost items are not included (i.e., real estate acquisition costs for upland and shoreline sites).

### 3.4.1 Land-Based Options (A)

Use of any of the upland sites for silt disposal would require that the material be dewatered prior to disposal. Dewatering would occur at Boston Harbor shoreline sites to facilitate trucking efficiency and minimize potential chloride impacts to freshwater systems. For calculations of disposal needs it was assumed that dewatering and compaction would reduce the silt volume nearly to its in-situ estimate of approximately 1.1 million cy.

Option A1. Option A1 would involve disposal of all silt at landfills. The three landfills which survived the screening process (see Table 3-1) are expected to have a combined maximum need of 1,000 cy/day of cover material. TCLP results indicated that most of the harbor silts would have to be mixed with equal quantities of clean materials to be suitable for daily

cover, reducing the total potential daily use of project material to 500 cy/day, or 7-13% of the anticipated dredging rate. Over the anticipated 100 days of silt dredging (assuming two dredges, yielding 8,000 cy/day each), the total daily cover needs at the landfills of 50,000 cy over the 100 days would fall far short of project disposal needs. In order for landfills to provide the necessary capacity, project sediments would have to be buried, not simply used as daily cover. Using all three landfills, a total of 525 cy/day of silt material, or 52,500 cy over the 100 day dredging period could be buried. The maximum disposal capacity for project silts combining daily cover and burial is, therefore, 102,500 cy.

As pointed out in preceding sections, there are definite environmental advantages to using landfills since they are engineered and permitted designated disposal areas. The major drawbacks to using landfills are daily limitations on quantities that the landfills can handle and competing public uses for landfill capacity. It would take more than 4 years to accommodate the 1.1 million cy generated by the BHNIP using Option A1. Costs would range from $56 - $101/cy to dispose of material at the landfills not including the cost of land needed to stockpile silt for four years (see Table 3-13).

Option A2. Option A2 would involve a combination of one or more landfills and one or more inland sites. Meeting the capacity requirements of the BHNIP would, at a minimum, involve using Wrentham (W-495), Squantum Point (QUI-03), and all three landfills. To reduce the volume of dredged materials to be buried at the landfills (52,500 cy), a third upland site, Everett (EVR-04), would have to be included. Any other combination of inland and landfill sites would fail to provide adequate capacity. Distribution of dredged material to four or five different locations would be difficult logistically and each town would feel the maximum potential effects of disposal. In addition, all dredged material would have to be dewatered at either Mystic Pier or North Jetty. Once dewatering started, dredged materials would have to be removed at the rate of 4,000-8,000 cy/day (200-400 truckloads) while silt was being dredged.

This option also assumes that a lined disposal facility would need to be designed and constructed at two or more inland or coastal sites and that silt overburden in excess of landfill capacity would have to be stored until access to sufficient quantities of clay become available for the facility's liner. Costs for Option A2 would be approximately $50/cy (see Table 3-14).

Option A3. Option A3 would rely entirely on developing land-based disposal sites for the silty material. Individually none of the four upland sites could provide the total capacity needed for the BHNIP, but the combination of the Wrentham (W-495), Woburn (WOB-11) and Squantum Point (QUI-03) sites meet the capacity needs. This option also provides some excess capacity beyond the current project needs. The benefits of Option A3 include reserving landfills for other public uses, minimizing the area and time needed for stockpiling and minimizing impact to the marine environment. Significant drawbacks include long-term management of three sites along with attendant costs, the minor capacity available for future dredging projects and on-site and neighborhood impacts from constructing the facilities and transporting up to 55,000 truckloads of silt to the sites. Costs for implementation of the above scenario of the Wrentham, Woburn and Squantum sites would be $50/cy (see Table 3-14).

### 3.4.2 Aquatic Options (B)

Aquatic options must be able to accommodate an estimated 1.3 million cy silt material which includes the 20% expansion factor over in-situ volumes.

Option B1. Option B1 relies on placing all the silt material in shoreline containment areas. Use of all the sites short-listed could not provide all the

disposal capacity needed for the BHNIP, but use of some or all of the sites could provide a variety of disposal configurations in combination with other types of sites. Filling these sites (Amstar, Cabot Paint, Mystic Piers, Revere Sugar to fastland; Little Mystic Channel to -3 ft MLW; and Reserved Channel to MHW in its western end and -6 ft MLW near the Summer St. bridge) would result in a temporary or permanent loss of marine habitat. However, this option would benefit the Boston Harbor aquatic environment by covering the silty sediments that presently exist at these sites, would enhance sediment quality for benthic organisms and could enhance primary productivity by creation of low salt marsh in Reserved Channel or subtidal productivity in parts of the Little Mystic Channel. Impacts to harbor traffic are also minimized by providing disposal within the vicinity of the proposed dredging. This option would not have capacity remaining for future use unless an additional site were included in the development plans.

Costs for maximum capacity at all six sites range from $33 - $278 cy depending upon the amount of engineering and site preparation required (Table 3-15). Costs include construction of a bulkhead across the face of each site and transfer of sediments from barge to truck by crane.

Option B2. Option B2 involves filling existing outer harbor subaqueous sites. No site by itself would provide the capacity necessary for the BHNIP. Combination of the maximum fill scenarios at Subaqueous B and Subaqueous E and Winthrop Harbor would provide sufficient project capacity. Because development of the subaqueous sites would not include construction of a physical containment structure, future use (if any capacity remained) would be dependent on having sufficient capping material. This option would result in temporary water quality impacts, and loss of marine subtidal habitat during the disposal and capping process. The habitat would be altered in depth, microtopography, and potentially, sediment grain size characteristics. The logistical benefits to this option are substantial as it would mean disposal sites would be near the dredge sites, minimizing conflicts with ship traffic and greatly reducing transportation costs and impacts.

Costs for this option would be approximately $15 per cubic yard (see Table 3-16). No site preparation costs would be incurred.

Option B3. Option B3 would require overdredging in at least three navigational channel areas, filling the dredged trench with silt and capping it with dredged parent material. Because this scenario would be confined to the footprint of the federal portion of the BHNIP, no additional habitat would be impacted. This option would prolong the dredging process by 3-6 months and require temporary barge storage of dredged silt until the initial cell was dredged. The three channel areas where it would be feasible to overdredge, Mystic, Chelsea and Inner Confluence, would be unable to provide the capacity needed for BHNIP; some parent material would have to be disposed elsewhere (probably MBDS). Overdredging would be impracticable in the Reserved Channel because it is the only tributary of Boston Harbor that has no physical restrictions to future deepening. This option might generate some tidal-dependent water quality problems. The ability to localize any impacts makes this an attractive option for the BHNIP, it would also offer a potential solution to hold aside for future maintenance dredging. Again, transportation disturbances and costs would be minimized by this option.

This option would cost approximately $25 per cy for disposal of 664,000 cy of silt which includes the costs of additional dredging and disposal of parent material (see Table 3-17).

Option B4. Option B4 would require dredging and capping a borrow pit for containment of BHNIP silts. A beneficial use would be sought for the material dredged from the pit. Meisburger 7 could provide capacity for all the silt dredged during the

BHNIP. Meisburger 2 also has the capacity if the sand and gravel deposits are proved to average more than 10 feet thick. The Spectacle Island CAD with a 45-acre footprint could also provide the necessary capacity. Each of these sites could be constructed to provide capacity for other projects if they occur during the time frame of the BHNIP. The Meisburger sites could provide sufficient additional capacity for future maintenance dredging of Boston Harbor, assuming disposal was confined to discrete cells.

Impacts associated with this option would be temporary but would include disturbance to areas utilized by commercial fish and fishing activities. In-harbor sites may experience some water quality exceedences while the offshore sites would not. Costs would range between $20 and $25 per cy, depending on the site selected. Reuse of sediment dredged at the disposal site could reduce the costs.

Option B5. Option B5 assumes a combination of aquatic shoreline sites and any of the other aquatic sites. This option would require use of at least two sites - an aquatic shoreline site and a subaqueous, in-channel or borrow pit site. An advantage over Option B1 would be the avoidance or minimization of permanent habitat loss, depending on the aquatic shoreline site selected. For example, this option could provide the capacity needed for the BHNIP by filling Revere Sugar to fastland and constructing an intermediate footprint at the Spectacle Island CAD. Any aquatic shoreline site could similarly be combined with the Spectacle Island CAD or with reduced disposal scenarios at the Meisburger sites to meet project capacity needs. Mitigation for water quality impacts would need to be addressed. Other possible combinations within this option would require the use of four or more sites (e.g. Little Mystic Channel, Subaqueous E, Inner Confluence In-Channel and Mystic River In-channel). Any sites not used could potentially be available for future disposal of Boston Harbor dredged materials.

### 3.4.3 Land-Based Aquatic Combinations (C)

Option C1. Option C1 would utilize a combination of landfills and aquatic shoreline sites. The combination of all six shoreline sites (to full capacity) and three landfills (50,000 cy of daily cover plus burial of 52,500 cy) would provide disposal capacity for a total of 1.18 million cubic yards. This option does not provide any future maintenance disposal and is logistically quite complex in terms of requiring dewatering locations, barge and truck loading at various sites around the dredging location and increased truck traffic in shoreline and landfill communities. In addition the option removes landfill capacity from other public users. The costs for this option range from $33 to $278/cy depending upon the site.

Option C2. Option C2 would combine non-landfill upland and aquatic shoreline sites. It could be implemented by using as few as three sites; a combination of Wrentham (W-495) and Everett (EVR-04) with Reserved Channel or Little Mystic Channel (to -6 ft MLW). That option would yield excess capacity. Alternatively, Squantum Point (QUI-03), Wrentham, and Mystic Piers (at maximum capacities) would meet needs but provide very little excess capacity. The costs for these scenarios would range between $50 and $255/cy depending on the site selected.

Not using Wrentham would require a minimum of eight sites: Squantum Point, Everett and the six aquatic shoreline sites except Little Mystic Channel, to their maximum capacities. Truck traffic impacts would be reduced in this scenario but construction of shoreline facilities would keep the cost range high, between $35 and $278 depending on the site.

Option C3. Option C3 would utilize a combination of landfills and aquatic disposal sites. Use of any of the borrow pits to full capacity would make landfill disposal essentially superfluous; however, landfills could be used in part if there were strong public pressure for landfill use. Without the landfills,

this option becomes similar to Options B4 or B5, discussed earlier. The Spectacle Island CAD, Meisburger 2 or Meisburger 7 (borrow pits) could provide the 1.3 million cy capacity and would be the simplest way to minimize use of landfill space and completely confine the dredged materials. No habitat would be permanently lost although capping the aquatic site would likely result in some alteration of substrate character. Spectacle Island CAD is located in shallow enough water to enable use of control structures to isolate the site during disposal. At other sites, because no physical structure other than lateral constraints provided by bathymetric conditions (existing or created) would be in place during disposal, some emigration of sediments and contaminants might occur from the aquatic disposal site during placement, potentially affecting nearby fisheries and other aquatic resources. If borrow pits were not used for this option, a minimum of two subaqueous depressions would be required.

Since no structures would be needed, costs for disposal under Option C3 would be less than C1 or C2. Assuming use of Spectacle Island CAD and East Bridgewater landfill, Option C3 costs range from $25 to $56/cy.

Option C4. Option C4 would combine development of a new land-based disposal facility with a non-shoreline aquatic site. Many possible combinations of two or three sites could meet current needs and potentially provide excess capacity for future dredging. Most efficient implementation of this option would likely focus on aquatic disposal first; development of the upland facility would start when clay dredged from the improvement portion of the BHNIP could be provided for the liner of the upland facility. The selection of both the upland and aquatic sites would determine whether excess capacity would remain for future dredged material disposal. Presumably, any excess capacity would be provided at the upland site, provoking the question of costs and responsibility for long-term management of the facility. Possible combinations of sites include Wrentham (W-495) and Subaqueous E; Wrentham, Everett (EVR-04), and Mystic River; and Squantum Point (QUI-03), Woburn (WOB-11), Subaqueous E, Mystic River and Inner Confluence.

Providing a constructed facility with substantial excess capacity would drive the costs of the BHNIP up substantially and would render this option impracticable. A regional use facility could be constructed and maintained by a separate authority. Costs for the suggested combinations of sites would range from $25 - $76 per cy, assuming that upland site preparation costs would be offset by future users of the excess capacity provided.

### 3.4.4 Previously Used Aquatic Disposal Sites

Option D1. Option D1 would rely on solidification of silty sediments prior to disposal at either MBDS or Boston Lightship. Solidification processes have been demonstrated to stabilize metals, PAHs and PCBs (Breslin, et al. 1988; IWT Co. 1993, pers. comm.) and have been considered to provide permanent removal of these contaminants from the ecosystem when applied in the terrestrial environment (see Section 3.5 and Table 3-19). There would be no short-term water quality impacts associated with offshore options, as demonstrated by the ADDAM'S model results. This option would also address concerns about resuspension and/or transport of silt sediments offsite, as well as further reducing on-site risks. However, this option would require special handling of the dredged material, and this, along with the cost of the treatment material, would make this option more costly. Disposal of hard material at an offshore site could increase habitat complexity or make habitat reestablishment more difficult.

Costs for solidification with offshore disposal would be approximately $55 per cy (see Table 3-19).

Option D2. Option D2 would rely on disposal of the silty sediments at either MBDS or Boston Light-



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ship and subsequent capping with parent material (primarily clay) from the channel deepening. As discussed in prior sections, resuspension of contaminants during disposal and from the boundaries of the designated disposal site has been the major concern associated with the capping option. However, modelling done in this study and by the EPA indicates that short-term water quality criteria exceedences should not be a problem with these sites. This project overcomes a major stumbling block faced in the past by proposals for capping at MBDS: availability (or lack thereof) of suitable capping material. The BIINIP will produce over 2 million cy of parent material, 1.5 times the quantity of silt to be dredged. Further, due to the physical constraints created by the transportation tunnels under the Main Ship Channel, it is likely that the Inner Confluence, Mystic Channel and Chelsea Channel will never be deepened below the authorized 40 feet. Thus, the supply of potential capping material is unlikely to be available for this purpose again without relying on an outside source. However, in its final site designation, EPA has found that disposal-and-capping (of unsuitable material) is prohibited at MBDS until its efficacy can be effectively demonstrated (40 CFR 228.12 [Amended]).

Cost for this option would be approximately $18 per cy for disposal of project silt (see Table 3-20).

## 3.5 ALTERNATIVE TREATMENTS AND BENEFICIAL USES

The silt portion of material to be dredged from Boston Harbor could undergo certain treatment processes that may either immobilize or reduce chemical concentrations to a level that may be acceptable for open water or other disposal options. Various commercial treatment processes exist that have been successfully utilized elsewhere in the country on sediment and on other material that may be applicable to dredged material. These treatment technologies were evaluated and potentially viable alternatives considered during the site screening process. Of the potentially viable alternatives considered, costs for treatment ranged from $50 per cy to $350 per cy, the most expensive being thermal treatment options (Table 3-19).

The parent material planned to be dredged for the full project has certain potential beneficial uses which deserve consideration within the alternatives analysis process. Some of these benefits occur one-time only, due to the proposed channel deepening, and therefore they should be considered carefully before the opportunity is permanently lost.

### 3.5.1 Treatment Technologies

Several general categories of treatment technologies were reviewed in the development of disposal options. The following paragraphs summarize each technology and its potential applicability to the BIINIP.

- **Physical/Mechanical.** These are largely dewatering and separation technologies often used to prepare materials for additional treatment. Dewatering processes include passive settling and drainage systems, as well as active mechanical systems such as belt filter presses and centrifugation. Mechanical separation and particle classification processes employ equipment such as grizzlies, hydroclones, and hydraulic classifiers to separate fine-grained clays and organic matter from coarser dredged material. This process may be desirable for the Boston Harbor material not only to facilitate handling, but because contaminants tend to sorb primarily onto the finer-grained material, thereby reducing the volume of material which would require treatment. These mechanical technologies are generally widely available, and many have been fully demonstrated in the treatment of sludges as well as in mining and other materials-handling indus-

tries. Factors limiting the effectiveness of these technologies can include the moisture content, flow rates, particle size distribution of the subject materials, and practicability of handling the large volumes and high daily production (dredging) rates. In addition, debris typically found in the harbor would have to be carefully removed prior to processing.

- **Biological.** These technologies, which include such processes as aerobic and anaerobic bioreclamation and digestion, treat contaminated sediment through the biodegrading action of microorganisms or enzymes produced by microbes. However, biodegradation is effective only to materials high in organic content, and is generally ineffective for treatment of heavy metals. In addition, biodegradation generally works best under operating conditions which permit a high degree of control of critical process parameters such as temperature, moisture, and nutrient content. These conditions may not be readily achievable for a large volume of material where climatic conditions vary widely or in instances when the treated materials are highly heterogeneous. Furthermore, biodegradation processes are complicated by the possible toxic effects of one contaminant in the treated matrix on the microorganisms used to treat another contaminant.

- **Chemical.** These technologies use chemical agents and processes to destroy, modify, remove (extract) or chemically immobilize toxic materials, or to alter them in a way that affects their solubility, stability, separability and other properties affecting handling and disposal. Averett et al. (1990) identify available chemical treatment processes, including chelation and nucleophilic substitution (dechlorination), as well as 22 extraction technologies, most of which can be viewed as essentially chemical in nature. Variations of these technologies are potentially effective in treating PCBs, non-halogenated semivolatiles such as PAHs, and metals. However, according to the literature, many chemical processes may be difficult to implement because of materials handling and process control requirements that have not been fully demonstrated for application to dredged material. Heterogeneity of grain size and density can limit the effectiveness of the extraction processes. For those processes, there may also be problems associated with recovery and disposal of the extraction solvents.

- **Immobilization.** These technologies typically isolate and limit mobility of contaminants through solidification and/or stabilization (S/S), and are usually applied to sediments that are ultimately placed in a confined site or disposal area. Averett et al. (1990) cite 12 such processes, including lime-based and Portland cement-based solidification processes, as well as encapsulation. S/S facilitates materials handling, decreases the surface area of the sediment mass across which contaminant loss or transfer can occur, and can limit contaminant solubility through Ph adjustment or sorption phenomena. According to the literature, S/S processes can be effective for both organics and metals. The most common of these technologies have been demonstrated on a pilot or full-scale basis for treatment of soils and solid residues from other treatment processes. In addition, the immobilization processes are generally not as sensitive to process control conditions as the biological and chemical-extractive processes. However, the effectiveness of cement-based solidification processes may be impeded by organics in the treated materials which reduce the binding capacity of the fixative, resulting in premature structural degradation. Another limiting factor in the use of immobilization technologies is the availability of a suitable confined



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disposal area or beneficial use for the solidified material. Marine applications may be available, however. Artificial reefs constructed of stabilized incinerator residues have been placed in Long Island Sound. Studies on mobility from these reefs of dioxins and furans (Wente and Roethal 1993) and various metals (Breshlin, et al. 1988) have indicated that these constituents have neither leached nor been accumulated by organisms attached to the reef. Other proprietary stabilizing agents have been demonstrated to immobilize PCBs and PAHs (IWT 1993, pers. comm.). Blocks constructed of solidified dredged material may also be useful for shoreline protection and reinforcement.

- **Thermal.** This category includes incineration processes, pyrolytic processes, vitrification processes, wet air oxidation, and other processes that involve heating the sediment hundreds or thousands of degrees above the ambient temperature. A number of these processes have been widely demonstrated, and are considered effective for destroying organic contaminants. However, they are often more expensive than other options. For example, the low fuel value and high water content of sediments results in high additional energy input requirements during incineration. In addition, volatilized metals and other incineration by-products must be removed from flue gases, ash or other residues for treatment and disposal. Incineration processes may also be difficult to implement because of siting problems related to complex permitting requirements and generally poor community acceptance. On the other hand, few of the non-incineration thermal processes have been demonstrated on other than a bench-scale or pilot basis.

Many of the specific processes which fall within each of the technology categories identified above have been reviewed in published literature, either generically or in connection with specific dredging or sediment remediation projects. From this review it was apparent that different investigators have used varying approaches to process nomenclature and categorization of specific processes (e.g., some reviewers classify chelation as a chemical process, others as a physical process; some place extraction within the chemical treatment category, others regard extractive processes as a treatment category by itself.) Averett et. al. (1990) have organized over 70 treatment process options within six technology categories. It is important to note that while many of these technologies have been widely demonstrated in non-marine applications, only a few have been used for bench scale and pilot scale tests on marine dredged materials, and few are considered commercially demonstrated and available for this purpose. The total volume of material being handled on this project and its rate of production are also serious impediments to the use of these technologies.

## New Technologies

The U.S. Environmental Protection Agency has established the ARCS Program in the Great Lakes Region with the interest of developing appropriate assessment and contaminant removal technologies in five areas of the Great Lakes. The Program includes a Technological Working Group on Engineering and Treatment Technologies, which assessed nine available treatment technologies. Four were selected for use in a pilot program: thermal adsorption, sediment washing, solvent extraction and bioremediation. The pilot studies were completed in 1993, with the results currently undergoing analysis and assessment. Final reports on the four technologies tested may be available in early 1994. This information, as available, will be included and further evaluated, as appropriate, in the FEIR/S.

The Corps of Engineers' Waterways Experiment Station (WES) in Vicksburg, Miss. has been investi-

gating a new technology, geotextile containers. Filling geotextile containers with sandy dredged material has been successfully used for construction of groins for several years but filling the containers with fine grained dredged material has been very limited. This technology as applied to the BHNIP would consist of mechanical or hydraulic dredging, filling the container positioned in a bottom dump scow, sealing the container, and disposing at an open water site. WES has just begun investigation into geotextile containers for deep open water disposal. Some of the advantages over traditional disposal includes: 1) no loss of contaminated material during the descent phase, 2) more control over the location size and shape of the deposition pile, and 3) long term containment of contaminated material. Capping of the containers, if required, would further seal contaminants from the environment. The cost of this technique has not been determined. Information on this technology, as it may be applied to the BHNIP, will be assessed as it becomes available.

## Technology Screening Criteria

A wide range of treatment technologies from the above described processes have been assessed with respect to effectiveness in treating the specific parameters of interest in the BHNIP (PCBs, PAHs, metals) as well as the implementability of each process considering the volume and through-put expected from the project. A subset of the most feasible technologies was further evaluated with respect to technical, environmental, economic and regulatory compatibility (Table 3-19). This subset was further narrowed to the selection of three treatment technologies (thermal, immobilization and chemical) that showed the most promise and applicability to the Boston Harbor sediments to be dredged. These technologies were evaluated for various effectiveness and implementability and are summarized on Table 3-19.

## Dredging and Potential Treatment Technology Relationships

The critical characteristics of the Boston Harbor Dredging Project that impact the selection of the alternative technologies include the following:

- The types of contaminants that are of concern, based upon contaminant concentrations found during the sampling and testing program, are polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), petroleum hydrocarbons and trace metals. The ability of each technology to treat these contaminants in the medium of dredged material is an important qualifier on effectiveness.

- A maximum of approximately 1.3 million cubic yards of dredged material may be unsuitable for unconfined ocean disposal and therefore could require treatment. Depending on the disposal option selected, production rates could range from 4,000 to 9,000 cy per day. This quantity and rate of dredged material would require a large scale facility for any of the applicable treatment technologies to be used. It is therefore, important to select demonstrated technologies that have operated on similar types of dredged materials at the scale required by the project schedule. This imposes a substantial constraint because there is very limited experience with operating treatment technologies at the scale of the proposed project for marine dredged materials.

Implementation of any alternative treatment technology will result in residue streams to the environment. The ability of each technology to control these residue streams, and thus to mitigate environmental impacts is another important consideration for effectiveness.

The projected quantities of dredged material will require relatively large sites (at least 4-6 acres) for any of the applicable treatment technologies except the solidification process which could utilize a barge mounted processing plant. Each treatment technology will be required to have similar receiving, storage, handling, and transport areas and relatively large fixed industrial facilities. To limit handling/transfer costs, the site would necessarily be located on the coast with barge access.

The time frame for permitting a relatively large and new industrial operation in the Boston area is estimated to take between 12 to 24 months. The design, construction/installation, start-up and testing of the selected treatment technologies could take an additional 12 to 24 months. Of the five basic treatment options, four show limited promise for use with the BHNIP dredged materials. Mechanical separation would do little to reduce the volume of material for disposal since contaminants are primarily associated with the silt. Biological digestion has not been shown to be effective with heavy metals. Chemical reclamation would require a multi-step process, including dewatering and disposal of solvents. Thermal treatment would be most effective on organic compounds. Solidification, on the other hand, has been demonstrated to immobilize a variety of organic and inorganic constituents effectively. It is the only treatment technology carried forward into the disposal options analysis.

### 3.5.2 Beneficial Uses

There is a strong potential a portion of the Boston Harbor dredged material to be used for one or more beneficial uses. The types and volumes of parent material may never be available again from Boston Harbor and therefore provide some unique mitigation opportunities for dealing with the silt. The parent material, specifically the rock and Boston Blue Clay could have a variety beneficial uses.

It is also possible that the silt portion of the dredged material containing elevated levels of organics (PCBs, PAHs and petroleum hydrocarbons) and heavy metals could be utilized for daily cover at Massachusetts Category A lined landfills, provided the material is mixed with a sufficient amount of cleaner material prior to use. However, the concentration of certain contaminants in the mixed material must meet the DEP criteria for this type of use. One drawback to utilization of the dredged material for landfill cover is that each landfill is limited to receiving small quantities (50-250 cubic yards at the short-listed sites) of material for daily cover use. Stockpiling at landfills is limited due to the confined space available. Consequently, only a small portion of the Full Project quantity of dredged silt material (approximately 1.1 million cubic yards total) could be used in this manner.

Beneficial uses for rock and parent material could include the following:

#### Use of Rock Material

**Fish Habitat Enhancement**

There will be a large quantity (132,000 cubic yards) of rock removed from this project which could be utilized for constructing or improving a fishery habitat. For a perspective on the overall volume of material available, a containment structure with an approximate height of 15 feet would encompass an area of over 5 acres. A structure of this magnitude could be located in an in-harbor or offshore area considered to be in need of fisheries improvement but away from heavily utilized locations and high energy areas. A drawback to the rock to be removed for the BHNIP is that it will be mostly small in size ( < 10") and mixed with some clay which would not provide large interstitial space for fisheries habitat. It would however, provide hard substrate for benthic organ-

isms and some interstitial space which could increase the diversity and productivity of habitat niches.

### Shoreline Protection

It was investigated to determine if some of the rock material could be utilized for shoreline protection along certain areas in and around Boston Harbor. Specifically, there are waterfront areas in Chelsea and Mystic Rivers and along the Main Ship Channel that may be structurally unstable due to erosion from inadequate protection. As an example, an area that may benefit from increased shoreline protection is a city property located along the south shore of the Chelsea Creek near Condor Street. Additionally, there may be shoreline areas outside of Boston Harbor proper that could benefit from increased protection. Massport does not have any waterfront areas that could readily use the rock material for protection. However, due to the size of the rock material after blasting (10" diameter) its use as shoreline protection will be limited.

### Containment Site Development/Armoring

The rock removed from dredging could be useful for developing a containment site for the unconsolidated (silty) dredged material. One such use could be for the construction of subaqueous berms that could assist in retaining the finer material during disposal operations at some types of sites. Likely sites for this use would include the subaqueous sites in the outer harbor and Spectacle Island CAD. The rock could particularly be useful in providing armor aggregate for a portion of the containment berms. However, it is expected that a substantial quantity of other larger size rock may be needed to completely protect the exposed faces of the containment berms.

### Upland Fill/Commercial Reuse

The dredged rock mixed with clay could be useful for various upland filling applications where clean fill is needed (highway construction, etc.). It would be relatively easy to handle and transport, and could provide a suitable foundation for certain light commercial or industrial uses. Additionally, the rock could have some commercial reuse potential as construction aggregate. Its clay content may decrease its utility.

## Use of Parent Material

### Open Water Disposal Cap

There will be approximately 2 million cubic yards of parent material (primarily clay and sand/gravel) available from the Boston Harbor Dredging Project. This material is highly cohesive and could be useful as capping material at an open water disposal site. Open water sites still under consideration which could utilize this method of containment include the Massachusetts Bay Disposal site, Boston Lightship, and the Meisburger 2 and 7 sites. Capping would be initiated soon after the disposal of silt material was completed. The operation would be conducted using traditional barge scows with bottom operating doors. The material would be point dumped within specific radii from the center of the silt material to form a continuous mound deposit of approximately 1 meter thick on top of the silt. This would effectively provide a clay cap which would seal off the silt from the environment.

### Nearshore Containment Cap

The parent material could also be used in a similar fashion for capping any of the nearshore containment sites currently under consideration. However, because of limited barge access to some of



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these sites, it may be necessary to utilize landbased equipment or a barge mounted crane for offloading the sediments from barges for cap placement.

**Subtidal/Intertidal Habitat**

The Reserved Channel and Little Mystic Channel containment options will require surface material that would be suitable for establishment of subtidal and intertidal habitat. The parent material to be dredged would be suitable as base material that could be placed directly onto the silty dredged material in the containment site. A surface layer of clean sand/silt mixture placed over the clay would provide substrate favorable for benthic recruitment and establishment of vegetation.

**Landfill Liner/Cap/Closure Material**

The parent material could also be useful for lining landfills or other upland sites that may require liner material. Since the parent material is primarily clay, it is highly impermeable and could be suitable for this purpose. This material could also be useful for capping or covering some of the silt to be dredged from this project that may require burial. The predominately clay parent material may also be useful as final closure material at certain landfills. Massachusetts DEP, Division of Solid Waste Management identified anticipated closure dates for municipal solid waste landfills in Massachusetts (January 6, 1993). The information indicates that 56 landfills are to close in 1993, 52 in 1994, 2 in 1995, 4 in 1996 and 1 in 1997. Excavated soils from the Central Artery project will be used to cap many of these landfills. Should CA/T material not be used in this manner, by the time BHNIP begins, the 108 landfills closing prior to 1995 could potentially utilize a proportion of the parent material provided practicability problems (primarily logistics and cost) can be overcome. However, the potential future use of synthetic liners for landfill application may substantially reduce or eliminate the need for clay at many landfills that currently use this material.

In summary, beneficial uses of rock and parent material may include a variety of enhancement and containment purposes as follows:

ROCK

(Amount available: approximately 132,000 cubic yards)
Fish habitat enhancement
Shoreline protection
Containment site development/armoring
Upland fill
Commercial reuse (construction aggregate)

PARENT MATERIAL

(Amount available: approximately 2 million cubic yards)
Open water disposal cap
Nearshore containment site cap
Landfill liner/cap
Landfill final closure material
Other upland site liner/cap

## 3.6 PREFERRED DISPOSAL OPTION

The single preferred disposal option is not identified in this Draft EIR/S. Public comment on the alternatives presented herein must be factored into that decision. The preceding discussions have demonstrated the complexity of identifying and combining sites to form disposal options. This section will assess the issues involved in critically evaluating the merits of the disposal options to select the preferred option.

Selection of the Preferred Disposal Alternative will be based on screening the options through a series of key criteria (Figure 3-2) which include:

- ability of disposal sites/methods to meet regulatory criteria for receiving material
- reasonable capacity for this project
- minimization of negative environmental impacts
- maximization of environmental benefits
- reasonable in light of logistics, technology and cost.

Determining the suitability of each site for the different types of dredged material is an initial screening criteria and this "matching" process was discussed earlier (Section 3.2). A second important factor is having enough capacity within the site(s) to offset its development cost. Sites with less than 200,000 cy of capacity were deemed impracticable for this project.

Environmental impact was a third criterion. Land-based (landfill and development of new inland or coastal sites) and aquatic (nearshore and various open water alternatives) disposal sites would inherently involve different types of impacts (Table 3-6) since different resource types would be involved in each case. Thus, while comparisons among land-based alternatives and among aquatic alternatives are fairly straight forward, comparisons between upland and aquatic alternatives are more complex. The types of environmental impacts that would weigh most heavily against a site being included in the preferred alternative (based on sensitive resources identified in this study) would include unmitigatable risks to:

- marine and/or upland habitat
- wetlands
- anadromous fish passage
- important resident fish and shellfish
- water quality
- threatened and endangered species
- traffic (marine and/or roadway)
- neighborhood impacts

Distinctions can be made among disposal alternatives based on their ability to provide environmental benefits (Table 3-8), although, again, it is difficult to weigh benefits against each other, particularly on the generic level. However, benefits that would weigh most heavily toward including a particular alternative would include:

- maximizing use of parent material
- use of any available sand or gravel
- providing capacity for future dredging needs
- providing clean bottom habitat within Boston Harbor
- providing alternatives which are practicable and achievable

Identifiable future disposal estimates (i.e., 50-year maintenance for Boston Harbor) point out the necessity to evaluate disposal options on both the generic and specific levels. As indicated in Section 3.4, identifying capacity for the BHNIP is the first challenge. Adding future dredging projections to the equation makes the evaluation more complex but is critical to the process and was identified as such in the MEPA scope. The preferred disposal option should include a site or sites and methods to accommodate future dredging as well as the current need.

Cost, in addition to logistics and technology, is a factor in determining practicability of the disposal options. Final cost comparisons among disposal options cannot be made without considering specific sites. An acceptable benefit/cost ratio must be reached or the project will not go forward. Federal participation in the BHNIP is governed by two cost-related criteria. These criteria relate to the material to be removed during construction of the project: 1) silt or maintenance material that has accumulated



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since the channel was last deepened; and 2) the parent material that must be removed to deepen the channels to their new depth. Because the cost of deepening the channels (removing parent material) and removing silt and parent material from project berths are direct project costs, the total must be compared to the benefits that the deeper project will provide. Therefore, the benefit-to-cost ratio for the project or each separable increment of the project must be at least 1:1 for the project to qualify for Federal funding. Included in the benefit to cost ratio is the incremental cost to maintain the project during its economic life (50 years).

As described in Section 1.3, costs of construction of disposal sites, or acquisition of lands for disposal, are non-Federal costs. While a particular disposal option may pass the Federal participation criteria, the sponsor may find its cost contribution unacceptably high. The screening process of practicability considered costs in excess of 4 times that of ocean disposal as prohibitive. The cost criterion that applies to the project related berths is affordability relative to the perceived benefits in site management.

The cost of disposal of silt material at one of the full capacity sites (Meisburger 2 or 7, Boston Lightship, Spectacle Island CAD and the Massachusetts Bay Disposal site) would range from about $24 million to about $33 million. Limited capacity sites, when combined to accommodate the total volume, would cost at least $10 million more than the most expensive full capacity site.

Identification of suitable disposal options for BHNIP has been an open process involving valuable collaboration with the project's working groups. This DEIR/S is another step in that process. Massport and the Army Corps of Engineers will incorporate comments received on the specific sites, disposal types, practicable disposal options and the final selection criteria into their determination of a Preferred Disposal Option which best meets the identified goals.

Table 3-21 provides a summary of the principal impacts associated with the twenty-four disposal sites and one treatment technology that remained potentially suitable for BHNIP material disposal after site screening. The existing conditions at each site and principal environmental impacts associated with its use are provided in Attachment 1 in Volume 1 of 2 of this Draft EIR/S. The twenty-four sites were screened against the final practicability considerations described above for selecting a preferred disposal option. This analysis has resulted in a final short-list of practicable alternatives from which a preferred disposal option will be selected.

While the selection of a preferred disposal alternative is not required by the Massachusetts Environmental Policy Act (MEPA), it is required under the National Environmental Policy Act (NEPA). Federal agencies (e.g., the Corps of Engineers) are required to "identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement..." In addition, the Final Rule for Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged Material into Waters of the U.S. or Ocean Waters (33 CFR 209, 335-338), states that dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404 (b)(1) evaluation process or ocean dumping criteria, will be designated the Federal standard for the proposed project. In compliance with the above regulations, Massport and the Corps select the Massachusetts Bay Disposal Site (MBDS), the Boston Lightship, Meisburger sites 2 or 7, and Spectacle Island CAD as their preferred disposal alternatives.

The DEIR/S is to be used also as a disposal site selection process for maintenance dredging if the proposed navigation improvement project is delayed or not implemented. Maintenance dredging of accumulated silt material will be needed to allow

ships to transit the harbor safely. Unlike the navigation improvement project maintenance dredging would not produce clean parent material which could be used for capping. Therefore, disposal options which provide cap material, such as the Meisburger sites, Spectacle Island CAD and in-channel disposal, are preferable. Disposal could occur at other sites if suitable cap material can be found from other projects.

The following section describes the factors and reasoning for selecting the final short list of practicable alternatives.

### 3.6.1 Practicable Alternatives

The preferred disposal option will be made up of one or a combination of several sites and options described earlier. The twenty four remaining disposal sites have been further screened to yield several practicable alternatives which meet the capacity, environmental benefits and cost requirements of the BHNIP.

As stated earlier "practicable" is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.10(a)(2)). Other "feasible alternatives" are evaluated under Section 103 of the Marine Protection, Research and Sanctuaries Act.

The twenty-four sites were evaluated according to a five step practicability screening which proceeded as follows:

1. Habitat loss at each disposal site was examined first. Sites were retained if habitat would not be lost or if it would be altered in a way that continued to provide resource function.

2. Sites meeting the first criterion were evaluated for water quality impacts. Sites were retained if disposal actions did not show water quality exceedences or if adequate mitigation measures could be implemented.

3. Sites meeting criteria 1 and 2 were examined for socioeconomic impacts. Potentially excessive exposure to neighborhoods, traffic or sensitive natural resources was used as an elimination criteria.

4. Sites meeting criteria 1, 2 and 3 were examined based on meeting a minimum capacity of 200,000 cy.

5. While not a direct reason for ruling out a site, sites with disposal costs greater than 4 times and higher, than capping at MBDS, were considered excessive.

6. Sites meeting all the above criteria were also evaluated as to their potential for providing capacity for future maintenance dredging projects.

These criteria were used to identify the least environmentally damaging practicable alternatives for the three areas of need (parent material, silt material, future maintenance material). Based on this analysis all land-based and aquatic shoreline sites were found to have severely limiting environmental socio-economic or capacity constraints. Cost, logistics, technology and capacity, measures of practicability, were also found to be less favorable at land-based and aquatic shoreline sites.

Table 3-22a lists the sites considered practicable for the BHNIP project. These sites were found to be the least environmentally damaging and the most practicable in terms of disposal capacity, logistics and costs. Among the listed sites Boston Lightship and MBDS have unlimited capacity as long as there is

sufficient capping material (and this mitigation measure is proven to be feasible at MBDS). The BHNIP can provide 2 million cy of parent material for capping during the improvement dredging. This capping material is a one-time opportunity for this project. Because there are no site preparation costs at Boston Lightship or MBDS, costs to implement these alternatives would be lower than other sites. The MBDS has been deemed acceptable for the parent material.

Meisburger 7, and potentially Meisburger 2, could accommodate all the silt dredged during the BHNIP as well as provide capacity for future maintenance. These sites would be excavated below grade, filled, then capped with parent material and the excavated material used to restore to existing grade and cover type. Thus, these sites could provide their own capping material. Costs for use of Meisburger 2 and 7 would have to include site preparation - dredging of the borrow pit - but could be partially offset by beneficial uses (e.g. beach nourishment projects) of the on-site sediment deposits.

Spectacle Island CAD, though no more costly than the Meisburger sites, could not provide the full capacity needed for the future maintenance material and, thus, has use only for silts from the present project.

In-channel locations, while not having the capacity, even taken together, to accomodate all the BHNIP silt material, do provide a total of about 740,000 cy and the environmental benefit of capping the contaminated sediments in place.

Table 3-22b lists sites which survived the screening process but on further review were found to provide insufficient capacity and were cost prohibitive. These sites are potentially practicable for future maintenance dredging requirements where the required capacity will not be as great. Among these potentially practicable sites, both Little Mystic Channel and Reserved Channel offer the potential for resource enhancement assuming temporary water quality impacts could be mitigated. Neither site, nor a combination of the two, could provide the necessary capacity for the BHNIP and are costly options.

Amstar, Mystic Piers and Revere Sugar would provide the benefits of capping contaminated sediments, but are of high cost relative to the amount of maerial they could accomodate. All aquatic shoreline sites, even if filled to capacity, would require bulkhead construction which has the benefit of isolating contaminated sediments in those areas. The trade-off is that existing sub-tidal habitat is lost to fast land if the sites are filled to capacity. Due to the permanent loss of subtidal habitat in the total fill option only the partial fill option, which provide for the establishment of intertidal habitat, was selected as potentially practicable.

Lined landfill sites do not provide sufficient capacity relative to costs per cubic yard for disposal. These sites may be suitable for future small quantity maintenance dredging needs if the cost is reasonable in relation to the amount of material to be disposed.

Solidification would also meet all the environmental criteria for the "least environmentally damaging" alternatives. Although it could meet the capacity requirements for the BHNIP, but not the dredge material production rates, current costs would be up to 8 times those for implementing the other alternatives. Other technologies (particularly bioremediation) are continually being investigated and may eventually prove to be practicable. Therefore, it may be a potential option for future maintenance material.

The potentially practicable alternatives selected through the foregoing process are listed in Table 3-22b. Table 3-22c lists the remaining sites of the 24 that survived the evaluation process. Further review of these sites, in terms of practicability, revealed that they do not provide the least environmentally

damaging alternatives and some are cost prohibitive. Based on the final evaluation these sites have been excluded from consideration as practicable alternatives.

### 3.6.2 Descriptions of Practicable Disposal Sites

Section 3.6.1 and Table 3-22a identified six practicable alternatives from which a preferred disposal option will be selected. The information which follows provides a description of each of these options, existing environmental conditions and proposed site conditions and impacts from material disposal operations.

In addition to the six identified sites, an additional five have been evaluated in the following sections. These additonal sites, consisting of aquatic shoreline facilities, are considered potentially practicable due to their proximity to the dredging locations and potential for providing environmental benefits by removing and capping contaminated sediments occuring at these locations. However, their practicability is limited due to the cost of site development relative to the capacity they provide and, as such, are not the preferred alternatives.

#### 3.6.2.1 Boston Lightship

The Boston Lightship disposal site (BLDS) is a historical disposal site approximately five miles across and more or less centered on the Boston Lightship (Figure 3-3). The site received hazardous and low level radioactive waste containers, construction debris and sunken vessels between 1940 and 1976. Three million c.y. of Boston Harbor dredged material was disposed there in the late 1960s and early 1970s. Volumes disposal in earlier decades are unknown.

**Existing Conditions**

The sedimentary environment out to the 50 m contour (which bisects this disposal site) has been characterized as either depositional (see hatched area in Figure 3-3) or sediment reworking (Knebel 1993) The depositional area, within which the disposal site is proposed, is depicted as an area with modern fine-grained (muddy sands and mud) sediments that have accumulated in areas of dominating weak bottom currents.

A summary of the benthic species collected at Boston Lightship in December of 1977 and May of 1978 indicate a smaller number of individuals and species than at other disposal sites located in the Gulf of Maine (DAMOS 1979b). Dominant benthic species include the polychaetes *Sternapsis scutata, Nepthys incisa, Maldane sarsi, Lumbrineris fragilis, Ninoe nigrippes, Goniada maculata, Ampharete acutifrons,* the nemertean worm *Micrura* sp., burrowing anemone *Edwardsia elegans,* and the amphipod *Hippomedon serratus* (DAMOS 1979b, Supp D).

The Massachusetts Bay area is a productive fishery habitat. Fish reported to occur in the area of the disposal site include cod, dab and gray sole, yellowtail flounder and whiting. Atlantic herring are caught near the vicinity of the Boston Lightship and the MBDS (DAMOS 1979b, Supp D). Lobster and ocean quahogs are also reported in the area.

**Proposed Use/Impacts**

This site is an alternative for disposal of the 1.3 million cy (expanded volume) of silt material, assuming the disposal would be capped with three feet of parent material. There is a depositional area within this site below the 50 m contour that is proposed as the disposal site in order to maximize opportunities for bottom stability (see Figure 3-3). Capping has occurred at this depth at the Portland, ME disposal

site. Knebel (1993) has estimated that fine sand and silt at this depth can show frequent motion at least 1.2% of the time with occasional movement another 14% of the time. He inferred that these movements are not sufficient to leave a permanent imprint on the bottom; this is consistent with studies by Rhoads et al (1978) which showed that only a few millimeters of mud deposits are moved by episodic strong bottom currents (in Long Island Sound) and massive erosion does not occur.

Sediment disposal simulations for the Boston Lightship site conducted with COE's ADDAM's model (Appendix F) showed that four hours after a 2,000 cy disposal event that water quality criteria for copper were not exceeded outside the disposal site's boundary. Since this was true for the summer (stratified) condition, it would be safe to assume it would hold for winter (unstratified) conditions as well. Within the site, soluble copper concentrations in the water column were also estimated to not exceed water quality criteria. After a four hour period, total volume of silt within the cloud was estimated to be equivalent to about 3.3% of the initial disposal volume. These results indicate that risks to marine resources would be minimal since water quality criteria are met after two hours within the disposal site.

Biological resources at the site would experience some impacts as a result of the disposal activity. The sessile benthic community within the footprint of the disposal would be temporarily lost; it may take a year or so for recolonization to occur from surrounding populations after disposal activities cease. Motile benthos and finfish feeding in the area would be displaced and may not return to pre-disposal levels until bottom secondary production is re-established. Impacts to these populations would be similar to those at other offshore alternative sites. However, given that this disposal site is not known to be biologically unique and recovery is expected within a reasonable time-frame, long-term adverse impacts are not anticipated. Consultation with the National Marine Fisheries Service has been initiated to ensure threatened or endangered species with this area would not be adversely affected (see the Biological Assessment, Appendix A). The EPA (1993) has already found that activities from this project and MWRA's ocean outfall should not result in cumulative damaging impacts to these species.

Boston Lightship is an inactive disposal site. Extensive shipping, fishing, recreational activities, and scientific investigations take place in Massachusetts Bay in the vicinity of the site. Barge traffic to the site would have to be coordinated by the U.S. Coast Guard, which would involve up to 500 trips for the parent material (including rock) and 170 barge trips for the silt, assuming large (4,000 cy) barges are used. There are no known or anticipated long-term interferences or damage to these activities from disposal events at this site. However, Boston Lightship is an area deemed "sensitive" by the Board of Underwater Archeological Resources because of the number of shipwrecks that have occurred there over time or because the historic disposal site may contain material of archaeological interest. Sensitivity of the site will be confirmed by the staff upon review of the Board's files.

### 3.6.2.2 Massachusetts Bay Disposal Site

The closest U.S. Environmental Protection Agency (EPA) designated dredged material open water disposal site is the Massachusetts Bay Disposal Site (MBDS). It is located approximately 22 nautical miles east from Boston Harbor in Massachusetts Bay (Figure 3-3) in 90 meters of water. MBDS has a circular boundary with a 2 nautical mile diameter.

The general vicinity of MBDS has received wrecks, dredged material, organic and inorganic compounds, including low level radioactive waste, and construction debris since the 1940s. Earlier disposal was not at a specified point, but sufficiently far from land to reduce the impacts of disposal.

Most dredged material was disposed of at sites closer inshore, especially the Boston Lightship Site (BLS). Historically, some dredged material considered "contaminated" or oil laden (without any testing) was disposed at the offshore area which eventually was termed the "Foul Area" and now is called the MBDS. This site has received approximately three million cubic yards of dredged material between 1975 and 1985 and about another million from 1986 to 1991. The majority of this material came from Boston Harbor dredging projects. MBDS has also received dredged material of varying composition from many harbors.

From past disposal activities at MBDS, 62.1% of all material was silt and clay (greater than 4 phi) and 37.3% was sand (-1 to 4 phi), the remaining 0.6% was gravel (less than -1 phi). Much of the material disposal was a mixture of sandy silt. MBDS has retained this material because of the stable nature of this deepwater offshore site. The majority of material at MBDS has come from Boston Harbor (67%), with harbors south of Boston making up 20% of the material historically disposed at MBDS. The remaining 13% was generated from dredging projects in harbors north of Boston to Gloucester, Massachusetts. Material from the CA/T project is currently being disposed at MBDS.

The EPA's decision regarding the boundary for the designation of an ocean dredged material disposal site in Massachusetts Bay has been issued as a Final Rulemaking published in the Federal Register. The revised location of MBDS will overlap the existing site but be offset slightly to the southwest. The center of the site is 42°-25.1' north latitude and 70°-35.0' west longitude. The Final Rulemaking, which follows the Proposed Rulemaking and is also published in the Federal Register, resulted in MBDS becoming an actual site designation. The final rule states that disposal and capping of unsuitable material is prohibited at MBDS until its efficacy can be effectively demonstrated (40 CFR 228.12 as amended).

Existing Site Conditions

The physical properties of the substrate near the disposal point is varying in composition, predominantly sandy silt, reflecting the various harbor dredging projects disposed here. The natural bottom covering the majority of MBDS (i.e., areas of the silt that have not received dredged material) is a fine silt/clay substrate (NED unpublished data). The composition of this natural material indicates the basin is a depositional area capable of containing the dredged material; it is this characteristic that could render it suitable for capping, with the appropriate capping management plan.

The EPA (1989) evaluated the sediment composition of the MBDS in their DEIS to evaluate the continued use of this site. The results of the metals analysis show that metal concentrations in the MBDS are either Category I (low) or II (moderate) (314 CMR 9.00) using the Massachusetts Department of Environmental Protection (MADEP) guidelines for dredged material. In general, these results were similar to levels found outside the disposal site in Massachusetts Bay (EPA 1989). Petroleum hydrocarbons were detected at a higher level within the MBDS than outside. However, polyaromatic hydrocarbons (PAHs), a measure of the aromatic fraction of petroleum hydrocarbons, was more varied inside than outside the disposal site. Polychlorinated biphenyl (PCB) levels in the dredged material were somewhat higher than ambient levels. PCB levels detected from dredged material in the vicinity of the MBDS are comparable to levels identified in other Massachusetts Bay studies (EPA 1989).

The oceanography of MBDS is influenced, in part, by the circulation of the Gulf of Maine (SAIC 1993). The Gulf of Maine circulation patterns in the vicinity of the MBDS are modified to a large extent by the presence of Stellwagen Bank on the eastern margin of the Massachusetts Bay. Results of MBDS oceanographic studies indicate the site to be located

in a low energy, deep water environment, allowing containment of dredged material within the site (DAMOS 1979; Turman 1977; Gilbert 1975; SAIC 1987a, 1993).

The temperature/salinity cycle of Massachusetts Bay is characterized by seasonal variability, with maximum temperatures (18° C) typically occurring at the surface in a stratified water column during August and September, and minimum temperatures (5° C) typically occurring in an essentially isothermal water column in January and February (SAIC 1987a). Salinity values range from 31-33 ppt in this area.

Recent sampling of the benthos at MBDS (SAIC 1986) determined three (3) distinct community assemblages responding to the specific and varied sediment regimes at the site. Coarse sands and gravel in the northeastern section of MBDS support the Syllidae polychaete *Exogone verugera profunda* (907 individuals/$m^2$); the Paraonidae polychaete *Levinsenia gracilis* (350/$m^2$); and the Spionidae polychaete *Prionospio steenstrupi* (313/$m^2$).

The western portion of the MBDS has been impacted by the approximately three million cy of dredged material continuously disposed from the greater Boston region. This continual disturbance of the bottom has caused the community of benthic organisms to be in dynamic equilibrium; the most adaptable species proliferate. Those species that reproduce rapidly and have high numbers of offspring (i.e., larvae) colonize the newly disposed dredged material and biogenically rework the substrate. This assemblage was dominated by oligochaetes (6,293 individuals/$m^2$); the Spionidae polychaete *Spio pettibonae* (4,607/$m^2$); the Cirratulidae polychaete *Chaetozone setosa* (2,160/$m^2$); and the Capitellidae polychaete *Metiomastus ambiseta* (1,757/$m^2$). The undisturbed section of MBDS was dominated by the Paraonitae polychaete *Levinsenia gracilis* (1,583/$m^2$); oligochaetes (1,050/$m^2$); and the Capitellidae polychaete *Metiomastus ambiseta* (693/$m^2$).

Various finfish species have been collected during sampling cruises (SAIC 1986) within the MBDS. In the spring of 1985, the spiny dogfish (*Squalus acanthias*) was the dominant finfish recovered. Fall 1985 finfish collections were dominated by the witch flounder or grey sole (*Glyptocephalus cynoglossus*) and the dab or American plaice (*Hippoglossoides platessoides*).

MBDS is located just outside of the western boundary of the Stellwagen Bank national marine sanctuary. Endangered whale species are known to congregate above the shallow (30 meter) Stellwagen Bank when foraging for prey (e.g., sand lance *Ammonytes americanus*) (U.R.I. 1981) . These species also have been observed within the 2 nautical mile circular boundary of the MBDS. Endangered species identified as transients of MBDS include the finback whale, *Balaenoptera physalus*; the sei whale, *Balaenoptera borealis*; the humpback whale, *Megaptera novaeangliae* and possibly the northern right whale, *Eubalaena glacialis* (Manomet Bird Observatory, MBO 1987). The impact of the use of the MBDS on endangered species is assessed in a Biological Assessment by the ACOE, NED (Appendix A). Use of the site to date has not indicated any impacts to threatened and endangered species. The EPA (EPA 1993) has examined the potential for cumulative impacts to threatened and endangered species from the BHNIP and MWRA's ocean outfall and found that such impacts are considered unlikely to occur.

Other marine mammals, not listed as threatened or endangered species, may occur in the area of the MBDS. The larger whales tend to select areas of rapidly changing bathymetry (MBO 1987). Other areas where large whales congregate are principally along the shelf edge of Georges Bank. The greatest concentrations of dolphins occur from Georges Bank south to the mid-Atlantic regions, principally from mid-shelf seaward to the shelf edge, independent of season (MBO 1987).



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The harbor seal *Phoca vitulina* is the most abundant pinniped species in the eastern United States (Manomet Bird Observatory 1987). They prefer sheltered and undisturbed rocky ledge haulout sites of coastal bays and estuaries from Maine south to Plymouth, Massachusetts. They are now only seasonal residents in southern New England south of Maine. The only active breeding population of the gray seal *Halichoerus grypus* in the eastern United States is located southwest of Nantucket Island, away from the proposed disposal sites.

Proposed Site Conditions/Impacts

MBDS has received approximately 300,000 cy of dredge material annually; this material has been of variable quality. As EPA (1993) has pointed out, further deposition of clean parent material from the Project would not cause any adverse effects to the current sediment regimes, but in fact could result in a "cleaner" sediment environment. Only clean materials can be disposed of at MBDS at this time, unless capping can be proven to effectively isolate unacceptable silt material at this depth. The parent material was tested and found suitable under Section 103 of the Marine Research, Protection and Sanctuaries Act for unconfined open water disposal.

A turbidity plume will be created by the disposal of the dredged material. During descent, some of the fine-grained sediment separates from the plume and remains in suspension. The amount of material that is dispersed in the disposal plume is dependent upon the physical characteristics of the sediment, the volume of material disposed, and method of disposal, and typically ranges from 3 to 5% (WES 1986). Results from COE's ADDAMS model, which is used to asses water quality exceedences at the perimeter of a dump site, indicated that the BHNIP should not cause water quality problems at MBDS (EPA 1993); this was based on disposal of even the most contaminated sediments from this project.

Dredged material which settles on the bottom at MBDS can be expected to remain in place. Near bottom currents are low, averaging less than 7 cm/s; the site is considered a depositional area. Resuspension from storm events is rare, typically resulting in resuspension of only 4% of the surficial material. This area has contained dredged material on site and does not disperse sediment or chemicals to affect ambient environments. In general, the proposed disposal of an estimated 2.0 million cubic yards of parent and rock material dredged from the project area will not cause long term adverse impacts to the disposal site given its physical, chemical and biological characteristics and general history of use; in fact, improvement to the sediment environment could occur.

Disposal of dredged (parent) material will have a temporary displacement impact on finfish at the site. These impacts are not expected to be substantial considering the mobile nature of fish. Temporary impacts are expected to come from the temporary loss of benthic species for foraging. Due to the already disturbed nature of the site and the quick recolonizing ability of benthic organisms, impacts should not be substantial. Any changes to the benthic community structure should be localized and not reflected on fisheries resources on a baywide basis.

No substantial impacts are anticipated to wildlife or threatened or endangered species (EPA 1993); these resources are transient under normal conditions. No impacts are expected to site usage or commerce. Also, since there are no regulated wetland resources or historical and archeological resources at MBDS, there will be no impacts relative to these issues.

Historically, disposal of sediments at the site has buried organisms inhabiting the impact area. The frequency of disposal events has maintained a constant state of disturbance that provides suitable habitat primarily for pioneer, opportunistic species. These species tend to occupy and rework the surficial

sediments. Disposal of additional sediments in the same location would keep the benthic community in a pioneering species stage, as long as it continues with some frequency.

### 3.6.2.3 Meisburger 2

Meisburger 2 is one of several potential sand and gravel offshore borrow pit areas that, along with Meisburger 7, has been identified by the EPA as a potential site for the disposal of contaminated materials for the Metro-Boston area (Metcalf and Eddy 1992). The largest part of the sand and gravel represents approximately 140± acres of subtidal area and could possibly contain all 1. 3 million cy of expanded silt material, plus a 3-foot cap. The total volume of sand estimated to be available from this site ranges from 780,000 cy to 4.7 million cy, providing an estimate of the disposal (including cap) capacity. Further surveys may be necessary to locate the specific borrow pit disposal area, as the sand deposits are indicated as ranging from 5 to 30 feet thick. An 86-acre, 13-foot deep disposal site was assumed, providing capacity for silt material and cap. Final design would depend on more detailed site survey data.

This site, centered at 42° 24.7'N and 70° 50.2'W, is located offshore of the proposed dredging sites, and approximately 7.2± miles east of Deer Island (Figure 3-4). Both Meisburger sites are in the general proximity of MWRA's proposed offshore ocean outfall and are within the nearfield monitoring zone for that project. The existing sediment (sand and gravel) would be removed to create a hole in which the silt material from the Inner Harbor would be disposed and capped with parent material. It is anticipated that the sediment removed could be used beneficially for beach nourishment or construction. The sites would be restored to their original bathymetry and physical substrate conditions with native materials from the site.

**Existing Site Conditions**

Based on the (Metcalf & Eddy 1992) report, Meisburger 2 lies in 98 feet of water and is about 4,100 feet long. Sand and gravel deposits at this site have estimated depths of about 5.0± feet, possibly extending to 30± feet deep; a 1-foot silt layer covers the coarse sand and gravel. A minimum of 780,000 cy of deposits and possibly as much as 4.7 million cy were estimated to be at this site, yielding at least the needed capacity for all the silty dredged material if this site is excavated; although there are a few peaks at the edges of the site which rise to 70 feet below MLW, the majority of the depths range from 80 to 105 feet.

The overlying waters at the site are classified as SA by MADEP. These waters have an absence of any well-defined mean current direction other than from storm events. Any discernible currents are tidal.

The dominant and representative benthic species for this site were typically an amphipod/polychaete combination (i.e., *Corophium crassicorne/Exogene hebes*) or a polychaete assemblage dominated by *Spio limicola, Polydora socialis*, and *Mediomastius californiensis*. The former species group was characteristic of the transition area between the soft bottom area and the hard substrate of the Meisburger sites.

Target fish species in the offshore coastal waters and Boston Harbor areas include forage species such as Atlantic menhaden, Atlantic herring and rainbow smelt, and predator species such as yellowtail flounder, winter flounder, striped bass, bluefish, pollock, Atlantic cod, tautog and cunner. The site is used for recreational boat and for commercial fishing. The site is under federal jurisdiction through Section 404 of the Clean Water Act.

Waterfowl, including great cormorant (*Phalacrocorax carbo*), herring gull (*Larus argentatus*), white winged scoter (*Melanitta deglandi*), common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala*



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*albeola*), mallard (*Anas platyrhynchos*), black duck (*Anas rubripes*), merganser (*Mergus* spp.) and scaup (*Aythya* spp.) are likely to intermittently utilize the area for feeding and resting. Each of these species feed on fish and invertebrates (Martin et al. 1951; Whitlatch 1982; and DeGraff and Rudis 1986) that occur in the area.

There are several threatened and endangered species which are documented to occur in the western North Atlantic and portions of Massachusetts Bay. These are presented in Attachment 1, Volume 1 of this EIR/S. There is nothing unique about the Meisburger 2 site that should attract these species beyond an occasional transient passage. There is no evidence indicating any substantial sightings of these species in this area. The ACOE, NED has addressed potential impacts to these species in the Biological Assessment (see Appendix A).

There are no listed historical or archeological resources at Meisburger 2.

Proposed Site Conditions/Impacts

The area proposed for disposal is 155± acres. The dredged sediments placed at the disposal site would be stabilized by a 3-foot cap of clean "parent" sediments. The borrow pit at Meisburger 2 could be filled to pre-existing contour with 490,000 to 6,196,000 cy of dredged material and thus could handle all 1.3 million cy of silt material from the present project. The dredged material will be stabilized by a 3-foot cap of clean sediment.

The cap and the dredged sediments would be confined within the walls of the borrow pit below the level of the sea floor. Therefore, a deposit in a borrow pit would present a low probability for the release of contaminants because it is not in direct contact with the water column or storm energy. To address concerns about the stability and/or grain size of the cap in this area, some of the mined sand and gravel could be saved and deposited as the final cap layer.

There is no well-defined steady current direction at Meisburger 2. Water and particle movements are generated by a variety of actions, including tides, winds, and river flow. During the construction of the pit, it is anticipated that turbidity levels in the immediate construction area will be increased by dredging and materials disposal activities. Use of a mechanical dredge would greatly reduce potential water quality impacts from this operation. The turbidity plume generated would be restricted to a very limited area in the vicinity of the dredge, with 95-99% of the suspension material settling within a few yards (Schubel et al. 1978). Because of the coarseness of the sand removed, resuspension would be minimal.

During the open water disposal operation, suspended solids would be released into the water column. As a result, there would be localized and temporary increases in suspended solids concentrations (and turbidity) in the water column. During this descent anywhere from 3% to 5% of the dredged material may be lost to the water column (WES 1986).

Representative sediment disposal simulations for the Meisburger 2 site, using the ADDAM's Model (Appendix F), indicated only temporary water quality impacts (i.e., below water quality criteria within 4 hours) on disposal activities; less than 5% of enclosed material would remain suspended and be transported outside of the site. Results indicate that risks to marine organisms outside the disposal site should be minimal; this is consistent with EPA's (1993) finding at MBDS, although that site is about twice as deep as the Meisburger site.

During construction and capping, the existing benthic community (amphipod/polychaete combination) will be lost. Upon completion of site activities, a recolonization to the previous benthic community will occur. The nature of the community will depend



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on the final cap make-up and organism response to the substrate.

Disposal operations would have only minor, short-term effects on fish in the vicinity of the borrow pit/disposal site (winter flounder, Atlantic cod and yellowtail flounder). Some mortality of adult fish may occur during construction of the pit and disposal events due to burial or exposure to high suspended sediment levels because they may be attracted to food items suspended during this activity. There will also be displacement of these species from the site construction activities. Impacts would be limited to the immediate vicinity of the site. Pit construction and disposal of dredged material would also temporary reduce prey available to species that feed primarily on benthic invertebrates.

Temporary displacement of Tidal Water resources are expected. Natural recolonization of this resource is expected. Construction of the borrow pit and disposal of dredged material in the borrow pit should have no significant impact on wildlife populations (e.g., birds) occurring at or near the disposal site.

The proposed project should have no significant impact on any species considered threatened or endangered by the USFWS, NMFS or the Massachusetts Natural Heritage and Endangered Species Program (MANHESP), nor on any historical or archeological resources, since none have been recorded at Meisburger 2.

Assuming all of the silt material was disposed of at Meisburger 2, the disposal operations could involve 660 barge trips to remove existing sediments, and 660 trips to transport Harbor sediments to the site. This would result in some delays to commercial and recreational boat traffic using the harbor. This activity would be regulated by the U.S. Coast Guard. Construction activities would have a minor adverse aesthetic impact.

The filling operation at this location will have some effect on fishing and recreational boating interests for the duration of the filling activity. The proximity of the sites to the MWRA's ocean outfall ensures monitoring data available before, during and after placement of material to evaluate any impacts from the filling operation; no permanent impacts are expected.

Use of this location will entail dredging of existing sand and gravel which may be suitable for beach nourishment projects provided it meets grain size, availability and suitability criteria for the specific beach nourishment project. In the alternative the material may be used for other construction purposes.

### 3.6.2.4 Meisburger 7

Meisburger 7 (Figure 3-5) is another of several sand and gravel borrow pit areas that could be developed for dredge material disposal. This site, as well as Meisburger 2, has been identified by the EPA as a potential site for the disposal of contaminated materials for the Metro-Boston area (Metcalf and Eddy 1992). This site, centered at 42° 20.7'N and 70°47.7'W, is located offshore of the proposed dredging sites in approximately 80 to 100 feet of water. It is approximately 8.2± miles east of Deer Island and in the proximity of MWRA's proposed offshore ocean outfall (Figure 3-5). The existing sediment (sand and gravel) would be removed to create a hole (up to 10 feet deep) in which the silt material from the Inner Harbor would be disposed and capped. The sediment removed would be used beneficially for beach nourishment or construction. The sites would be restored to their original bathymetry and physical substrate conditions. The sand and gravel borrow pit at Meisburger 7 could range up to 403 acres and could yield the needed capacity for all the silty material from this project. The Metcalf and Eddy (1992) report indicates that up to 19.5 million cy of sand and gravel may exist at this

site, yielding capacity for future maintenance material as well. The final design of the site would depend on results of site-specific surveys to determine sand depths and preferred locations. The dredged material will be stabilized by a 3-foot cap of clean sediment and a sand layer could be added to that to further stabilize the cover and restore sediment characteristics to existing conditions.

## Existing Site Conditions

The overlying waters at the site are classified as SA by the Massachusetts Department of Environmental Protection (MADEP). These waters have an absence of any well-defined mean current direction; other than storm influence, most discernable currents are tidal.

The dominant and representative benthic species for this site were typically an amphipod/polychaete combination (i.e., *C. crassicorne/E. hebes*) or a polychaete assemblage dominated by *S. limicola, P. socialis*, and *M. californiensis*. The former species group was characteristic of the transition area between the soft bottom area and the hard substrate of the Meisburger sites.

Target fish species in the offshore coastal waters and Boston Harbor areas include forage species such as Atlantic menhaden, Atlantic herring and rainbow smelt, and predator species such as yellowtail flounder, winter flounder, striped bass, bluefish, pollock, Atlantic cod, tautog and cunner. The site is used for recreational boat and for commercial fishing.

Waterfowl, including great cormorant (*P. carbo*), herring gull (*L. argentatus*), white winged scoter (*M. deglandi*), common goldeneye (*B. clangula*), bufflehead (*B. albeola*), mallard (*A. platyrhynchos*), black duck (*A. rubripes*), merganser (*Mergus* spp.) and scaup (*Aythya* spp.) are likely to intermittently utilize the area for feeding and resting. This site is under federal jurisdiction through Section 404 of the Clean Water Act.

There are several threatened and endangered species which are documented to occur in the western North Atlantic and portions of Massachusetts Bay; these are discussed in Attachment 1. There is nothing unique about the Meisburger 7 site that should attract these species beyond an occasional transient passage. There is no evidence indicating major use of this area by these species. A Biological Assessment by ACOE, NED in Appendix A addresses these issues further.

There are no listed historical or archeological resources at Meisburger 7.

## Proposed Site Conditions/Impacts

The cap and the dredged sediments would be confined within the walls of the borrow pit at or below the existing contour level of the sea floor. Therefore, a deposit in a borrow pit would be protected from releasing contaminants. To address concerns about the stability and/or grain size of the cap in this area, some of the mined sand and gravel would be saved and deposited as the final cap layer.

There is no well-defined mean current direction at Meisburger 7. Water and particle movement are generated by a variety of actions, including tides, winds, and river flow. During the construction of the pit, it is anticipated that turbidity levels in the immediate construction area will be increased by dredging and materials disposal activities. Use of a mechanical dredge would greatly reduce potential water quality impacts from this operation. The turbidity plume generated would be restricted to a very limited area in the vicinity of the dredge, with 95-99% of the suspension material settling within a few yards (Schubel et al. 1978). Because of the coarseness of the sand removed, resuspension would be minimal.

During the disposal operation in open water, suspended solids would be released into the water column. As a result, there would be localized and temporary increases in suspended solids concentrations (and turbidity) in the water column. During this descent any where from 3 to 5% of the dredged material may be lost to the water column (WES 1986). Sediment disposal simulations for the Meisburger 7 site using the ADDAM's Model (Appendix F) indicated only temporary water quality impacts ( < 4 hours) during construction and disposal activities; only 5% of disposal material would remain suspended and be transported outside of the site.

During construction and capping, the existing benthic community (amphipod/polychaete combination) will be completely lost. Upon completion of site activities, it is reasonable to assume that a recolonization to the previous benthic community will occur. The nature of the community will depend on the final cap make-up and organism response to the substrate.

Disposal operations would have only minor, short-term effects on fish (winter flounder, Atlantic cod and yellowtail flounder) in the vicinity of the borrow pit/disposal site. Some mortality of adult fish may occur during construction of the pit and disposal events due to burial or exposure to high suspended sediment levels. Therefore, there may be some displacement of these species from construction activities. Impacts would be limited to the immediate vicinity of the site. Pit construction and disposal of dredged material would also temporary reduce prey available to species that feed primarily on benthic invertebrates.

Temporary displacement of Tidal Water resources are expected. Natural recolonization of this resource is expected. Construction of the borrow pit and disposal of dredged material in the borrow pit should have no significant impact on wildlife populations (e.g., birds) occurring near the disposal site.

Water quality disturbances from the proposed project should have no significant impact on any species considered threatened or endangered by the USFWS, NMFS and MANHESP (EPA 1993); the Biological Assessment prepared by ACOE, NED (Appendix A) addresses this further. Significant historical or archeological resources were not identified at the Meisburger 7 site, so no impacts of this nature are expected.

The disposal operations could involve approximately 660 barge trips to remove existing sediment and 660 barge trips to transport Harbor sediments. This would result in some delays to commercial and recreational boat traffic using the harbor. Again, this would be coordinated by the Coast Guard.

The filling operation at these locations will have a minor effect on fishing and recreational boating interests for the duration of the filling activity. Rigorous turbidity controls will minimize these impacts. The proximity of the sites to the MWRA's ocean outfalls should address the question of monitoring before and during placement of material to evaluate any impacts from the filling operation, since the outfall's monitoring program is well in place. After completion of the filling, there will be no permanent impact.

Use of these locations will entail dredging of existing sand and gravel which maybe suitable for beach nourishment projects provided it meets grain size, availability and suitability criteria for the specific beach nourishment project. In the alternative, the material may be used for other construction purposes.

### 3.6.2.5 Spectacle Island (CAD)

Spectacle Island is located on the western edge of the Outer Boston Harbor (Figure 3-6). The nearest neighboring islands are Thompson Island, located 3,000± feet to the west; Long Island, 5,000± feet to

the east; Moon Head, 8,000± feet to the south, and Castle Island, 6,000± feet to the northwest. Approximately 700 feet north of the northern end of Spectacle Island is President Roads, the 45-foot-deep main shipping channel that connects Boston to the open ocean. The island is bounded by a 15-foot-deep channel to the west called Western Way and by Sculpin Ledge Channel (15 to 22 feet deep) to the east and southeast.

An area of between 22 and 50 acres (most likely about 45 acres) being considered for disposal of the contaminated sediments from the Project is located off the east side of the island in the nearshore subtidal region (Figure 3-6). This area is east of that previously affected by the historic landfill on Spectacle Island (CDM 1990). Water depths in this location vary from 4 feet to 15 feet below mean low water (MLW) with an average depth of about 9 feet. The proposed site is located in an area defined by earlier studies (Cortell 1990b) as having cleaner sediments.

Existing Site Conditions

Bulk sediment analyses of sediment borings conducted for CA/T indicate the sediments are made up of fine sands, silts and some clays (Cortell 1990b). Surface and near surface sediments were generally free of contaminants (Category I) under MADEP criteria for the classification of dredge and fill materials (314 CMR 9.00). However, arsenic levels in surficial and deeper sediments were elevated to both Categories II and III levels, respectively.

The waters in the vicinity of Spectacle Island have been classified as Class SB waters. This classification protects saline waters for the propagation of marine life, primary and secondary contact recreation and shellfish harvesting with depuration. Water quality in the outer harbor area has historically been influenced by raw sewage discharges, CSOs, various industrial discharges, urban runoff and the pollutants flowing from the inner harbor system. However, as upgrades to treatment processes are completed, water quality in the harbor should improve.

Circulation is dominated by tidal currents. Waves in the vicinity of the site are primarily storm driven, with breaker heights ranging from 0.09 to 2.6 feet with wave powers of 0.1 to 412.9 ft.-lb/sec.

Benthic resources east of Spectacle Island were dominated by the amphipod *Ampelisia abdita*, and the gastropod *Nassarius trivittatus*. In addition, offshore areas support nereid worms, *Pagarus* sp. (hermit crabs), *Panopeus* sp. (mud crabs) and *Cancer irroratus* (rock crabs). Free-living and early benthic phase lobsters and mussel beds were also very prevalent (Cortell 1990b).

Based on the on-going development of the artificial reef design, as required by the Individual Permit—Landfill Closure and Maintenance at Spectacle Island for CA/T (ACOE no. 199202207; 2/16/93), target fish species in the Spectacle Island area include forage species such as Atlantic menhaden, Atlantic herring and rainbow smelt, and predator species such as winter flounder, striped bass, bluefish, pollack, Atlantic cod, tautog and cunner. The location is currently used by fishermen and recreational boaters.

The Spectacle Island CAD location is considered Land Under the Ocean under the Massachusetts Wetlands Protection Act and Regulations (MGL c.131, s.40, and 310 CMR 10.00) and Tidal Waters under Section 404 of the Federal Clean Water Act. Several species of waterfowl have been observed feeding on fish and invertebrates in the vicinity of Spectacle Island. No federally or state-listed threatened or endangered species occur or are expected in the vicinity of the site. This site does not contain any listed historical or archeological resources.

Proposed Site Conditions/Impacts

Construction of the Spectacle Island CAD would require dredging a disposal pit in the shallow subtidal flat east of the island (Figure 3-6). Silt material from the Inner Harbor would be deposited in the pit and capped with parent material. Sediments of suitable quality dredged from the CAD area could be retained for final capping. The rest of the material "borrowed" would be evaluated for beneficial uses or disposal at MBDS. The site would be restored to its original bathymetry and physical substrate condition. All activities would be beyond the dike being constructed along Spectacle Island and removed enough so as to not affect the integrity of this structure.

The placement and capping of the dredged sediments in the proposed pit will isolate these materials from existing substrates. Construction of the pit, and deposition of the dredged sediments should cause only temporary impacts during the activity. Disposal silt plume modeling (ADDAM's Model) indicates that suspended solids concentrations should be low ( < 30 mg/l) and should quickly decline. The model also predicts about 5% of the suspended material may remain suspended and transported from the site (Attachment 1). The model shows that copper concentrations (the most conservative parameter) in the dredged material should be below the water quality criteria within about 3.8 hours from the time of disposal; at the rate of water movement in Sculpin ledge Channel (approximately 0.6 kn) this should be reached within about 9,000-13,000 feet of the disposal point on flood and ebb tides, respectively (see Attachment 1). The slower currents within the CAD area as well as the structure of the pit itself should help greatly reduce this distance. It is expected that silt curtains, if properly designed, could be employed to help control suspended solids and silt plumes in current areas less than approximately 0.5 knots; such designs might include more rigid controls of the curtains and their extension to or near-bottom. This mitigation approach should help reduce the size and area of influence of the silt plume.

The project activity would cause a direct short-term impact to 20-50± acres classified by the state as Land Under the Ocean and Tidal Waters. Temporary impacts and displacement of the benthic community and area fishing resources would occur. After completion of the disposal and capping, it is reasonable to expect that recolonization and re-population of the benthic and finfish resources should occur.

Construction of the borrow pit and disposal of dredged material in the borrow pit would have no significant impact on wildlife populations, or any species considered threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) or the Massachusetts Natural Heritage and Endangered Species Program (MANHESP), occurring near the disposal site. There are no listed historical or archeological sites at or near the Spectacle Island CAD site.

The disposal operations would involve approximately 660 barge trips while the same number would be required to remove the existing CAD site material to MBDS. This could result in some delays to commercial and recreational boat traffic using the harbor; this traffic would be coordinated by the U.S. Coast Guard. Close coordination with the Lobsterman's Association would be necessary to help minimize barge traffic conflicts with lobster gear in the adjacent channel area. MWRA's Deer Island Project involves the transport of four barges per day in the Harbor, about the same rate expected from the dredging project, and has not experienced problems with this level (Steve Corbett, MWRA, 1993, pers. comm.). Construction activities would have a minor adverse aesthetic impact, and result in slightly elevated noise levels.

Part of the Spectacle Island Landfill Closure Plan for CA/T includes the installation of an artificial fish reef. Due to plans to locate this structure (about one acre footprint) in Sculpin Ledge Channel, special mitigation plans may be necessary during disposal site construction and use to protect this resource, as

well as shellfish (lobster) resources to the north of the Island.

### 3.6.2.6 In-Channel Sites

These sites include the Chelsea Creek, Inner Confluence and Mystic River In-Channel disposal scenarios. The In-Channel disposal scenario assumes that the silt material will be dredged from each channel and placed on a barge, while a deeper trench will then be dug in the channel (parent material); the silt would then be placed within the trench and capped with some parent material. Excess parent material removed from the trench would be disposed at MBDS. Each channel/tributary would then contain its own capped silt material. The environmental resources impacted for this disposal alternative are the same as for the dredging site.

Benefits from this alternative include keeping the silt material within the channel of origin, thus reducing the amount of silt exposed to biological resources elsewhere and keeping transportation costs, vessel traffic disturbances and socio-economic impact to a minimum.

#### Proposed Conditions/Impacts

General site conditions would be the same as described for each channel/tributary. Essentially, once dredging is complete, the site will be left at the proposed project depth.

The proposed disposal sites occur in tributaries currently used by ship traffic. The U.S. Coast Guard would need to coordinate between ships needing to use the tributary and disposal activities. However, since material would essentially be disposed in the same place it is dredged, only barges for temporary storage and those required to dispose of excess parent material would have to be dealt with; major barge movement within the harbor should not be necessary.

The characteristics of the underlying sediments in the channels have been described in Section 2.2 of the DEIR/S as clean parent material. Bulk sediment analysis indicated that no parameter exceeded Category I limits. The channel would be filled with silt and capped with parent material. The remaining parent material would be disposed at the MBDS or other suitable site. Since the channels are currently covered with silt material, returning the silt to its place of origin and capping it with parent material would provide an environmental benefit.

The disposal site would end up, as proposed, 3.0 to 5.0 feet deeper than the channel's current authorized depth. The area would of course remain subtidal; the substrate would change from a silt material to a clay or gravel material. The benthic community may change as a result of this sediment change but should be "healthier" because the availability of contaminants for bioaccumulation will be reduced, at least until future siltation occurs. No federally or state-listed threatened or endangered species are expected to be at risk from this activity in the channel and tributaries.

Each of the channels falls within the Designated Port Areas of Boston Harbor (e.g., Mystic River, Chelsea Creek, East Boston and South Boston designations) under State jurisdiction (310 CMR 10.00) and within Tidal Water jurisdiction under Section 404 of the Federal Clean Water Act. Since these proposed disposal sites are part of the overall maintenance dredging operation, their construction will not impact these regulated resources beyond the impacts of the dredging itself, other than from increased silt plumes during disposal. ADDAM's model results indicate that these plumes should not directly impact economically important fish and shellfish resources. Any impacts would be temporary and, upon capping and project completion, the resources should restore themselves to natural conditions. Newly-exposed

substrate and clean capping materials will provide better substrate conditions for benthic community development in the near-term.

This disposal alternative should have no effect upon any structure of historic or archeological significance as defined by the Massachusetts Historical Commission (MHC) or the National Historic Preservation Act of 1966, as amended.

### 3.6.2.7 Little Mystic Channel

The Little Mystic Channel, which is a small inlet off the Main Ship Channel in Charlestown (Figure 3-7), is proposed as a disposal site for silt materials. The Little Mystic Channel could be filled to 3 to 6 feet below MLW with 233,000 to 303,000 cy of dredged material. The dredged material would then be stabilized by a 3-foot cap of clean sediment. The site would be maintained as a shallow subtidal area, providing suitable habitat for marine benthic organisms and other biological resources that utilize this habitat in Boston Harbor.

The Little Mystic Channel is 150 feet wide and extends from the Main Ship Channel. This minor tributary channel was originally a tidal channel draining the Mystic flats at the mouth of the Mystic River in Charlestown. The filling of the Mystic flats by the Commonwealth in the 1860's closed off the upper end of the Channel. The Mystic-Tobin Bridge crosses the Little Mystic Channel. A number of land-based terminals (overland shipping) and a condominium complex were constructed on the filled tidelands. Only the northern banks of the Little Mystic Channel lie in the Mystic River Designated Port Area (DPA). This site is approximately 15.0 acres. The water depth in the Mystic Channel ranges from approximately 3 to 31 feet below lower MLW.

#### Existing Site Conditions

A vertical granite wall surrounds the north and south side of the site. On the west side there is a sloping rip-rap embankment for approximately 100 feet. A metal bulkhead approximately 50 feet in length is located about 50 feet from the Mystic-Tobin Bridge. Close to this is a pile of debris (bricks and scrap metal). On the north side of the site, five storm drainage pipes (possibly inactive) and one active drainage pipe were observed. There is one CSO, the Chelsea Street Extension outfall, which discharges directly to the Little Mystic Channel along the south shore. At the eastern end, the mouth of the site is restricted by concrete bridge pilings. The distance between the bridge and the water at high tide, is small based upon the water mark on the bridge piling. There are some submerged logs and a submerged boat in the middle of the channel. There is a sandy/gravel beach on the south side, and the rock ledge beach on the north side of the site.

Observed representative sediment textures were predominantly fine-grained silt-clay. Bulk sediment analyses showed arsenic, cadmium, chromium, copper, lead, mercury, and zinc at Category II and III levels (314 CMR 9.00). Total PAHs, TPHs and PCBs were present at elevated concentrations.

The water quality of the Little Mystic Channel is influenced by tidal exchange and the six discharge pipes that were observed on the north side of the site and a CSO. These storm drainage pipes add an unknown level of pollutants, along with their runoff water, into the Channel. The Little Mystic Channel is classified as SC water by the MADEP. The currents in Little Mystic Channel are primarily tidally driven.

Available dissolved oxygen levels diminish within Boston Harbor and cause a corresponding depression in biological activity at the sediment-water interface. This is commonly referred to as the "August Effect" and hereafter will be cited as such. Salinity data



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collected in April 1993 ranged from 16.8 to 28.9% at low tide, indicating the influence of freshwater inputs. Little Mystic Channel flows directly into the Main Ship Channel, but the Mystic-Tobin Bridge pilings slow and deflect currents and contribute to sedimentation in the vicinity of the pilings.

The intertidal habitats within the Mystic Channel vary and include: vertical granite walls on the north and south sides, sloping rip-rap embankment on the west side, wooden bridge pilings on the east side, submerged logs and boat on the north side, a metal bulkhead approximately 50 feet from the bridge, a sandy/gravel beach on the south side, and a rock ledge beach on the north side. *Fucus* sp., green algae, and some mussels are the dominant fouling biota.

Composition of the benthic infauna (see Attachment 1) generally includes oligochaetes as the dominant taxa supported by *Caullereilla* sp., *Strebolospio benedicti*, and nematoda. Although there were no data from this site, the dominant finfish species recorded in the Main Ship Channel include flounder (*Pleuronectes americanus*), rainbow smelt (*Osmerus mordax*), and alewife (*Alosa pseudoharengus*) (ACOE, NED 1988). There probably is movement of at least some of these species in and out of the Little Mystic Channel.

Little Mystic Channel is located within the Mystic River DPA (310 CMR 10.00). The site is primarily Land Under the Ocean, under Massachusetts Wetlands Protection regulations, and is considered to be significant to marine fisheries, storm damage prevention and flood control. The vertical granite wall on the north and south side, together with the sloping rip-rap embayment on the west of the site, were all structures designed for storm damage prevention and flood control. Anadromous fish are known to traverse the Main Ship Channel; there may be some movement into the Little Mystic Channel but it is not a destination. The entire site is classified as Tidal Waters under federal Section 404 regulations.

Little Mystic Channel may provide feeding habitat for several waterfowl and diving feeders (e.g., mallards, cormorants and terns). Abandoned piers also provide roosting sites for gulls and terns. No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity, and there are no listed historical or archeological resources at the Little Mystic Channel site.

This little-used channel in Charlestown is surrounded by a mixture of land uses including residential, recreational and maritime-industrial. The channel provides a visual buffer between the residences to the south and the marine terminal to the north. A public boat ramp is located on the north side of the channel. However, this ramp has not received the use anticipated when it was installed in the early 1970s. Marine access to this site is constrained by the 12 foot vertical clearance under the Little Mystic Channel Crossing at the mouth of the channel.

**Proposed Site Conditions/Impacts**

Sediments in the Little Mystic Channel contain moderate to high levels of certain chemicals. PCBs, arsenic,lead and zinc were found at Category III levels. The dredged sediments proposed for placement at this disposal site would be stabilized by a 3 foot cap of clean sediment. Therefore, although this alternative would decrease the water depth (and volume) in the channel, it would have the beneficial affect of providing 15 acres of new, clean sediment habitat.

The Little Mystic Channel can be characterized as a low energy environment suitable for dredged material disposal and containment. The average current velocity at this site is approximately 0.5 knots. During disposal operations, suspended solids would be released into the Little Mystic Channel waters. Because of these potential impacts, use of a silt curtain at this site to trap most of the suspended sediment would likely be necessary to maintain water



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quality standards during construction. Localized and temporary impacts are anticipated from the suspended solids and chemical concentrations on the water quality within the site. Most of the chemical constituents are tied up with the sediment.

In the intertidal zone, there would be temporary reduction in *Fucus* sp., green algae, and barnacle production on the hard substrate and on the small gravel/sandy beach present at the site. Benthic invertebrates in the Little Mystic Channel would be buried during disposal operations. There would be a temporary loss of 15.0± acres of soft substrate. Dredged material placed at the site would quickly be re-colonized with resident taxa (i.e., likely to be *S. benedicti*, oligochaetes, and other common species) occurring in the harbor sediments. The resulting community is expected to be similar to that presently existing in the Little Mystic Channel subtidal areas. However, since the cap material would be clean, a more diverse population should occur.

Siltation caused by disposal operations would probably have some short-term adverse impacts on invertebrates occurring in the immediate adjacent areas. However long-term impact on invertebrate communities in the shallow subtidal area of the Little Mystic Channel are not expected to be measurable.

Disposal operations would have some impact on fish utilizing the disposal site. Some mortality of fish eggs, larvae, and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Impacts will be limited to the immediate vicinity of the disposal site. Disposal of dredged material would temporarily reduce prey available to species that feed primarily on benthic invertebrates, such as winter flounder.

There would be a short-term impact on 15.0± acres classified as Tidal Waters and Land Under the Ocean in a DPA at this site. The site would be restored after construction and maintained as a shallow subtidal area. However, disposal of dredged material in Little Mystic Channel should not adversely impact wildlife populations occurring near the disposal site. No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of Little Mystic Channel.

The proposed project would have no effect upon any structure or site of historical, architectural or archeological significance as defined by MHC the National Historic Preservation Act of 1966, as amended.

The disposal operations would involve approximately 170-220 barge trips to the Mystic Pier. This would result in some minor delays to commercial and recreational boat traffic using the harbor which would be controlled by the U.S.C.G. Alternatively, approximately 11,700-15,200 truck trips would be involved in transporting the dredged material. There would be some impact of noise and traffic from truck trips between the Mystic Pier and Little Mystic Channel. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels.

While the most direct effect of partial filling of the channel would seem to be compromising the boat dock facility, this dock has not been used for its intended purpose so this is viewed as a minor impact.

### 3.6.2.8 Reserved Channel

Both project areas are depicted on Figure 3-8, and can be characterized as follows:

Area A—This area is located at the mouth of the inlet on the inner side of the bridge (away from open water). A floating dock and the yacht club are located in this portion of the site. The passage under the Summer Street Bridge is 40 feet in width. Northwest of the bridge is a vertical granite wall approximately 50 feet in length. Continuing west-northwest, the granite wall is replaced by a metal bulkhead. On the far north-

western end of the bulkhead are some abandoned wood pilings and an old floating dock. On the southwestern side of the site from the bridge is a sloping rip-rap embankment for approximately 50 feet. From this rip-rap toward the neck are discarded concrete slabs and trash material. West of the trash material are wooden pilings and behind the pilings is a vertical granite wall.

Area B—This portion of the site extends from the neck on the northwest toward the tip of the peninsula. A steel bulkhead extends for approximately 75 feet. Continuing along the western tip and along the southwestern side of the inlet is a sloping rip-rap embankment. Between the bulkhead and the rip-rap is a pile of rubble. On the southwestern side toward the neck the rip-rap is replaced by a granite wall, which is fronted by a rocky beach. In front of the rocky beach are one or two sunken boats and some abandoned pilings. In the middle of the tidal area is a floating lobster pot dock.

Both Areas A and B are not a part of the DPA. Areas A and B are approximately 8.9 and 7.7 acres, respectively. The water depth in Area A ranges from 6 to 12 feet, and in Area B from 0 to 16 feet below mean lower low water.

## Existing Site Conditions

Benthic samples collected at the Reserved Channel contained odorless, gray-black clay/silt sediment. No chemical analyses were performed on these sediments, but Station 3 of the Boston Edison Intake was located approximately 1000 feet from the Reserved Channel Area B. This station had a 66.2% silt-clay component and indicated PCB at Category III levels. Fluoranthene, ideno(1,2,3-cd)pyrene, and pyrene contributed more than 50% to the total elevated PAHs concentrations. Cadmium, Lead, and Nickel were found at Category II at this station. Total organic carbon was 13%, the second-highest value of all the sites analyzed for TOC. This indicates that the potential for bioaccumulation at the Reserved Channel Area B may be lower than other sites in the Boston Harbor. The total petroleum hydrocarbon at this station was 4270 ppm.

The COE conducted chemical sampling during 1986 at four stations in the Reserved Channel. One station (A) was located in the western end of the Reserved Channel close to Area B where a 18-23 cm core section was analyzed. It had a 18.2 cm layer of black organic clay. This upper organic clay consisted of 93% fine grain material with a moderate chemical oxygen demand (79,000 ppm). Lead was the only chemical constituent present at Category III concentrations (221 ppm). Mercury (1.48 ppm), zinc (264 ppm), chromium (186 ppm), and nickel (58 ppm) were detected at Category II. PCB samples were also collected at eight stations in November 1982, from the Reserved Channel west of Summer Street Bridge within Area A. PCB concentrations at all eight stations occurred at Category III and, ranged from 1.0-34.5 ppm.

The water quality of the Reserved Channel is influenced by the three combined sewerage overflows (CSO) observed approximately 700 feet northwest of Pappas Street, at Summer Street, and at I street. These CSOs can add urban runoff pollutants (e.g., PAHs, nutrients, detergents, bacteria, etc.) into the Channel. Boston Edison Intake has a NPDES discharge pipe in the vicinity of Summer Street, which may impact water quality by increasing temperature in the Reserved Channel.

The Reserved Channel flows directly into the Main Ship Channel. The Summer Street bridge pilings slow and deflect currents and contribute to some sedimentation in the vicinity of the pilings.

The Reserved Channel is classified as SC Water by the MADEP. In both Areas A and B, dissolved oxygen readings collected in April ranged from 8.4-8.7 ppm and 6.8-8.9 ppm respectively. In August,

available dissolved oxygen levels diminish and cause a corresponding depression in biological activity at the sediment water interface. Salinity data collected in April 1993, ranged from 27.0-31.2 ppt at Area A and 23.4-33.4 ppt at Area B during low tide, indicating the influence of freshwater inputs.

The intertidal habitats within the Reserved Channel include:

Area A:- The wooden bridge pilings and floating dock at the yacht club were sparsely covered with green algae. Vertical granite walls were covered with approximately 20% of algae. Metal bulkheads were covered with green algae and barnacles. A sloping rip-rap was covered with *Fucus* sp., barnacles, *Littorina*, and green algae. A concrete slab and trash material had no visible growth.

Area B:- A steel bulkhead was approximately 90% covered with barnacles. The sloping rip-rap embankments were moderately covered with *Fucus sp.*, *Enteromorpha* sp. and other green algae. A granite wall had moderate growth of *Fucus* sp., *Ulva* sp., and barnacles. Rocky beach areas in front of the granite wall were sparsely covered with *Littorina*, *Fucus* sp., and green algae.

Benthic infauna in the Reserved Channel are dominated by Oligochaeta, *S. benedicti*, *C. insidiosum* and Nematoda. The dominant finfish species in the Main Ship Channel (about one mile from Area A) have been recorded as winter flounder (*P. americanus*), rainbow smelt (*O. mordax*), and alewife (*Alosa pseudoharengus*). There may be movement of these species into the Reserved Channel; the Reserved Channel may provide spawning habitat for winter flounder.

Areas A and B of the Reserved Channel are not located within a DPA (310 CMR 10.00). The site is primarily Land Under the Ocean under State regulations (310 CMR 10.00), and is considered to be significant to the protection of marine fisheries. Nearshore areas of Land Under the Ocean such as Areas A and B are likely to be significant to storm damage prevention and flood control. The entire site is classified as Tidal Waters under federal Section 404 regulations. The fined-grained sediment and contaminant levels of the samples analyzed indicate that this site has the potential for sediment/toxicant affinity and nutrient retention.

The Reserved Channel may provide feeding habitat for several waterfowl and diving feeders (e.g., mallards, comorants and terns). Abandoned piers and pilings also provide roosting sites for gulls and terns. No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Reserved Channel. Also, there are no listed historical or archeological resources in the Reserved Channel site.

This channel is generally surrounded by industrial and office uses in South Boston. There is a sewer outfall at the southerly end of the Channel which would require relocation if this area were to be filled. There is a yacht club immediately adjacent to the Summer Street Bridge, and a passive water viewing area has been created for the general public to use on the west side of the channel.

While the South Boston peninsula was settled early in Boston's history, much of the land area between the subject site and Boston Harbor was created by filling the tidal flats. The filled land supported maritime shipping and railroad terminal uses. Marine access to this site is restricted by the 6.0± feet vertical clearance at high tide at the Summer Street Bridge.

## Proposed Site Conditions/Impacts

The silt sediments proposed to be placed at each area would be stabilized by a 3-foot cap of clean sediment. Since this site already has elevated chemical levels, covering it with clean dredged materi-

al would have a beneficial effect on the existing sediment quality, reducing the likelihood of disseminating contaminants into the water column and harmful bioaccumulation. Use of the Reserved Channel areas for disposal will require construction of a steel bulkhead fronting the water edge. The cost for the bulkhead, in addition to other costs, requires that disposal capacity at the site offsets the cost of development. Area A does not provide substantial capacity (only 14,000) cy to offset the cost. Therefore, only Area B is potentially practicable.

Both areas of the Reserved Channel can be characterized as a low energy environment suitable for dredged material disposal and containment. During disposal operations, suspended solids would be released into the Reserved Channel waters. As a result, there would be localized and temporary increases in suspended solids and attendant chemical concentrations in the water column. The use of a silt curtain would help trap and contain most of these suspended sediments.

There would likely be some temporary impacts on intertidal resources, including reductions in green algae, barnacles, *Fucus* sp., barnacles and *Littorina* sp. production in both areas. The small rocky beach in front of the granite wall on the southwestern side of the site would be temporarily impacted.

Benthic invertebrates in Area A of the Reserved Channel would be buried during disposal operations. There would be a temporary loss of 8.9± acres of soft substrate. Dredged material placed at the site should quickly be colonized by local taxa, including *S. benedicti*, oligochaetes, and other common species occurring in the harbor sediments. Benthic invertebrates in Area B of the Reserved Channel would be buried during disposal operations. There would be a permanent loss of 7.7± acres of soft substrate.

Siltation caused by disposal operations may have some short-term adverse impacts on invertebrates occurring in adjacent subtidal and intertidal areas. Area A would recolonize to a similar or better habitat. Area B will experience a change from subtidal habitat to salt marsh.

Some displacement and/or mortality of adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Impacts should be limited to the immediate vicinity of the disposal site. Disposal of dredged material in Area A would temporarily reduce prey available to species which feed primarily on benthic invertebrates, such as winter flounder. In Area B there would be permanent replacement of subtidal finfish refuge and foraging habitat with intertidal.

There would be a short-term impact on the areas classified as Tidal Waters and Land Under the Ocean at Area A (8.9 acres). The site would be restored after construction and maintained as a shallow subtidal area. However, in Area B, there would be a permanent loss of Land Under the Ocean and Tidal Waters, but the 7.7 acres loss would be replaced with intertidal habitat.

Disposal of dredged material in Areas A and B should not adversely impact wildlife populations occurring near the disposal site. Converting Area B into a salt marsh would in fact provide new habitat for various wildlife species. No federally or state-listed threatened or endangered species are expected to occur within the vicinity of either area.

The proposed project would have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

The disposal operations would involve approximately 140 barge trips to the North Jetty, resulting in some minor delays to commercial and recreational boat traffic using the harbor. There would also be some impact of noise and traffic from the estimated

9800 truck trips between North Jetty and the disposal areas.

The impacts of disposal at this location should be limited to water dependent uses in the Channel. Depending on the extent of fill material placed in this portion of the channel, the yacht club operation could be affected. If there is only partial fill, odor from this "backwater" could also be problematic for yacht club patrons if disposal occurs during the prime use period.

### 3.6.2.9 Amstar

Amstar is an industrial site containing approximately 20 acres in Charlestown (Figure 3-9). It is currently available for sale, although there are several industrial tenants. One tenant runs a sand and gravel operation and uses the dock for material transfer. The site is in the City's Maritime Economy Reserve Zone which is geared to water dependent activities. It is surrounded by industrial uses to the east and west. Across Medford Street from the site are residences and a park.

This site can be filled with 128,000 cy of dredged material and capped to MLW. The silt sediments placed at the disposal site would be stabilized by a retaining wall and 3 foot cap of clean sediment. The elevation after filling would be equal to the adjacent land. Sediment samples collected in close proximity to this site indicated that the sediments within the site are likely to be moderately to highly contaminated. The existing poor sediment quality will be isolated by capping and bulkheading, reducing the potential of disseminating contaminants into the water column and of bioaccumulation.

#### Existing Site Conditions

There are three types of intertidal habitat that occur at the Amstar site. Pilings and vertical seawalls along the eastern side provide hard substrate that has been colonized by barnacles, mussels and green algae. Beneath the ramp to the floating dock is a small, gently sloping gravel-cobble beach. The cobble support green algae. The rest of the south boundary is a rip-rap slope comprised of boulders that are heavily covered with *Fucus* sp. There is a little *Fucus* sp. on the western rip-rap slope except at the mouth of the site. Along the western boundary barnacles and periwinkles (*Littorina* sp.) were numerous; green algae was present above and below the barnacle zone.

Amstar is located within the Mystic River Designated Port Area (DPA) (310 CMR 10.00). The site is primarily Land Under the Ocean, under Massachusetts wetlands regulations, and is considered to be significant to marine fisheries, storm damage prevention and flood control. The Amstar site may provide both refuge (from predators and currents) to many fish species and feeding opportunities (primarily demersal species). It is unlikely to provide important spawning habitat.

Benthic samples collected at Amstar contained odorless, grey silty sediments. No chemical analyses were performed on sediments from the Amstar site, but Station 3 from the Revere Sugar berth was located approximately 300 feet from the mouth of the site and is assumed to be representative of on-site conditions (see EIR/S Section 2.2). That station had a 73% silt-clay component (Category III). Chromium, copper and nickel all occurred at Category II levels; arsenic, lead, zinc and PCBs were Category III concentrations. Total PAHs were among the highest (46.41 ppm) observed during the 1992 berth area sampling. Benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene and pyrene each contributed more than 5 ppm to the total concentration. Total petroleum hydrocarbons were 3,540 ppm. Total

organic carbon was 6.6%, among the higher values observed during the berth sampling, suggesting that potential for bioaccumulation of contaminants is lower at Amstar than other sites in Boston Harbor. Zinc and PAH uptake may be exceptions to this generalization, as these constituents were found at higher levels at Revere Sugar Station 3 than at other berths.

There are no listed historical and archeological resources on or within 1,000 feet of the Amstar site.

Proposed Site Conditions/Impacts

Filling of the Amstar site would result in a conversion of approximately 3.5 acres of wetland resources (Land Under the Ocean and Tidal Waters) to intertidal habitat.

In the present intertidal zone, there would be a permanent loss in production from barnacles, mussels and green algae on the hard substrate (pilings, vertical seawalls and rip-rap) present at the site. The construction of a retaining wall across the pier opening would replace some of that habitat. The small gravel-cobble beach beneath the ramp would also be lost.

Benthic invertebrates at the Amstar site will be permanently buried and displaced from disposal operations. Nematodes, the polychaete *P. cornuta* and oligochaetes were typically abundant harbor-wide and were the abundant species at this site. The dredged material placed at the site would fill the site to the adjacent land elevation.

Disposal operations would impact fish utilization of this site. Some displacement and/or mortality of adult fish would occur during disposal events due to burial or exposure to high suspended sediments levels. Anadromous river herring could no longer use this area for refuge. Subtidal regions would not be available to provide food resources for demersal browsers. Most fish species could avoid the area of disposal, but there would be permanent loss of finfish refuge and foraging habitat.

The average current velocity at this site is less than 0.5 knots. During disposal operations suspended solids could be released into the Mystic River waters resulting in localized and temporary increases in suspended solids concentrations in the water column. Therefore, the use of a silt curtain at this site would be appropriate to trap most of the suspended sediment. Disposal activity will occur for a 6- to 9-month period; if properly controlled effects from the suspended solids concentrations on the water quality in the vicinity of the site should be minimized. A sedimentation basin or a settling pond may be necessary to mitigate water quality impacts. There would be no degradation of the Class SC waters.

The disposal operations would involve approximately 130 barge trips to Amstar. The Coast Guard would have to coordinate any minor delays to commercial and recreational boat traffic using the harbor. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels.

Adjacent to the Amstar site is Revere Sugar which has an active water transportation facility. Any filling at the Amstar property would require a bulkhead to contain material so as to prevent any effect on the dock at Revere Sugar. Partial filling of the property would restrict ship to shore transfer of people or freight including the current sand and gravel operation. However, it would not restrict marine-related storage of material. Since placement of material would occur from the water, there will be no impact on adjacent streets caused by truck traffic delivering material to the site.

### 3.6.2.10 Mystic Piers

The inlet between the Mystic Pier No. 1 and Pier 49 is no longer used for cargo handling at Massport's Moran Terminal in Charlestown. Charlestown is a neighborhood within the City of Boston. Recreational vessels docking here in the late 1970s were removed to accommodate shipping activity. The recreational docking has not been reinstated even though the port-related shipping activity ceased to operate in the inlet. There are no residential areas abutting this property. The closest residential neighbors are across the Little Mystic Channel in the Charles Newtowne complex and in the former Navy Yard.

This site could be filled with 98,000 cy of dredged material and capped at MLW (Figure 3-10). The silt sediments placed at the disposal site would be stabilized by a retaining wall and a 3 foot cap of clean sediment. Sediment samples collected in close proximity to this site indicated that the sediments within the pier are likely to have moderate to high levels of metals and organics (see Section 2.2 of the EIR/S). The existing poor sediment quality would be covered by capping, eliminating the potential for further dissemination of existing contaminants into the water column and for further bioaccumulation.

#### Existing Site Conditions

Like all of Boston Inner Harbor, the Mystic Piers site is a depositional environment (EG&G 1984), accumulating fine grained sediments (silts and clays). Sediment sampling along the harbor-face of Massport's Mystic Piers 1 (Station 1), 49 and 50 (Stations 1 and 2), adjacent to the proposed disposal site, revealed that the silt-clay component was 41-78%, averaging 60% (see EIR/S Section 2.2). Benthic grabs collected within the proposed disposal area contained predominantly silty sediments, although gravel was present in one sample.

No within-berth data were available for assessing sediment quality. However, all stations sampled to characterize berth-area dredged materials were within approximately 400 feet of the mouth of the proposed Mystic Pier disposal site and may be indicative of sediment quality. Assuming these data reflect conditions within the Mystic Pier site, the sediments are likely to contain moderate to high levels of metals and organics. Arsenic, chromium, copper and mercury likely occur in Category II levels; lead and zinc likely occur in Category III levels. Total PAHs concentrations are likely to be high ( > 10 ppm), with fluoranthene and benzo(g,h,i)perylene contributing the highest concentrations. Total organic carbon is likely to be 2-3% of dry weight, indicating a relatively high potential for bioaccumulation of contaminants.

The site was visited during low tide on April 28, 1993, to evaluate habitat conditions. The intertidal zone is restricted to the tidal excursion vertically along the walls and pilings surrounding the Mystic Piers site, except in the southwest corner where rubble has accumulated in sufficient quantity to be exposed at low tide. Intertidal portions of the western and northern walls are covered extensively with algae (primarily *Fucus* sp. with some *Spongomorpha* sp.). The pilings along the southern perimeter were heavily covered with barnacles, blue mussels (*Mytilus edulis*) and green algae (*Spongomorpha* sp.) with algal cover increasing with distance from the mouth. Diatoms were present on the algae and rubble. Mussels and macroalgae both provide habitat for other organisms. These communities may be exploited for food or shelter by crustaceans and finfish.

Two areas were sampled (in April 1993) for benthic infauna. One station, adjacent to the pilings, was nearly azooic (two taxa totalling 86 individuals/$m^2$. The second station, near the head of the site, contained 17,759 individuals/$m^2$ (11 taxa) of which 11,954/$m^2$ were nematodes. The total abundance at the second station was in the range observed by the

Corps in the Chelsea Creek and Confluence Area in 1986. However, the channel stations were dominated by polychaetes (> 70%) while the Mystic Pier station was dominated by nematodes (67%). *Capitella capitata* and oligochaetes comprised 85% of the remaining organisms. These predominant taxa are classified as pioneer taxa. Nematodes are early settlers in organically enriched sediments whose presence stimulates microbial degradation of organics (Tietjen 1982). Oligochaetes and *C. capitata* are typically associated with organically enriched, stressed environments. Its reproductive strategy enables *C. capitata* to colonize disturbed sediments rapidly. No amphipods or live mollusks were collected. The moderate abundance of infauna (17,759/$m^2$ in at least a portion of the site contributes to the productivity of Boston Harbor and these near-surface dwelling organisms are available as prey items for crabs and demersally feeding fish. Winter flounder (*Pleuronectes americanus*) have been documented as feeding on *C. capitata* in Boston Harbor (Haedrich and Haedrich 1974; NAI 1985), although their preferred prey includes amphipods and large worms.

Finfish were not sampled in this site. It is likely that most species that reside in or migrate through Boston Inner Harbor could enter this area. The pilings and wharf, shading the area below, offer shelter from predators. The orientation of the site perpendicular to the main channel provides shelter from currents. Both subtidal and intertidal benthic resources provide prey items. Soft substrate could support feeding by demersal species (e.g., winter flounder). Fish such as cunner (*Tautogolabrus adspersus*), tomcod (*Microgadus tomcod*) and sculpins (*Myoxocephalus* spp.) could feed on the fouling community on the walls and pilings (Edwards et al. 1982; Menge 1982; Ojeda and Dearborn 1990). Two species of particular concern are alewife (*Alosa psuedoharengus*) and winter flounder. The anadromous alewife spawns above the head of tide of the Mystic River so reproductive adults migrate upriver past the Mystic Piers site between April and May (Whitlatch 1982). Adults descend the river during the summer, juveniles swim downriver past the site from late summer-fall (Loesch 1987). Another anadromous species, rainbow smelt, may also use this portion of the Harbor. Winter flounder is one of the most abundant species in Boston Harbor where it is considered to be a resident. It prefers to spawn on sand common in the outer harbor (Bigelow and Schroeder 1953). Site-specific data for winter flounder were not available.

Under the jurisdiction of the Massachusetts Wetlands Protection Act (MGL c.131, s.40 and 310 CMR 10.00) the Mystic Piers site is a Designated Port Area (DPA). DPAs are almost completely developed areas where few or no natural land forms or vegetation remain. They tend to be paved, bulkheaded, and used for heavy industry so that they have virtually no significance to the interests of the Act, except for Land Under the Ocean. Land Under the Ocean in DPAs are significant to flood control, storm damage prevention, and the protection of marine fisheries, as is Land Under the Ocean outside of DPAs. The major addition is that Land Under the Ocean in designated port areas also provides support for coastal engineering structures, such as bulkheads, seawalls, revetments, and solid fill piers. As Land Under the Ocean, the site is potentially important to marine fisheries, storm damage prevention and flood control. Land Under the Ocean within the Mystic Pier provides food resources and shelter; however, the silty substrate is not preferred spawning habitat for winter flounder, nor are the saline conditions conducive to spawning of the anadromous alewife. Storm damage protection and flood control are provided by the vertical granite wall surrounding the perimeter of the site.

Under federal wetlands guidelines, the entire Mystic Piers site is defined as tidal water. The fine-grained character of sediments at the site, as well as proximity to identified contaminants, suggest that the potential for retention of sediments, toxicants and nutrients exists. Abundance and diversity of the benthic fauna varied substantially in the site. Com-

pared to other locations in the harbor, Mystic Piers exhibited moderate potential for supporting higher trophic levels. Construction activities could be more sensitive at this site due to its proximity to an anadromous fish run (in the Mystic River).

No federally or state-listed threatened or endangered species are identified or anticipated to occur within the boundaries of the Mystic Piers site (Lincoln 1993). Although common terns have been observed nesting within Boston Harbor, no evidence of nesting was present at the Mystic Piers site on April 28, 1993.

There are no listed historical or archaeological resources at the Mystic Piers site.

**Proposed Site Conditions/Impacts**

There would be a conversion of 2.7 acres of Land Under the Ocean in a DPA and Tidal Waters at this site to intertidal habitat.

In the present intertidal zone there would be a permanent loss in macroalgae, barnacles, and blue mussel production on the hard substrate (vertical seawalls and pilings) present at the site. The construction of a retaining wall across the pier opening would replace some of that habitat.

Benthic invertebrates at the Mystic Piers site would be buried during disposal operations. The overall high abundance of infauna in at least a portion of the site contributes to the productivity of Boston Harbor and these near-surface dwelling organisms are available as prey items for crab and demersally feeding fish. The dredged material placed at the site would fill the site to the adjacent land elevation.

Disposal operations would have some impact on fish at the disposal site. Some displacement and/or mortality of fish eggs, larvae, and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Finfish are likely to use the site for shelter from currents and predators and for feeding. The anadromous alewife spawns at the head of tide in the Mystic River, so reproductive adults migrate upriver past the Mystic Piers site between April and May. Adults descend the river during summer. Winter flounder could spawn in the close proximity to this site from March to September but prefers to spawn on sand common in the outer harbor. Seasonal disposal restrictions would be enforced at this site during migration and spawning of species of concern. Most fish species would avoid the area during disposal and thus be displaced; there would be permanent loss of finfish refuge and foraging habitat.

The average current velocity at this site is less than 0.5 knots. In general, water circulation at the Mystic Pier site is driven by tidal cycles and influenced by seasonal weather patterns. This should not be affected by filling of a relatively limited area of existing tideland. During disposal operations, suspended solids would be released into the Boston Harbor waters. As a result, there would be localized and temporary increases in suspended solids concentrations in the water column as discussed below. The use of a dragline at this site would also contribute to a higher amount of suspended sediment at this site; however, the use of a silt curtain would trap most of the suspended sediment. Disposal activity would occur for a 6- to 9-month period and if controlled there would be only temporary impacts of the suspended solids concentrations on the water quality in the vicinity of the site.

The effects of disposal on the Boston Harbor water column chemistry are likely to be minor; mitigative measures (silt curtains, etc.) would minimize release of sediment contaminants into the water column. There would be no degradation of the Class SC waters.

### 3.6.2.11 Revere Sugar

Revere Sugar, a site containing 6.5 acres in Charlestown, is currently under lease from Massport by the MWRA which has constructed a water transportation facility for the ferrying of construction personnel to Deer Island (Figure 3-11).

This site could be filled with 85,000 cy of dredged and capped to MLW. The silt sediments placed at the disposal site would be stabilized by a retaining wall and a 3 foot cap of clean sediment. Sediment samples collected in close proximity to this site indicated that the sediments are likely to contain high concentrations of metals and organics (see Section 2.2 of the EIR/S). The existing poor sediment quality would be isolated by capping and bulkheading, eliminating the potential for further exposure of contaminants to the water column and for bioaccumulation.

#### Existing Site Conditions

Habitat conditions were examined at the Revere Sugar site on April 28, 1993. The intertidal zone is restricted primarily to vertical excursion on pilings and walls. The wooden retaining wall along the eastern boundary and the abandoned pier on the southern side supported small quantities of macroalgae (predominantly *Fucus* sp. with some green algae). Barnacles and littorinid snails were present but not numerous. The barnacle cover increased along the western pilings towards the mouth. The granite wall behind the pilings supported some algae cover (*Fucus* sp. and green algae). Barnacle cover was heaviest on the metal pilings at the mouth of the site. Mussels were observed only at the northwest corner of the site.

Breaching of the retaining wall along the southeast portion of the site has allowed erosion into the aquatic zone, creating a small intertidal zone of rubble and fine-grained sediments.

Benthic infauna was sampled in three locations. Nematodes accounted for >80% of the abundance at Stations RS-1 and RS-2 (98% RS-1, 84% RS-2); *C. capitata* and oligochaetes were also numerically important components of the fauna. Abundances at RS-3 were low, made up primarily of the cirratulid polychaete *Caullariella* sp. and nematodes. Species richness at RS-1, near the mouth of the site, indicates that, at least seasonally, benthic infauna can be relatively diverse in this site. The polychaetes present are primarily surface deposit feeders, indicative of the stressed sediment conditions. The tube dwelling amphipod *Microdeutopus gryllotalpa*, is commonly found associated with docks, algae and mussels (Bousfield 1973). Its presence in the infauna suggests it is present among the fouling organisms on the pilings and bulkheads. The paucity of suspension feeders (e.g., bivalves) indicate that suspended particulates or siltation rates are higher than suitable.

As with Mystic Piers, finfish are likely to utilize the Revere Sugar site for shelter from currents and predators, and for feeding. Species feeding indiscriminantly on the bottom would encounter prey. Species that prefer to browse on hard substrates would find little food. While winter flounder could spawn in this area, their preferred spawning habitat (sand) may not occur at this site. Revere Sugar is located well below the head-of-tide, so does not provide suitable conditions for anadromous species to spawn.

The Revere Sugar site is located within the Mystic River Designated Port Area (DPA) (310 CMR 10.00). Under Massachusetts wetlands regulations, most of the site would be designated as Land Under the Ocean and have the potential to be significant to marine fisheries, storm damage prevention and flood control. This site could provide both refuge (from currents and predators) and feeding opportunities (primarily for demersal feeders). It is unlikely to provide spawning habitat for either winter flounder, as it appeared to lack sandy sediments, or anadromous species (e.g., alewife), as it is located well below



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the head-of-tide. Storm damage prevention and flood control are enhanced at this site by the man made boundaries, although the seawall at the southern end of the site is in disrepair and offers limited protection against exceptionally high tides. The greatest potential for storm damage prevention and flood control occurs during low tides.

Intertidal resources include a debris strewn beach in the southeastern corner and the granite walls and pilings surrounding the site. The beach could be categorized as Coastal Beach but is not significant in the DPA. No natural intertidal features exist at this site.

No federally or state-listed threatened or endangered species are identified or anticipated to occur within the boundaries of the Revere Sugar site (Lincoln 1993). Although the state-listed common tern has been observed in Boston Harbor, no evidence of nesting activities of this species were seen during a site visit on April 28, 1993.

There are no listed historical or archaeological resources on or within 1,000 feet of the Revere Sugar site.

**Proposed Site Conditions/Impacts**

There would be a conversion of 3.7 acres of Land Under the Ocean in a DPA and Tidal Waters at this site to intertidal habitat.

There will be a permanent loss of present intertidal substrate and secondary production of marcroalgae, barnacles, and littorinid snails on the hard substrate (pilings and vertical seawalls). The construction of a retaining wall across the pier opening would replace some of that habitat on its outside wall.

Benthic invertebrates at the Revere Sugar site will be permanently buried and displaced during disposal operations. Nematodes accounted for > 80% of the abundance, also, *C. capitata* and oligochaetes were numerically important components of the fauna. The dredged material placed at the site would fill the site to the adjacent land elevation.

The average current velocity at this site is less than 0.5 knots. Circulation within the Revere Sugar site is governed by tidal flow and physical structures. Disposal activities would occur for a 6- to 9-month period with some potential for temporary impacts from the suspended solids in the vicinity of the site. As with other pier sites, silt curtains and other mitigative measures (settling basin, etc.) would be necessary to prevent unacceptable levels of suspended sediments form entering the river and harbor. Partial bulkheading during site construction and disposal would help restrict openings to the river and provide better opportunities for point-source controls.

The effects of disposal on the Mystic River water column chemistry are likely to be minor. Release of sediment-borne contaminants into the water column are expected to be controlled so that there would be no degradation of the Class SC waters.

### 3.6.2.12 Treatment Technologies

Pre-disposal treatment or alternative technological use of silty sediments from Boston Harbor is being kept as a potentially practicable alternative for Boston Harbor sediments. For the current maintenance dredging needs it is not practicable because technically and logistically feasible treatments are not cost effective for the large volume of material and the rate it would be generated from this project. However, research on these technologies is continuing and by the time future maintenance dredging for this project is needed, these options may become practicable. When logistics and cost become reasonable, treatment of silt material to render it a material suitable for unconfined open water disposal (or other economically feasible use) would appear to be the most practicable alternative at this point since a



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designated site is available (MBDS). Upland disposal of treated sediments would still not appear practicable because of disposal siting difficulties (permitting, logistics, cost), unless it is in small enough quantities such that it could be used as daily cover for landfills.

## 3.7 CUMULATIVE IMPACTS

Construction of the Boston Harbor navigation improvement project will provide deeper access channels for ships using the Port of Boston. During construction of this project, additional barge traffic will occur in the shipping channels and at the open water disposal sites. Barge traffic from the Boston Harbor navigation improvement project is not anticipated to interfere with barge traffic from the CA/T project. Barge traffic to Spectacle Island is anticipated to be complete by the end of 1995.

The MBDS is not receiving any more material from the CA/T project. Approximately 470,000 cubic yards of material from the CA/T project was disposed at the MBDS. No material was disposed at this disposal site from the MWRA project in Boston Harbor (the other large project in Boston Harbor). Other small dredging projects in the Massachusetts Bay area (such as the Winthrop Harbor) may dispose of materials at the MBDS. The draft and final EISs for the MBDS site designation discuss the cumulative impacts from disposal at the MBDS. However, because of the current designation restrictions to the MBDS, the likelihood of many projects being accepted for disposal there is slight.

Disposal at any of the other preferred disposal sites discussed in this report could increase as more material is determined not to be acceptable for disposal at the MBDS. The Commonwealth of Massachusetts, with the Corps of Engineers, is currently evaluating the regional need for a disposal site(s). The data obtained in this report will also be evaluated by a working group looking at this long-term problem.

Beneficial cumulative impacts are expected with the dredging of silt material from the navigation improvement project. Silt material will be removed from the navigation channel and disposed at a site that will sequester the contaminants. This will expose the "clean" parent material. At the same time, the MWRA is controlling sludge and CSO's disposal into the harbor, and will have a new sewage treatment plant in operation. This will reduce the amount of contaminants released to the harbor and provide a cleaner substrate and water column for aquatic organisms inhabiting Boston Harbor.

## 3.8 SECONDARY IMPACTS/SUSTAINABLE DEVELOPMENT

Deepening the Federal navigation channels in Boston Harbor will improve the access for deep draft vessels. The benefits resulting from the project are improved operating efficiency and navigational safety which will help the Port of Boston maintain its standing in the world market and to attract deeper draft vessels, which will make up a larger percentage of the world's fleet, in the future. The benefits are not expected to require land-based infrastructure improvements or a substantial increase in the work force tied to Port operations since the Port is already well served by an established support service industry.

The benefits accruing from the project are also expected to sustain Port activities over the 50-year life of the project. Maintenance dredging, which would be required to maintain the Port over the next 50-years even without the project,would benefit from the identification and creation of a disposal site(s) for the current proposal which can maximize the beneficial use of the uncontaminated parent material.



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## 3.9 IRREVERSIBLE AND IRRETRIEVABLE RESOURCES

Construction of this project will result in the use of diesel engines on dredges used to remove material from the navigation channels and berthing areas, and to dispose of the material. Diesel fuel, which is an irreversible and irretrievable resource, will be used to operate this equipment. A temporary increase in air pollutants will occur as a result of this action.

## 3.10 MITIGATION

Dredging and disposal activities will have some short-term impacts. The dredging and blasting impacts on organisms associated with the substrate in the project area include potentially interfering with anadromous fisheries movements, increasing turbidity levels, resuspending sediments with absorbed contaminants (e.g., lead and PCBs) and causing mortality to finfish and shellfish in the vicinity of the blasting shockwave. Control of sediment resuspension will be minimized by the use of an "environmental bucket" during the removal of the silt. Use of silt curtains, where they can be effectively designed and implemented, may be appropriate and or necessary at certain in-harbor disposal sites.

The Boston Harbor Navigation Improvement project proposes various measures and precautions to minimize interference with the movement of anadromous fish. Anadromous fish movements through the project area are predominantly transiting spawning runs that occur in the spring. Finfish that spawn in freshwater respond to chemical signals in the water column and transit the estuarine project areas traveling upstream to freshwater spawning regions. The Mystic River channel dredging has the potential to impact this anadromous migration. The dredging activity will increase ambient turbidity levels and release sediment absorbed contaminants as the dredge bucket moves through the water column. This activity has the potential to degrade system productivity (primary and secondary). Restricting dredging of this channel to the months of June through February will avoid impacting these sensitive resources.

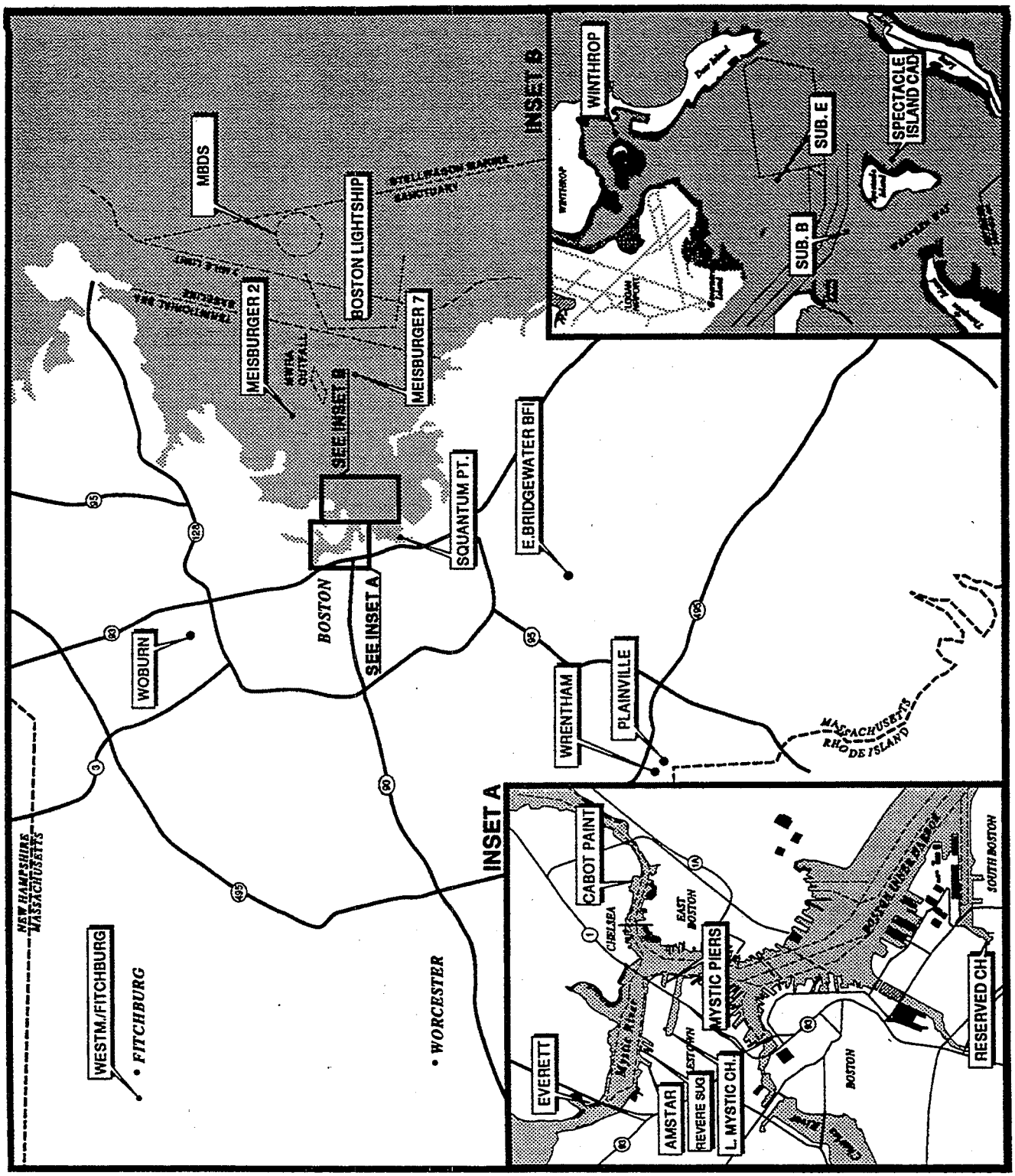
The blasting and removal of rock will destroy associated finfish and benthos. Proper blasting techniques (e.g. minimize blasting during fisheries migrations) will minimize fish mortalities. The potential exists for the use of the rock material for environmental enhancement. This material can be disposed in a location separate from parent material at the Massachusetts Bay Disposal Site to increase habitat niches there. Other rock disposal areas could be identified to increase habitat diversity, but the size of the rocks ( < than 10") precludes placement in a nearshore area exposed to high storm waves.

The transport and disposal of dredged material will be monitored by onboard disposal inspectors under contract to the Corps. The inspectors will record the position of the barge at the time of disposal to ensure point discharges at selected disposed sites. This type of disposal maintains a layering or capping of material, since the most contaminated materials will be disposed first and then capped with pristine clays. The rock/cobble barge loads could be disposed at an alternate buoy for habitat creation. These mitigation measures are in accordance with ongoing Corps management practices of the Massachusetts Bay Disposal Site, isolation of contaminated dredged material and Corps policy for beneficial use of dredged material.

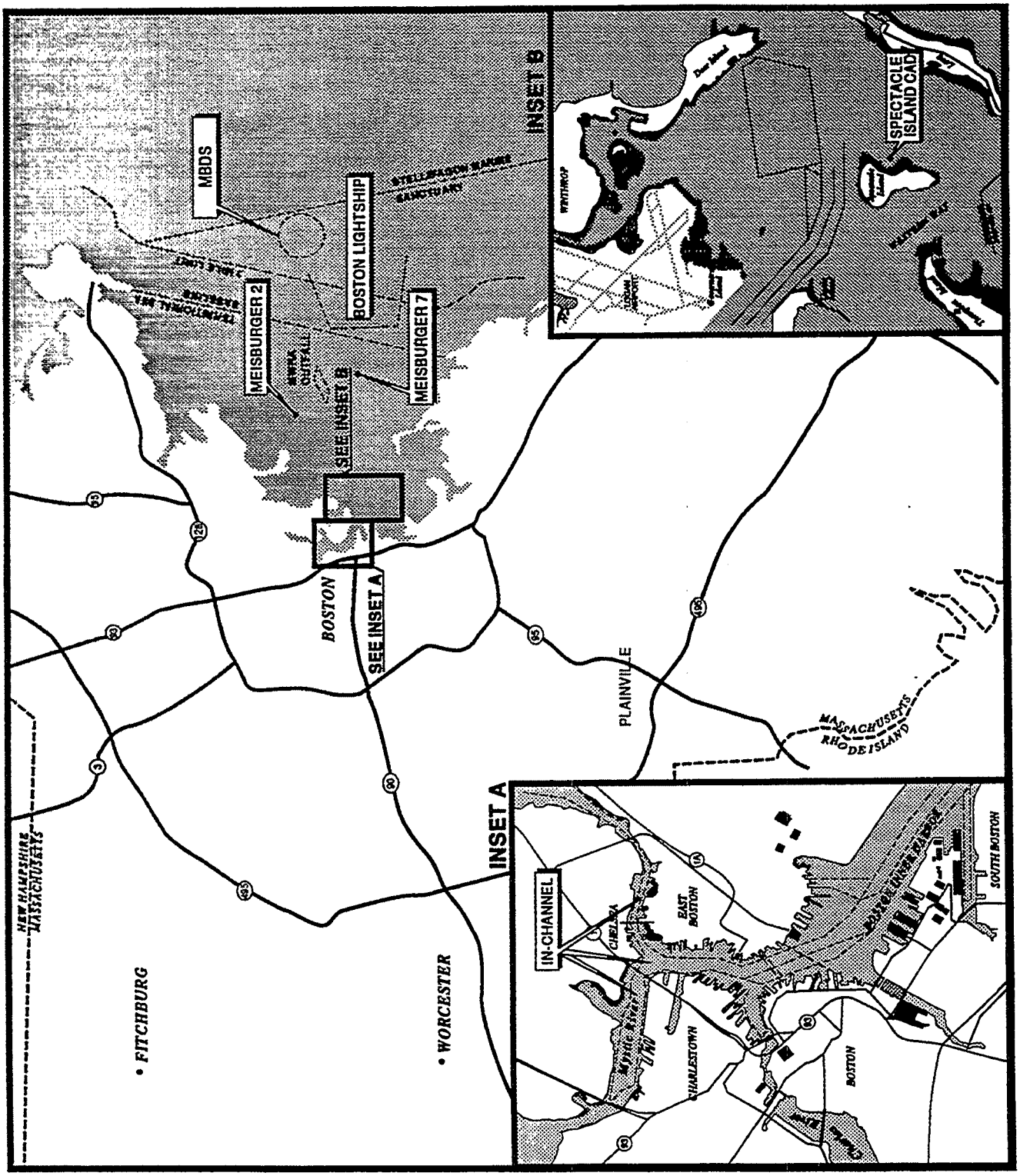
An operational timing sequence (approximately 17 months) would be to dredge the Mystic River and Inner Confluence beginning in the fall and winter (October through February), then proceed by spring and through summer (March through October) to the Reserved Channel. Upper Chelsea River regions could be dredged at any time (e.g., once the Reserved Channel is finished and heavy winter petroleum shipments have lessened). Any remaining work on the Mystic River and Inner confluence areas would be finalized in October through February.

Mitigation for loss of subtidal habitat associated with inshore harbor filling could include saltmarsh or eelgrass plantings in Boston Harbor. Some of the inshore pier disposal sites could be filled to the mean low water level increasing tidal habitat in Boston Harbor. This area could be left to recolonize naturally or planted with saltmarsh grass. As the waters of Boston Harbor are improving in water clarity and quality, eelgrass plantings could succeed in greater depths and in more areas.

In summary, the dredging schedule could proceed year round with the above mitigation practices to minimize environmental impact on the dredging or disposal site ecosystems. Loss of subtidal or intertidal habitat could be replaced with additional intertidal habitat, saltmarsh or eelgrass plantings.




| Boston Harbor Dredging Project EIR/S | *Figure 3-1*<br>Locations of potential disposal sites extensively evaluated. |
|---|---|
| N<br>*Scale:* 0 10<br>*Approx. Scale in Miles* | *Source:*<br>USGS Quadrangles<br>Revised by NAI to reflect pertinent site conditions. |




| Boston Harbor Dredging Project EIR/S | Figure 3-1a. Locations of practicable disposal sites. |
|---|---|
| N<br>Scale: 0 10<br>Approx. Scale in Miles | Source:<br>USGS Quadrangles<br>Revised by NAI to reflect pertinent site conditions. |

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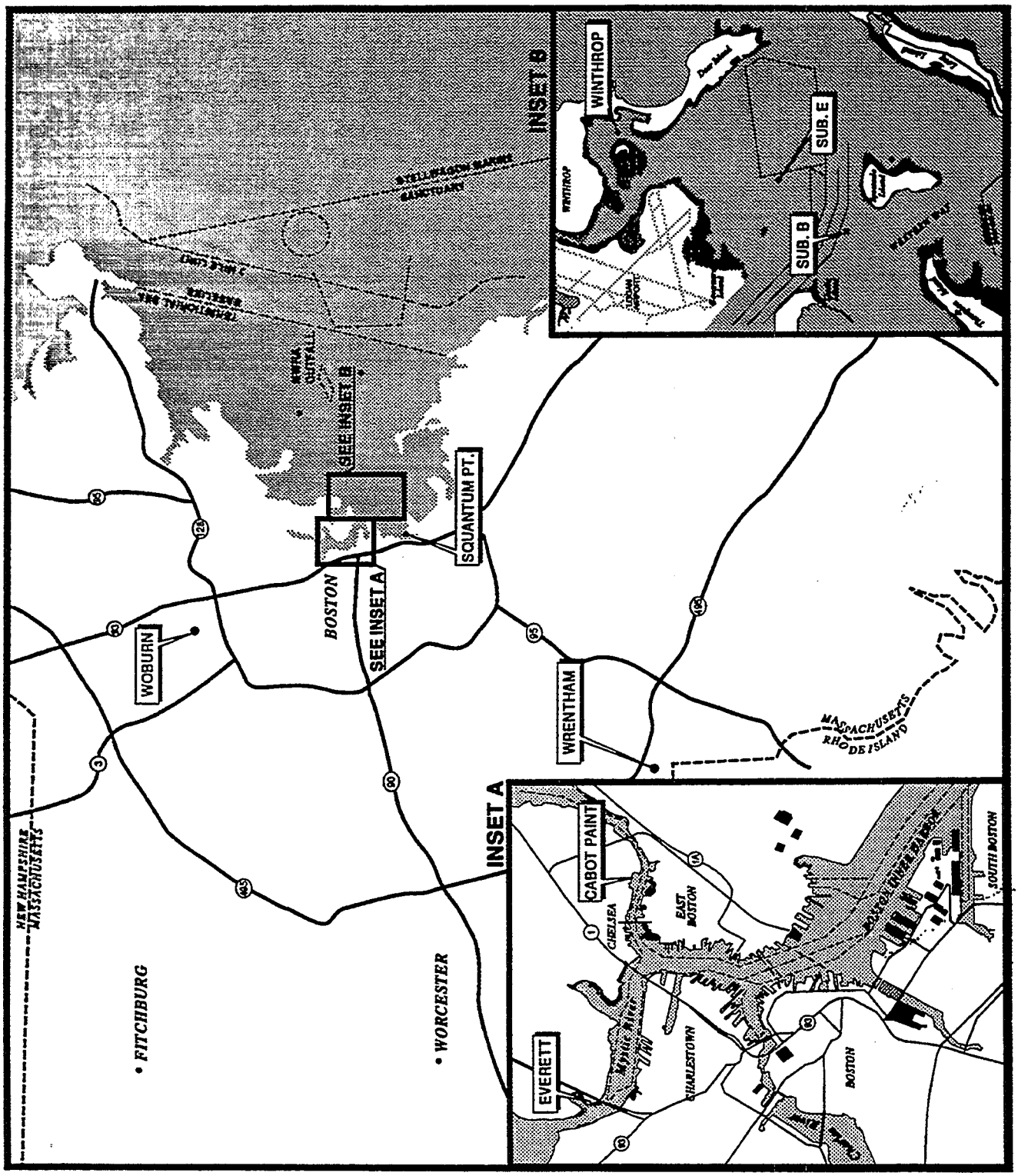
| Boston Harbor Dredging Project EIR/S | Figure 3-1b. Locations of potentially practicable disposal sites. |
|---|---|
| N<br>*Scale:* 0 10<br>*Approx. Scale in Miles* | *Source:*<br>USGS Quadrangles<br>Revised by NAI to reflect pertinent site conditions. |




| Boston Harbor Dredging Project EIR/S | Figure 3-1c. Locations of short-listed sites found not practicable. |
|---|---|
| N<br>Scale: 0 10<br>Approx. Scale in Miles | Source:<br>USGS Quadrangles<br>Revised by NAI to reflect pertinent site conditions. |

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## ALTERNATIVES SCREENING PROCESS

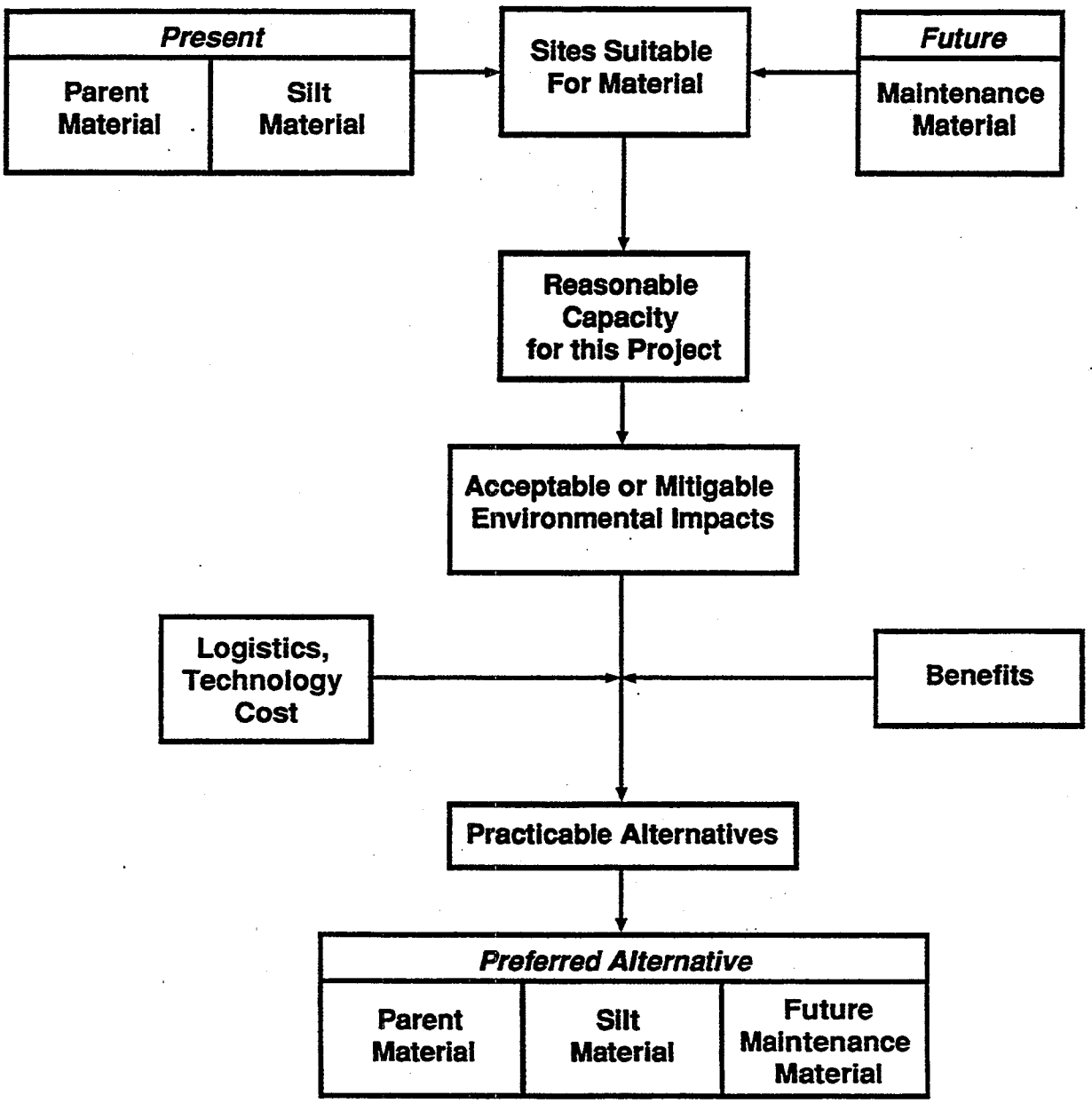
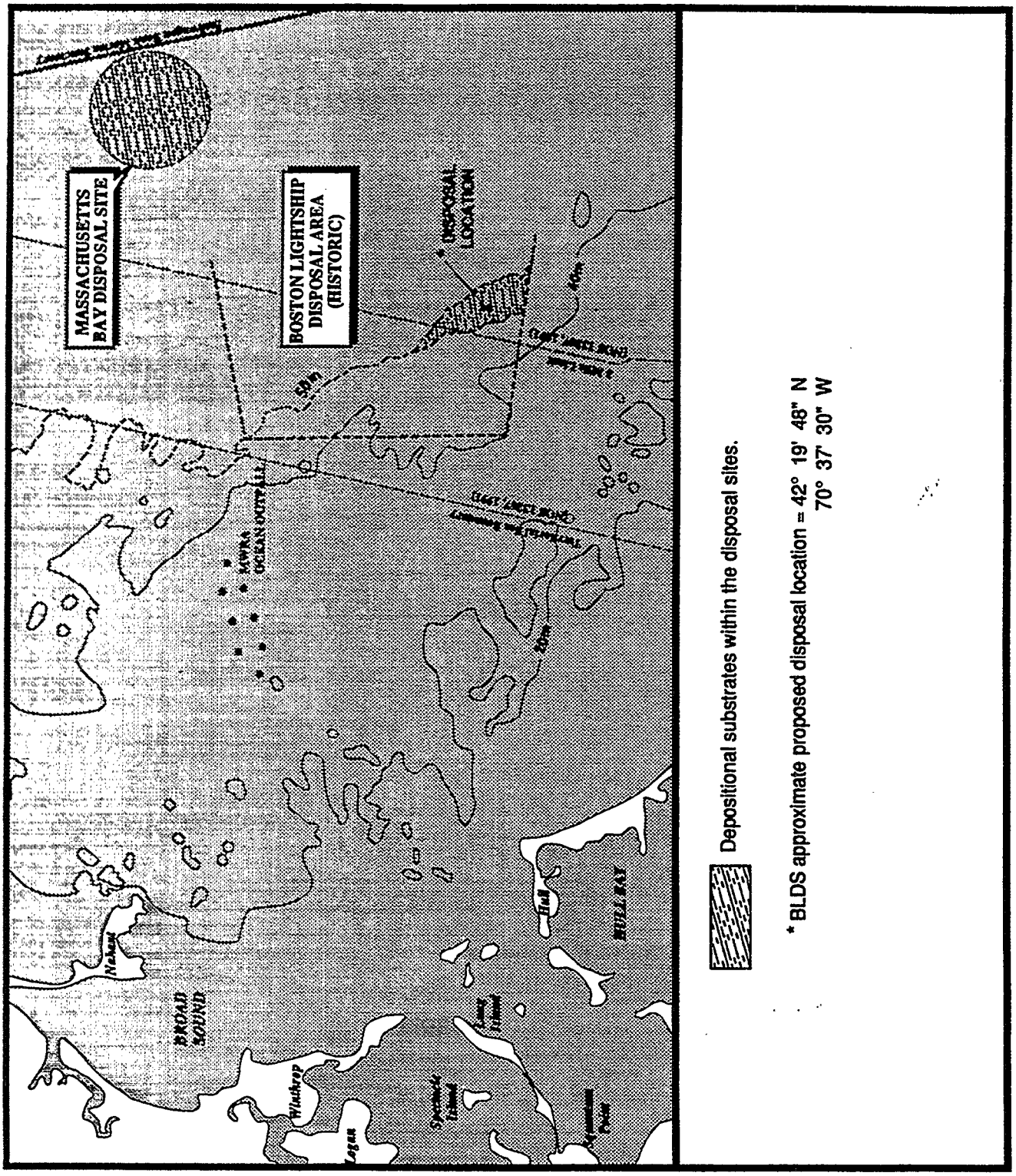



Figure 3-2. Screening of final-listed sites to determine preferred alternative for disposal of present and future (maintenance) dredged material. Boston Harbor Navigation Improvement Project.




| Boston Harbor Dredging Project EIR/S | *Figure 3-3*<br>Site map for Boston Lightship and MBDS Sites. |
|---|---|
| *Scale:* 5000 Scale in yards | *Source:*<br>Boston Harbor Navigation Chart |



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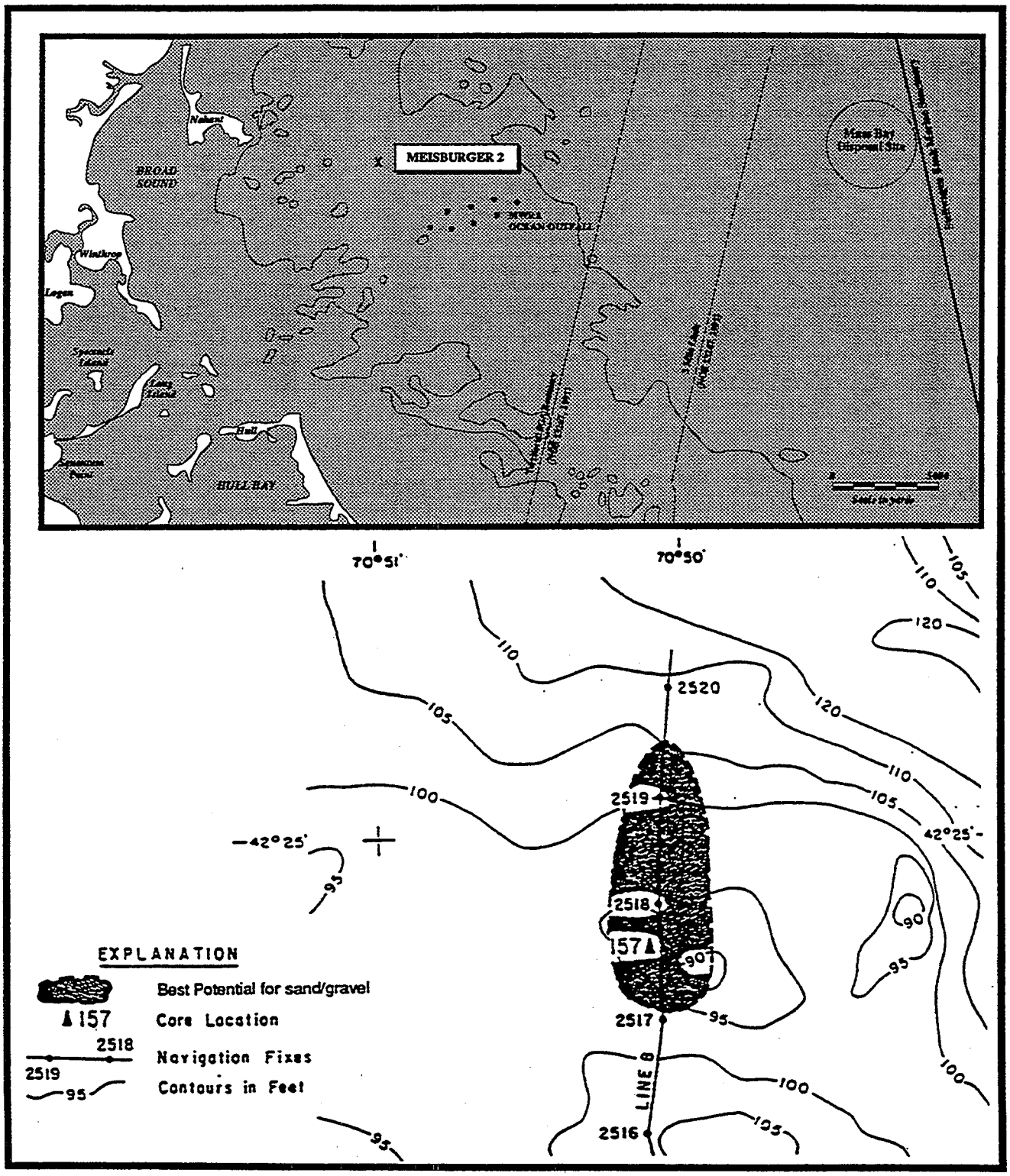
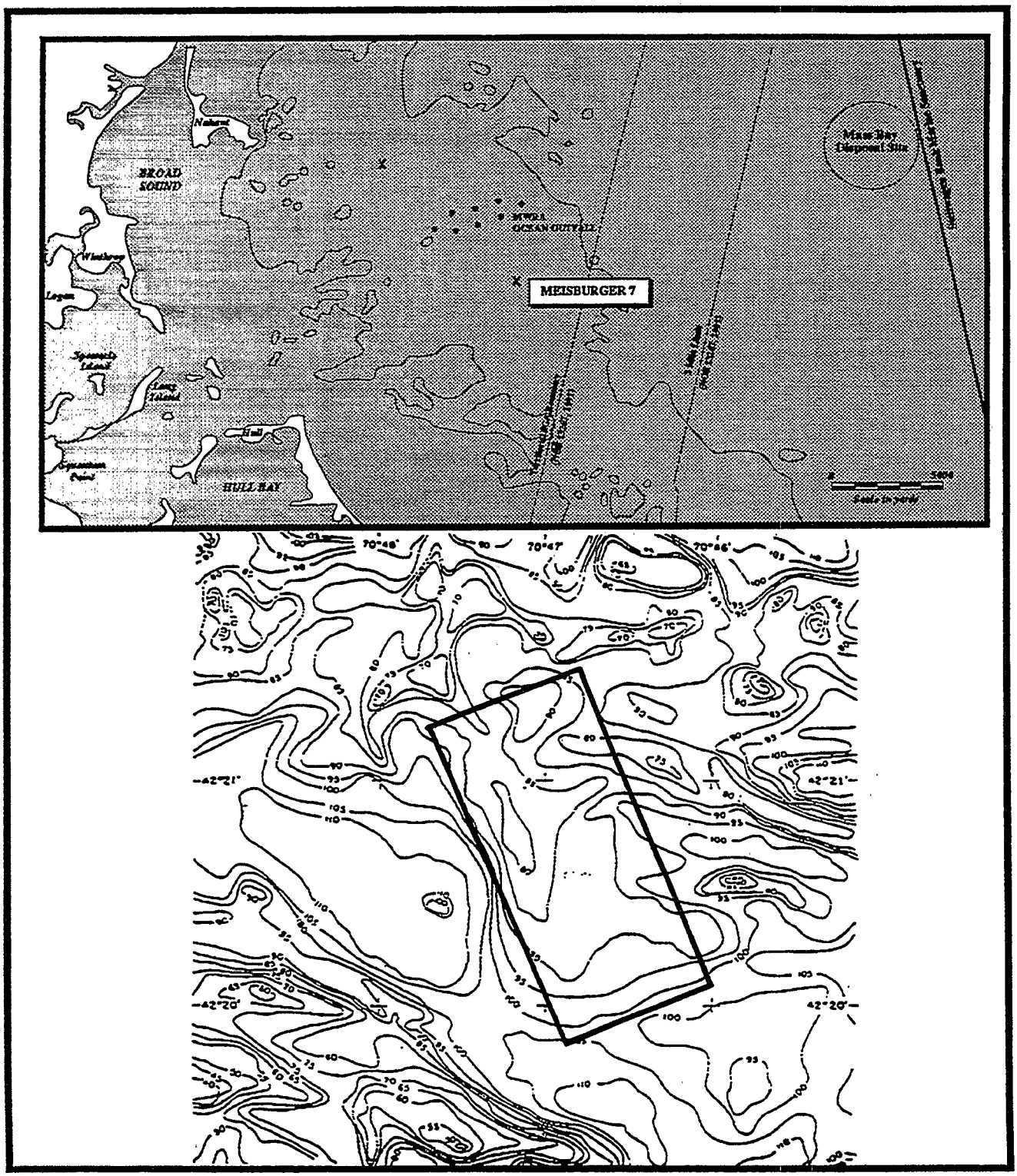

MEISBURGER 2
BROAD SOUND
Nahant
Winthrop
Lagoon
Spectacle Island
Long Island
Hull
Squantum Point
HULL BAY
Massachusetts Bay Outfall
Massachusetts Bay Outfall
Massachusetts Bay Outfall




| Boston Harbor Dredging Project EIR/S | *Figure 3-5* Site map for Meisburger 7 Site.<br>* GENERAL AREA WITHIN WHICH DISPOSAL SITE WOULD BE LOCATED. |
|---|---|
| N<br>*Scale:* Scale in Yards 0 1000 2000 | *Source:* Metcalf & Eddy Inc., 1992 |



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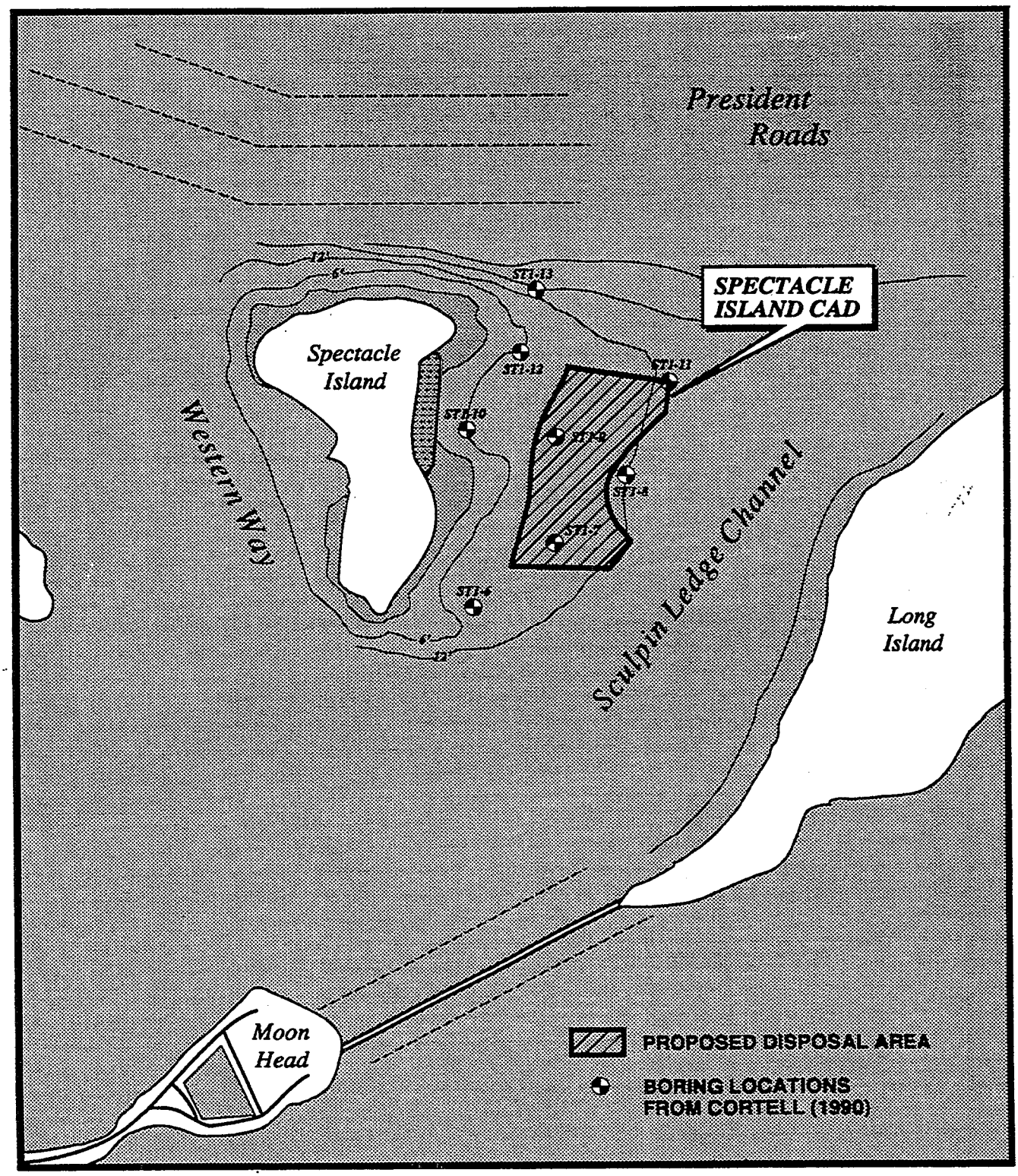
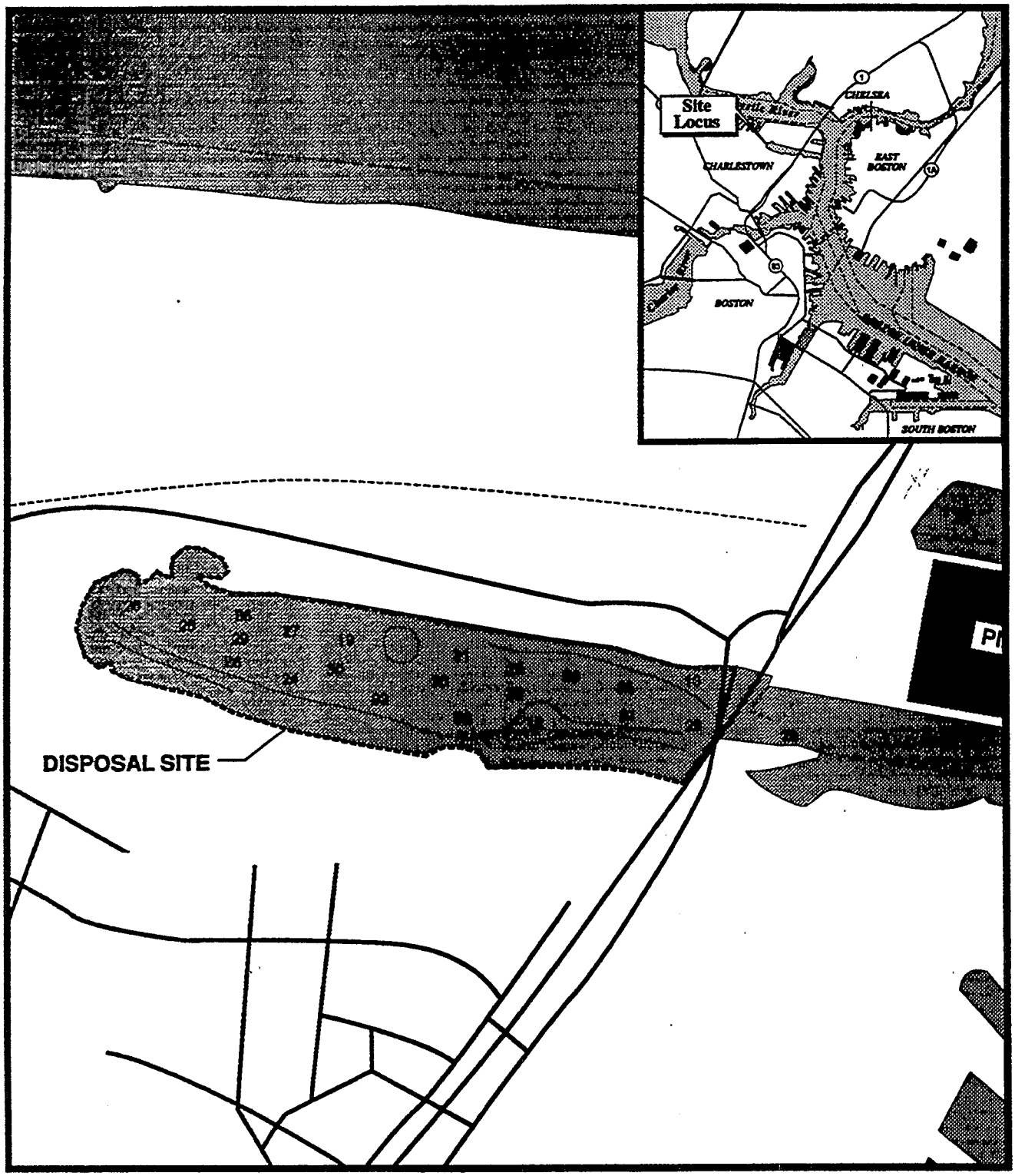
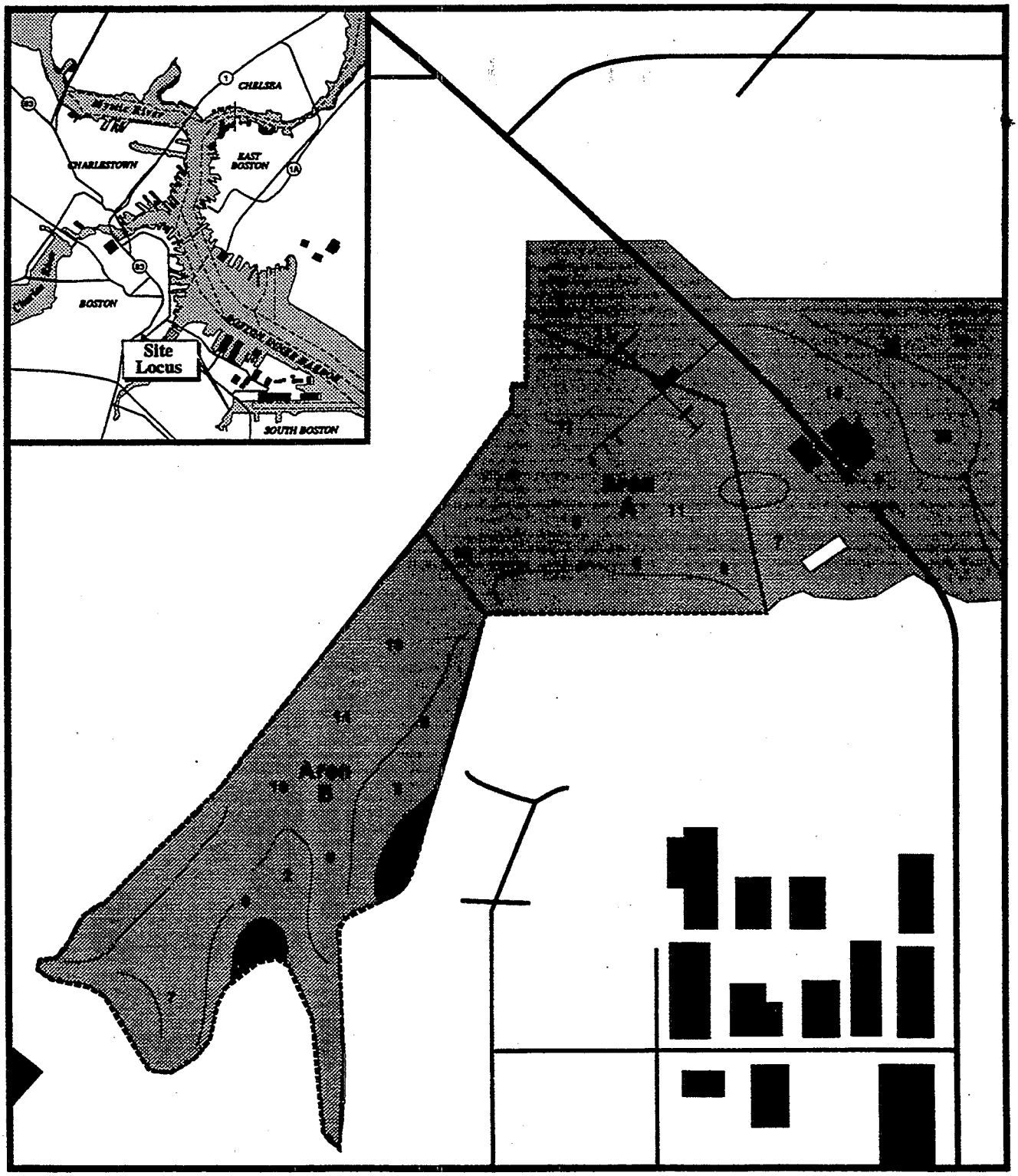


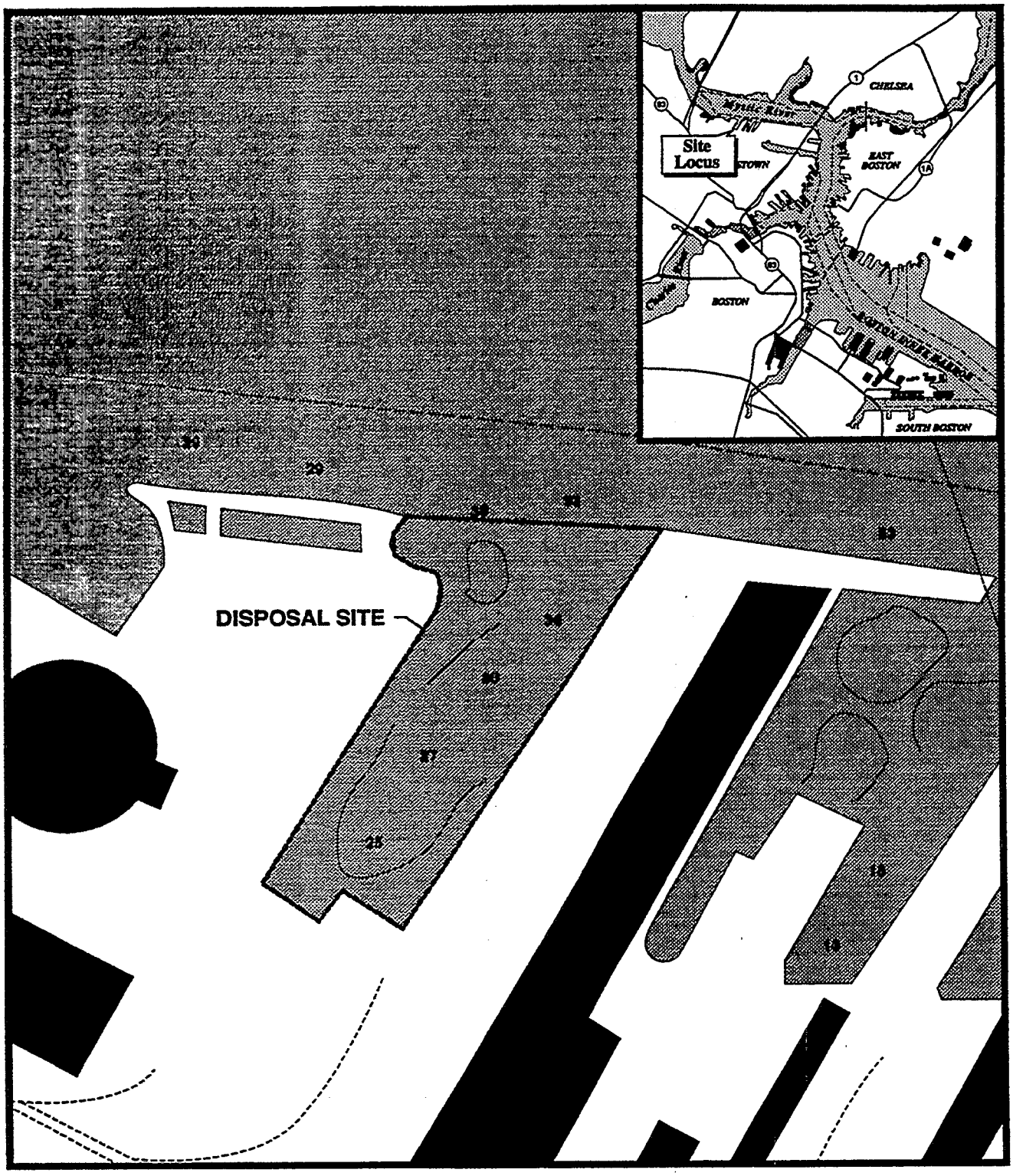

| | |
|---|---|
| **Boston Harbor Dredging Project EIR/S** | *Figure 3-6*<br>Site map for Spectacle Island CAD site. |
| *Scale:*<br>Scale in Yards<br>500 0 1000 | *Source:*<br>NOS Chart No. 13270<br>Sediment Classifications from Cortell 1990 |



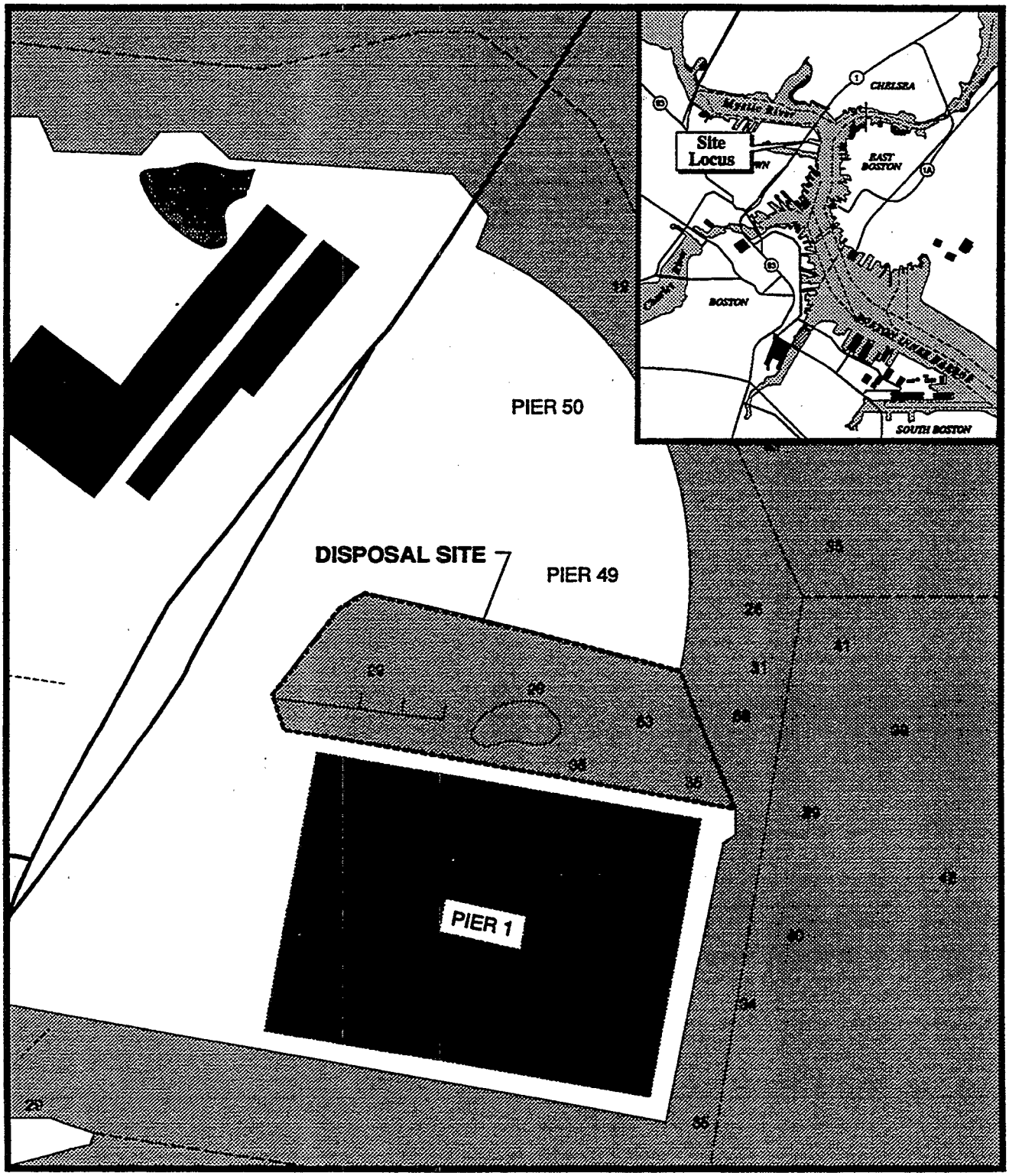

| Boston Harbor Dredging Project EIR/S | *Figure 3-7* Site map for Little Mystic Channel site. |
|---|---|
| N *Scale:* 0 100 200 *Scale in Yards* | *Source:* Boston Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | *Figure 3-8*<br>Site map for Reserved Channel site. |
|---|---|
| N<br>*Scale:* 0 100 200<br>*Scale in yards* | *Source:*<br>Boston Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | *Figure 3-9* Site map for Amstar site |
|---|---|
| N — *Scale:* 0 50 100 *Scale in Yards* | *Source:* Boston Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | *Figure 3-10* Site map for Mystic Piers site |
|---|---|
| N *Scale:* 0 50 100 *Scale in Yards* | *Source:* Boston Harbor Navigation Chart |



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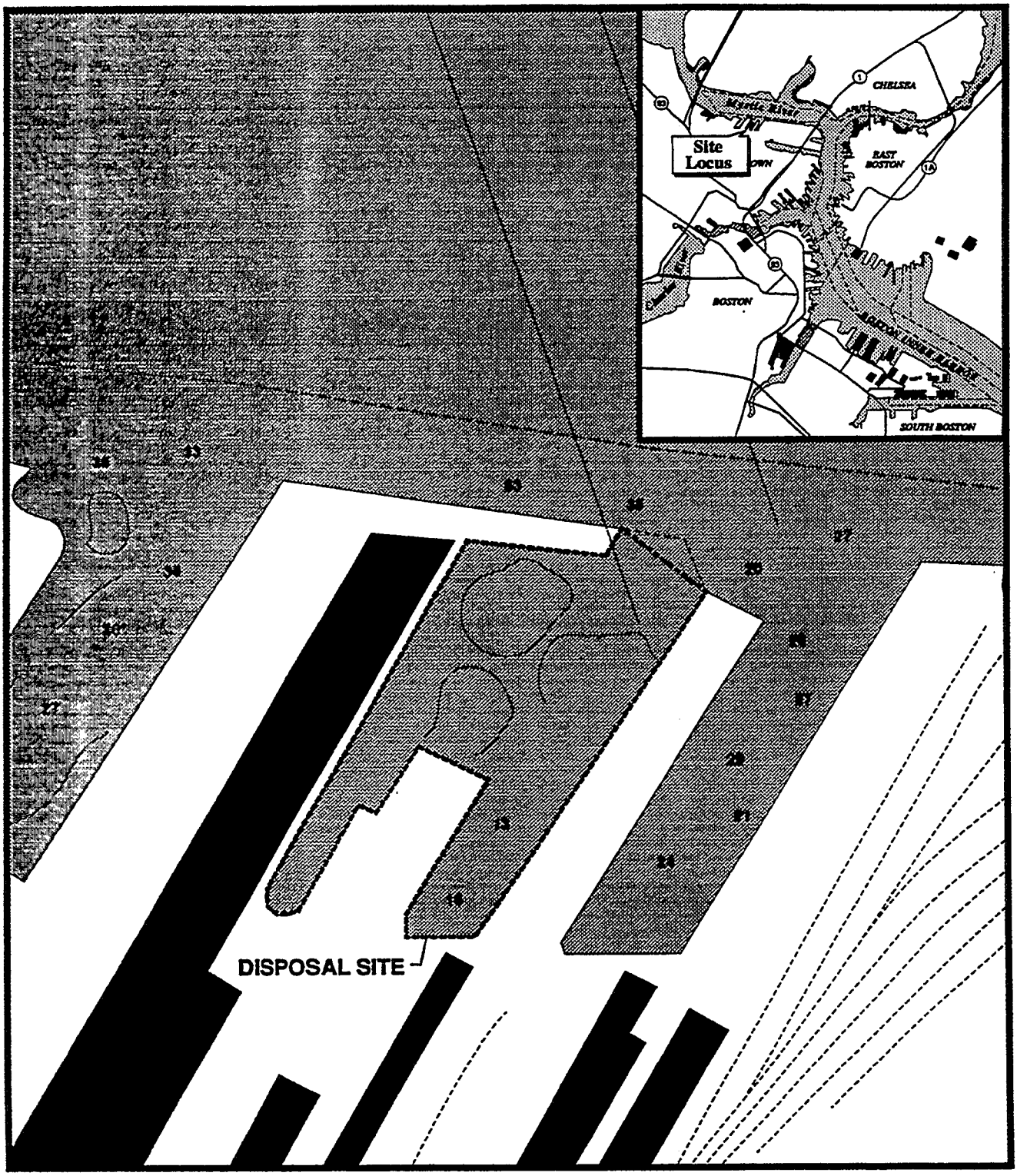


| Boston Harbor Dredging Project EIR/S | *Figure 3-11* Site map for Revere Sugar site |
|---|---|
| N *Scale:* 0 50 100 *Scale in Yards* | *Source:* Boston Harbor Navigation Chart |

TABLE 3-1. POTENTIAL DISPOSAL SITE LISTS BY CATEGORY PRODUCED AT THE END OF EACH SCREENING PHASE.

| PHASE 1 | PHASE 2 | PHASE 3 (DEIR/S) |
|---|---|---|
| LAND-BASED OPTIONS: | | |
| Land-based Inland | | |
| BRN-06 | BRN-06 | |
| CAN-17 | | |
| EBROOK | | |
| HLB-13 | HLB-13 | |
| NAT-02 | NAT-02 | |
| NOR-02 | NOR-02 | |
| RAYNHAM | | |
| RED-03 | RED-03 | |
| SAG-02 | SAG-02 | |
| W-495 | | W-495 |
| WEY-13 | | |
| WIL-06 | | |
| WIL-07 | | |
| WOB-11 | | WOB-11 |
| Land-based Coastal | | |
| BOS-13 | BOS-13 | |
| BOS-23 | BOS-23 | |
| BOS-25 | | |
| BOS-31 | BOS-31 | |
| EVR-04 | | EVR-04 |
| LOGAN | | |
| LYN-02 | LYN-02 | |
| MAL-01 | | |
| CHAR-01 | CHAR-01 | |
| PROV | | |
| QUI-03 | | QUI-03 |
| QUI-09 | QUI-09 | |

(Continued)

TABLE 3-1. (CONTINUED)

| PHASE 1 | PHASE 2 | PHASE 3 (DEIR/S) |
|---|---|---|
| Landfills | | |
| Agawam | | |
| E. Bridgewater | E. Bridgewater | E. Bridgewater |
| Fall River | Fall River | |
| Plainville | Plainville | Plainville |
| Fitchburg/Westminister | Fitchburg/-Westminister | Fitchburg/-Westminister |
| | GCR Peabody* | |
| AQUATIC OPTIONS: Aquatic Shoreline Sites | | |
| Amstar | Amstar | Amstar |
| Cabot Paint | Cabot Paint | Cabot Paint |
| CHEL-01 | CHEL-01 | |
| FPC | FPC | |
| LMC | LMC | LMC |
| Mystic Piers | Mystic Piers | Mystic Piers |
| Northend Park | Northend Park | |
| ResChn | ResChn | ResChn |
| Revere Sugar | Revere Sugar | Revere Sugar |
| Spec CDF | Spec CDF | |
| | Hangman's Island* | |
| | Island End River* | |
| Subaqueous Depressions | | |
| Subaq B | Subaq B | Sub B |
| Subaq D | | |
| Subaq E | Subaq E | Subaq E |
| Subaq F | | |
| CHEL-02 | CHEL-02 | |
| Winthrop | | Winthrop |

(Continued)

TABLE 3-1. (CONTINUED)

| PHASE 1 | PHASE 2 | PHASE 3 (DEIR/S) |
|---|---|---|
| Borrow Pits | | |
| Willet I | Willet I | |
| Willet III | Willet III | |
| Meis 2 | | Meis 2 |
| Meis 7 | | Meis 7 |
| | Spec Is CAD | Spec Is CAD |
| In-Channel Sites | | |
| | | Chelsea Creek** |
| | | Mystic River** |
| | | Inner Confluence** |
| Existing Disposal Sites | | |
| MBDS | MBDS | MBDS |
| Boston Lightship | Boston Lightship | Boston Lightship |

*Added after DOWG meeting, 1/25/93
**Added after DOWG meeting, 4/15/93

TABLE 3-2. CHARACTERISTICS OF GENERIC DISPOSAL ALTERNATIVES.

| CHARACTERISTIC | LINED LANDFILL (CATEGORY A) | UNLINED LANDFILL (CATEGORY B) | LAND-BASED (NON-LANDFILL) | AQUATIC SHORELINE CONTAINMENT | OPEN WATER | OPEN-WATER WITH CONTAINMENT |
|---|---|---|---|---|---|---|
| Potential Environmental Problems | • Leachate impacts<br>• (Minimal since lined) | • Leachate impacts | • Groundwater contamination<br>• Wetland impacts | • Contaminant migration<br>• Burial impacts | • Water column impacts<br>• Benthic impacts<br>• Bioaccumulation | • Contaminant migration<br>• Burial impacts |
| Major Testing Requirements | • Bulk analysis<br>• TCLP[a]<br>• Elutriate | • Bulk analysis<br>• TCLP<br>• Elutriate | • Bulk analysis<br>• TCLP<br>• Elutriate | • Bulk analysis<br>• TCLP<br>• Elutriate | • Bulk analysis<br>• Benthic toxicity<br>• Bioaccumulation | • Bulk analysis<br>• Elutriate or water quality modelling<br>• Benthic impacts<br>• Bioaccumulation |
| Available Options | • Daily cover<br>• Disposal with burial | • Unconfined disposal<br>• Contouring/grading material<br>• Daily cover | • Unconfined disposal<br>• Confined disposal<br>• Reuse | • Habitat creation<br>• Upland use | • Unconfined disposal<br>• Capping | • Habitat enhancement<br>• Burial |
| Design Considerations | • Existing site design<br>• Transportation | • Existing site design<br>• Transportation | • Capacity<br>• Containment<br>• Monitoring<br>• Transportation | • Capacity<br>• Containment<br>• Monitoring<br>• Transportation | • Capacity<br>• Containment<br>• Monitoring<br>• Transportation | • Capacity<br>• Containment<br>• Monitoring<br>• Transportation |
| Available Control Measures | • Mix with cleaner materials<br>• Dewatering | • Diking<br>• Runoff control<br>• Dewatering | • Diking<br>• Runoff control<br>• Leachate control<br>• Dewatering | • Bulkheading<br>• Diking<br>• Subaqueous berm<br>• Capping | • Point dumping<br>• Capping | • Subaqueous berm<br>• Borrow pit<br>• Capping<br>• Point dumping |

[a]TCLP = toxic concentrations leaching potential

TABLE 3-3. MASSACHUSETTS REGULATORY GUIDELINE LEVELS OF DREDGED MATERIALS FOR VARIOUS DISPOSAL ALTERNATIVES.

| | OPEN WATER DISPOSAL MASSACHUSETTS SEDIMENT CLASSIFICATION | | | | | | UPLAND DISPOSAL LANDFILL CATEGORY | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I[a] | II[b] | III[c] | A | B | C | (LINED) A[d] | (UNLINED) B | MIN. BULK SOIL CONC.[e] FOR TCLP ANALYSIS (ppm) | TCLP REGULATORY LEVELS[f] (mg/l) |
| BULK ANALYSIS (ppm) | | | | | | | | | | |
| Mercury | <0.5 | 0.5-1.5 | >1.5 | | | | 10 | 2 | | |
| Lead | <100 | 100-200 | >200 | | | | 500 | 500 | | |
| Zinc | <200 | 200-400 | >400 | | | | | | | |
| Arsenic | <10 | 10-20 | >20 | | | | 40 | 40 | | |
| Cadmium | <5 | 5-10 | >10 | | | | 25 | 14 | | |
| Chromium | <100 | 100-300 | >300 | | | | 500 | 100 | | |
| Copper | <200 | 200-400 | >400 | | | | | | | |
| Nickel | <50 | 50-100 | >100 | | | | | | | |
| Total PCBs | <0.5 | 0.5-1.0 | >1.0 | | | | 2 | 2 | | |
| Total PAHs | | | | | | | 100 | 100 | | |
| Total VOCs | | | | | | | 10 | 4 | | |
| Total PHC | | | | | | | 1000 | 500 | | |
| Volatile Solids (%) | | | | <5 | 5-10 | >10 | | | | |
| Water Content (%) | | | | <40 | 40-60 | >60 | | | | |
| Silt/Clay (%) | | | | <60 | 60-90 | >90 | | | | |
| Oil & Grease (%) | | | | <0.5 | 0.5-1.0 | >1.0 | | | | |
| TCLP | | | | | | | | | | |
| Arsenic | | | | | | | | | 100 | 5 |
| Cadmium | | | | | | | | | 20 | 1 |
| Chromium | | | | | | | | | 100 | 5 |
| Lead | | | | | | | | | 100 | 5 |
| Mercury | | | | | | | | | 4 | 0.2 |
| Selenium | | | | | | | | | 20 | 1 |
| Silver | | | | | | | | | 100 | 5 |

[a]= normally approved for unconfined open water disposal
[b]= the presence of several parameters in this category may require bioassay and bioaccumulation testing for evaluating open water disposal
[c]= the presence of one or more parameters in this category will most likely require bioassay and bioaccumulation testing for evaluating open water disposal
[d]= dredged material which exceeds any of the limits may be mixed with cleaner material to bring the material into compliance with this classification
[e]= TCLP analysis would be needed for those parameters that exceed any listed threshold
[f]= material has non-hazardous characteristics if listed regulatory levels are not exceeded using the TCLP test methods

TABLE 3-4. EVALUATION OF SUITABILITY OF BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT SEDIMENTS FOR VARIOUS DISPOSAL ALTERNATIVES.

| DREDGE SITE | | MASS BAY DISPOSAL SITE (UNCONFINED) | | | OPEN WATER AQUATIC (EXCLUDING MUDS) UNRESTRICTED | | | OPEN WATER AQUATIC (EXCLUDING MUDS) (CAPPING) | | | NEARSHORE AQUATIC W/ CONTAINMENT | | | UPLAND COASTAL | | | UPLAND INLAND | | | LINED LANDFILL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SILT | PARENT | ROCK | SILT | PARENT | ROCK | SILT | PARENT | ROCK | SILT | PARENT | ROCK | SILT | PARENT | ROCK | SILT | PARENT | ROCK | SILT | PARENT | ROCK |
| Reserved Channel | FP | U | S | S | U | S | S | S | S | S | S | S | S | S | S | S | S | A,S | S | U | A,B,C,S | S |
| Conley | P | U | S | NA | U | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Army Base | P | U | S | NA | U | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Boston Edison (Barge Berth) | P | U | S | NA | U | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Boston Edison (Intake) | P | N | NA | NA | N | NA | NA | S | NA | NA | S | NA | NA | S | NA | NA | S | NA | NA | D,E | NA | NA |
| Main Ship Channel | FP | N | S | S | N | S | S | S | S | S | S | S | S | S | S | S | S | S | S | D,E | A,B,C,S | S |
| North Jetty | P | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Mystic Piers | P | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Chelsea River | FP | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | U | A,B,C,S | NA |
| Eastern Minerals | P | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Gulf Oil | P | U | S | NA | U | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Mystic River | FP | N | S | S | N | S | S | S | S | S | S | S | S | S | S | S | S | A,S | S | U | A,B,C,S | S |
| Moran | P | N | NA | NA | N | NA | NA | S | NA | NA | S | NA | NA | S | NA | NA | S | NA | NA | D,E | NA | NA |
| Revere Sugar | P | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Distrigas | P | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |
| Prolerized | P | N | S | NA | N | S | NA | S | S | NA | S | S | NA | S | S | NA | S | A,S | NA | D,E | A,B,C,S | NA |

Keys: FP = Federal project; P = Non-Federal project

A = suitable as liner
B = suitable as closure material
C = suitable as daily cover without mixing
D = suitable as solid waste for disposal in a lined landfill
E = suitable as daily cover with mixing
N = unsuitable
NA = not applicable
S = suitable
U = unresolved; treated as unsuitable for disposal option alternatives analysis

TABLE 3-5. SUMMARY OF POTENTIAL SITE PREPARATION, MANAGEMENT REQUIREMENTS FOR USE OF GENERIC DISPOSAL ALTERNATIVES.

| | UPLAND | | | AQUATIC | | | |
|---|---|---|---|---|---|---|---|
| | LANDFILL | UPLAND INLAND | UPLAND COASTAL | NEARSHORE | BORROW PITS | OPEN WATER | EXISTING DISPOSAL SITES |
| SITE PREPARATION | | | | | | | |
| •Baseline investigations | | X | X | X | X | X | |
| •Permitting | X | X | X | X | X | X | X |
| •Acquisition | | X | X | X | | | |
| •Dredging | | | X | | X | | |
| •Containment structure-dike | | X | X | | | X | |
| -berm | | | | X | | | |
| -bulkhead | | | | X | | | |
| •Access road/rail | | X | | | | | |
| •Alteration of navigational channel | | | | | | X | |
| •Liner | | X | X | | | | |
| MATERIAL PREPARATION | | | | | | | |
| •Dewatering | X | X | X | | | | |
| •Mixing | X | | | | | | |
| TRANSPORTATION | | | | | | | |
| •Barge | X | X | X | X | X | X | X |
| •Truck | X | X | X | X | | | |
| •Rail | X | X | | | | | |
| SITE MANAGEMENT | | | | | | | |
| •Runoff control | X | X | X | | | | |
| •Closure | | | | | | | |
| -landscaping | | X | X | | | | |
| -dredged clay | X | X | X | X | | X | X |
| -soil | | X | X | | | | |
| -structure | | | | X | | | |
| -marine organic | | | | X | | | |
| -marine mineral | | | | | X | | |
| -prior demonstration of success | | | | | | | X |
| -marine habitat | | | | X | X | | |
| •Burial | | X | X | | X | X | X |
| •Daily Cover | X | X | X | | | | |

TABLE 3-6. POTENTIAL IMPACTS FROM SILT DISPOSAL AT GENERIC ALTERNATIVE DISPOSAL SITES.

| IMPACT | LAND-BASED | | | AQUATIC | | SUBAQUEOUS | | BORROW PITS | EXISTING SITES | | SOLIDIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | LANDFILL | INLAND | COASTAL | TOTAL | PARTIAL | OUTER HARBOR | CHANNEL | W/ CAP | W/ CAP | W/O CAP | |
| Exceeds Sediment Criteria | | | | | | | | | | X | |
| Loss of Habitat | | | | | | | | | | | |
| Terrestrial | | X | X | | | | | | | | |
| Wetland (F.M.) | | | P | | | | | | | | |
| Marine subtidal | | | | X | T | T | T | T | T | T | |
| Marine intertidal | | | T | X | | | | | | | |
| Alteration of Habitat | | | | | | | | | | | |
| Terrestrial | | X | X | | | | | | | | |
| Wetland (F.M.) | | P | P | | | | | | | | |
| Marine subtidal | | | T | X | X | X | X | T | T | T | T |
| Marine intertidal | | | X | X | P | | | | | | |
| Water Quality | | | | | | | | | | | |
| Freshwater | | P | | | | | | | | | |
| Marine | | | T | T | T | T | T | T | T | T | |
| Current Use (Displacement) | X | X | X | X | X | | | | | | |
| Socioeconomic | | | | | | | | | | | |
| Traffic | | | | | | | | | | | |
| Truck | X | X | X | | | | | | | | |
| Barge | X | X | X | X | X | X | X | P | P | P | P |
| Historic/ Archeological | | P | P | P | P | P | P | P | | | |
| Emigration Potential for Contaminants | | | | | | | | | | | |
| During disposal | | | | | | P | P | P | P | P | |
| Prior to containment | | | | | | P | P | P | P | | |
| Volatization | | P | P | | | | | | | | |
| Long-term | P | P | P | | P | P | P | P | P | X | |
| Bioaccun. potential | | | | | | T | T | T | T | X | |

Key: X = Impact; P = Possible impact; T = Temporary impact.

TABLE 3-7. IMPACTS CAUSED BY USING SPECIFIC UPLAND SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | PLAINVIEW/ LAIDLAW LANDFILL | WESTMINSTER LANDFILL | EAST BRIDGEWATER LANDFILL | WRENTHAM |
|---|---|---|---|---|
| SITE DESIGN | •Dewatering facility at Mystic Pier or North Jetty<br>•No special site modifications required<br>•Available capacity: daily cover ≤ 500 cy/day<br>•Waste ≤ 150-200 cy/day | •Dewatering facility at Mystic Pier or North Jetty<br>•No special site modifications required<br>•Available capacity: daily cover ≤ 250 cy/day<br>•Waste ≤ 200 cy/day | •Dewatering facility at Mystic Pier or North Jetty<br>•No special site modifications required<br>•Available capacity: daily cover ≤ 400 cy/day<br>•Waste ≤ 75 cy/day | •Dewatering facility at Mystic Pier or North Jetty<br>•Site modification from undeveloped forest/shrub to lined landfill<br>•Footprint approx. 60 acres<br>•Capacity approx. 785,500 cy |
| WATER QUALITY | None | | | •No groundwater impacts<br>•Possible temporary surface water impacts from sedimentation and contaminants |
| MARINE INTERTIDAL | None | | | |
| MARINE SUBTIDAL | None | | | |
| SHELLFISH | None | | | |
| FINFISH | None | | | |
| FRESHWATER AQUATIC RESOURCES | None | | | |
| WETLAND VEGETATION, WILDLIFE | None | | | •Permanent loss of 9 ac. wetland<br>•Permanent loss of habitat to resident species and fragmentation of wooded land |
| THREATENED & ENDANGERED SPECIES | None | | | Possible habitat for northern hairstreak and Philadelphia panic grass |
| HISTORIC & ARCHEOLOGICAL | None | | | |
| SOCIOECONOMIC & LANDUSE | No change in land use, but use for dredge material disposal would preempt other uses | | | Possible change from undeveloped forest and shrubland to lined containment facility |
| TRAFFIC | Increase in truck traffic for transporting dredged material to landfill | | | •Increase in truck traffic during construction and dredge disposal phase<br>•Heavy truck use already occurs from adjacent gravel operation |

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TABLE 3-7.(CONTINUED) IMPACTS CAUSED BY USING SPECIFIC UPLAND SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | WOBURN | EVERETT | SQUANTUM POINT |
|---|---|---|---|
| SITE DESIGN | •Dewatering facility at Mystic Pier or North Jetty<br>•Capping closed municipal landfill with lined facility<br>• Footprint=25 acres<br>• Capacity=158,600 cy | •Dredge barge lane<br>•Site modified from abandoned urban land to landfill<br>• Footprint=6 acres<br>• Capacity=70,000 cy | •Dredge barge lane<br>•Construct lined containment berm and fill with dredged materials up to 10 feet deep<br>•Dewater through detention basin, cap when dry<br>• Footprint=18 acres • Capacity=210,000 cy |
| WATER QUALITY | •May improve groundwater quality by capping landfill<br>•Possible temporary surface water impacts from sedimentation and contaminants | •Temporary local increase in suspended solids during dredging<br>•Temporary release of contaminants during dredging | |
| MARINE INTERTIDAL | None | •Dredging of 2 acres of intertidal habitat<br>•Potential siltation during dredging and barge manuevering | Permanent loss of approximately 0.3 ac. of fine-grained tidal flat and 0.03 ac. of salt marsh |
| MARINE SUBTIDAL | None | Dredging of approximately 0.03 ac. of fine-grained sediment and disturbance during barge manuevering will result in temporary loss of benthic production | Alteration of approximately 1.4 ac. of fine-grained habitat |
| SHELLFISH | None | No harvestable shellfish beds in area | Temporary impact to mussel and softshell clam habitat |
| FINFISH | None | Temporary disturbance to finfish habitat. | Temporary disturbance to finfish habitat. |
| FRESHWATER AQUATIC RESOURCES | Possible temporary impacts to tributary to Hall's Brook | None | |
| WETLAND VEGETATION, WILDLIFE | •Permanent loss of portion of 1 ac. wetland<br>•Permanent loss of early successional field and wooded habitat | •No freshwater wetland impacts<br>•Loss of open land in an urban setting | •Permanent loss of approximately 0.33 ac. of wetland<br>•Permanent loss of shrubland bird habitat and disturbance of salt marsh tidal flat habitat |
| THREATENED & ENDANGERED SPECIES | None | None | Loss of short-eared owl migratory/wintering habitat |
| HISTORIC & ARCHEOLOGICAL | None | Jacknife drawbridge within 1000 ft of site | None |
| SOCIOECONOMIC & LANDUSE | Permanent capping of closed municipal landfill | Permanent change from abandoned urban land to landfill | None |
| TRAFFIC | •Construction traffic<br>•Increase in truck and rail traffic due to transport of dredged material to landfill | •Construction traffic<br>•Dredged material transported by barge | •Construction traffic<br>•Dredged material transported by barge |

TABLE 3-8. POTENTIAL BENEFITS OF DREDGED MATERIAL DISPOSAL ALTERNATIVES.

| BENEFIT | UPLAND | | | AQUATIC SHORELINE | | SUBAQUEOUS | | BORROW PITS | EXISTING DISPOSAL SITES | | SOLIDIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | LANDFILL | INLAND | COASTAL | TOTAL | PARTIAL | OUTER HARBOR | CHANNEL | W/ CAP | W/ CAP | W/O CAP | |
| Remove/Isolate Contaminated Sediment from Environment | X | X | X | X | X | X | X | X | X | | X |
| Cover Existing Contaminated Sediments | P | | | X | X | | | | P | | |
| Enhance Resource/Habitat | | P | P | | X | | | | P | | X |
| Economic Benefits | | | | P | | | | P | | | |
| Cap Existing Disposal Site | X | | | | | | | | X | X | |
| Beneficial Use of Parent Material | X | X | X | X | X | X | X | X | X | | |
| Use of Existing On-site Materials | | | | | | | | X | | | |
| Future Use of Impacted Area | X | P | P | X | X | X | | | X | X | P |

Key: X = Benefit; P = Possible benefit

TABLE 3-9. IMPACTS CAUSED BY USING SPECIFIC AQUATIC SHORELINE SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | MYSTIC PIERS | | REVERE SUGAR | | AMSTAR | |
|---|---|---|---|---|---|---|
| | TOTAL FILL | PARTIAL FILL | TOTAL FILL | PARTIAL FILL | TOTAL FILL | PARTIAL FILL |
| SITE DESIGN | Bulkhead harbor face; fill behind silt curtain/weir to MHW or higher. Dragline to position sediments. Footprint=2.7 ac.; capacity=135,000 cu. yds. | Bulkhead harbor face; fill behind silt curtain/weir to -3 ft MLW,cap with clay to MLW. Dragline to position sediments. Footprint= 2.7 ac.; capacity=96,000 cu. yds. | Bulkhead harbor face; fill behind silt curtain/weir to MHW or higher. Dragline to position sediments. Footprint=3.7 ac.; capacity=136,000 cu. yds. | Bulkhead harbor face; fill behind silt curtain/weir to -3 ft MLW, cap with clay to MLW. Dragline to position sediments. Footprint= 3.7 ac.; capacity=85,000cu. yds. | Bulkhead harbor face; fill behind silt curtain/weir to MHW or higher Dragline to position sediments. Footprint=3.5 ac.; capacity=179,000 cu. yds. | Bulkhead harbor face; fill behind silt curtain/weir to -3 ft MLW, cap with clay to MLW. Dragline to position sediments. Footprint= 3.5 ac.; capacity=126,000 cu. yds. |
| WATER QUALITY | •Permanent loss of 38 million gal. of Boston Harbor capacity, no impact on current velocity •Dewatering controls needed. | •Permanent loss of 29 million gal. of Boston Harbor capacity, no impact on current velocity •Dewatering controls needed | •Permanent loss of 21 million gal. of Boston Harbor capacity, no impact on current velocity •Dewatering controls needed. | •Permanent loss of 27 million gal. of Boston Harbor capacity, no impact on current velocity •Dewatering controls needed. | •Permanent loss of 53 million gal. of Boston Harbor capacity, no impact on current velocity •Dewatering controls needed. | •Permanent loss of 39 million gal. of Boston Harbor capacity, no impact on current velocity •Dewatering controls needed. |
| MARINE INTERTIDAL | Permanent loss of macroalgae, barnacle, and blue mussel production on hard substrate | No loss of hard substrate | Permanent loss of macroalgae, barnacle, and littorina snail production on hard substrate | No loss of hard substrate | •Permanent loss of barnacle, mussel and green algae production on hard substrate •Permanent loss of gravel beach | No loss of hard substrate |
| MARINE SUBTIDAL | Loss of 2.7 acres fine-grained soft habitat | •Alteration of 2.7 ac. fine-grained soft substrate. •Capping of existing contaminants •Loss of piling and bulkhead (hard substrate) | Loss of 3.7 acres fine-grained soft habitat | •Alteration of 3.7 ac. fine-grained soft substrate. •Capping of existing contaminants •Loss of piling and bulkhead (hard substrate) | Loss of 3.5 acres fine-grained soft habitat | •Alteration of 3.5 ac. fine-grained soft substrate. •Capping of existing contaminants •Loss of piling and bulkhead (hard substrate) |
| SHELLFISH | Loss of intertidal mussels on pilings | | None | | | |
| FINFISH | •Mortality of demersal fish eggs; larvae and adults trapped behind bulkhead. •Permanent loss of finfish refuge and foraging habitat | •Mortality of demersaal fish eggs; larvae and adults trapped behind bulkhead. •Temporary loss of finfish refuge and foraging habitat | •Mortality of demersal fish eggs; larvae and adults trapped behind bulkhead. •Permanent loss of finfish refuge and foraging habitat | •Mortality of demersal fish eggs; larvae and adults trapped behind bulkhead. •Temporary loss of finfish refuge and foraging habitat | •Mortality of demersaal fish eggs; larvae and adults trapped behind bulkhead. •Permanent loss of finfish refuge and foraging habitat | •Mortality of demersal fish eggs; larvae and adults trapped behind bulkhead. •Temporary loss of finfish refuge and foraging habitat |
| FRESHWATER AQUATIC RESOURCES | None | | | | | |
| WETLAND VEGETATION, WILDLIFE | Permanent loss of 2.7 acres subtidal wetlands Possible bird forage habitat | Alteration of substrate of 2.7 acres subtidal wetlands. Possible bird forage habitat | Permanent loss of 3.7 acres subtidal wetlands Possible bird forage habitat | Alteration of substrate of 3.7 acres subtidal wetlands. Possible bird forage habitat | Permanent loss of 3.5 acres subtidal wetlands Possible bird forage habitat | Alteration of substrate of 3.5 acres subtidal wetlands. Possible bird forage habitat |
| THREATENED & ENDANGERED SPECIES | None | | | | | |
| HISTORIC & ARCHEOLOGICAL | None | | | | | |
| SOCIOECONOMIC & LANDUSE | •Conversion of aquatic habitat to fastland. •Proposed future use compatible with neighborhood. | Eliminate future potential use in commercial port activity | •Conversion of aquatic habitat to fastland. •Proposed future use compatible with neighborhood. | Eliminate future potential use in commercial port activity | •Elimination of MWRA floating dock on eastern edge of site. •Conv. of aquatic hab. to fastland •Prop. future use of compatible w/surrounding landuse | •Elimination of MWRA floating dock on eastern edge of site. •Restriction of ship to shore transfer of people and freight |
| TRAFFIC | •Transport sediments by barge (approx. 100 barge trips) •No truck traffic impacts | •Transport sediments by barge (approx. 70 barge trips) •No truck traffic impacts | •Transport sediments by barge (approx. 100 barge trips) •No truck traffic impacts | •Transport sediments by barge (approx. 60 barge trips) •No truck traffic impacts | •Transport sediments by barge (approx. 130 barge trips) •No truck traffic impacts | •Transport sediments by barge (approx. 90 barge trips) •No truck traffic impacts |

TABLE 3-9 (CONTINUED). IMPACTS CAUSED BY USING SPECIFIC AQUATIC SHORELINE SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | CABOT PAINT | | LITTLE MYSTIC CHANNEL | RESERVED CHANNEL | |
|---|---|---|---|---|---|
| | TOTAL FILL | PARTIAL FILL | | AREA A | AREA B (WEST END) |
| **SITE DESIGN** | Bulkhead harbor face; fill behind silt curtain/weir to MHW or higher. Footprint=5.6 ac.; capacity=99,000 cu. yds. | Bulkhead river face; fill behind silt curtain/weir to -3 ft MLW,cap with clay to MLW. Footprint= 5.6 ac.; capacity=16,000 cu. yds. | Bulkhead river face; fill behind silt curtain/weir to -3 ft MLW,cap 3 ft thick with clay to MLW. Footprint=15 ac.; capacity=303,000 cu. yds. | Bulkhead near Summer St. Bridge, west of marina. Fill to -6ft MLW; Cap; Cut bulkhead, Footprint=8.9 ac Capacity=14,000 cy | Bulkhead westernmost end; Fill to +6ft MLW, Cap to MHW; Remove bulkhead; Saltmarsh Footprint=7.7 ac Capacity=185,000 cy |
| **WATER QUALITY** | •Permanent loss of 33 million gallons of Boston Harbor capacity •Dewatering controls needed. | •Permanent loss of 12 million gallons of Boston Harbor capacity •Dewatering controls needed. | •One CSO and six discharge pipes may need to be diverted •Siltation controls needed. | •Perm. loss of 48.5 million gallons of Boston Harbor Capacity, no impact on current velocity •Siltation controls needed. | •Perm. loss of 16 million gallons of Boston Harbor Capacity •3 CSO's would need to be relocated •Siltation controls needed. |
| **MARINE INTERTIDAL** | •Perm. loss of Fucus & barnacle production on hard substrate •Permanent loss of gravel beaches on northeast and northwest | Permanent loss of gravel beaches on northeast and northwest | •Temporary reduction in Fucus, green algae and barnacle production on hard substrate •Short-term impact on small sandy-gravel beach | Temporary reduction in Fucus, green algae and barnacle production on hard substrate | •Perm. loss of barnacle, Fucus, green algae and barnacle prod. on hard sub. •Perm. loss of small rocky beach •Increase in intertidal habitat •Increase primary prod. (saltmarsh) |
| **MARINE SUBTIDAL** | Permanent loss of 5.6 acres fine-grained soft habitat | •Alteration of 5.6 ac. of soft substrate. •Improve sediment quality | •Conversion to shallow subtidal habitat •Improve sediment quality •Temporary loss of 15.0 acres of soft substrate | •Conversion to shallow subtidal habitat •Improve sediment quality •Temporary loss of 8.9 acres of soft substrate | •Conversion to shallow subtidal habitat, then to salt marsh •Permanent loss of 7.7 ac. of soft substrate |
| **SHELLFISH** | None | | Short-term impacts on mussels and metal bulkhead | None | |
| **FINFISH** | •Mortality of demersal fish eggs; larvae and adults trapped behind bulkhead. •Permanent loss of finfish refuge and foraging habitat | •Mortality of demersal fish eggs; larvae and adults trapped behind bulkhead. •Temporary loss of finfish refuge and foraging habitat | •Short-term mortality of fish eggs; larvae and adults trapped behind bulkhead. •Temporary reduction on prey available to species which feed primarily on benthic invertebrate •Temporary loss of finfish refuge and foraging habitat | | •Mortality of fish eggs; larvae and adults trapped behind bulkhead. •Temporary loss of finfish refuge and foraging habitat |
| **FRESHWATER AQUATIC RESOURCES** | Not applicable | | | | |
| **WETLAND VEGETATION, WILDLIFE** | Permanent loss of 5.6 acres of intertidal and subtidal wetlands | Alteration of 5.6 acres of intertidal and subtidal wetlands | Temporary impact of 15 ac. of subtidal wetlands | Temporary loss of 8.9 ac. of subtidal wetlands | Temporary loss of 7.7 ac. of intertidal and subtidal wetlands |
| **THREATENED & ENDANGERED SPECIES** | None | | | | |
| **HISTORIC & ARCHEOLOGICAL** | None | | | | |
| **SOCIOECONOMIC & LANDUSE** | •Conversion of aquatic habitat to fastland. | None | None | Possible conflict with yacht club | |
| **TRAFFIC** | •Transport sediments by barge (approx. 70 barge trips) •No truck traffic impacts | •Transport sediments by barge (approx. 15 barge trips) | •Transport sediments by barge (approx. 170-220 barge trips or 11,700 - 15,200 truck trips) | •Sediment by barges (140) and trucks (9800): minor delays to commercial/recreational boating traffic. •Some roadway traffic delays and noise impacts | |

TABLE 3-10. POTENTIAL IMPACTS CAUSED BY USING SPECIFIC SUBAQUEOUS, BORROW PIT AND IN-CHANNEL SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | SUBAQUEOUS B | SUBAQUEOUS E | WINTHROP HARBOR | CHELSEA CREEK IN-CHANNEL | INNER CONFLUENCE IN-CHANNEL |
|---|---|---|---|---|---|
| SITE DESIGN | Place silt and cap with clay to final depth of -15 ft MLW. Footprint=83 ac. Capacity=up to 609,000 cy | Place silt and cap with clay to final depth of -8 ft MLW. Footprint=79 acres Capacity=up to 614,000 cy | Place silt and cap with clay to final depth of -12 ft MLW. Footprint=9 acres Capacity=167,000 cy | •Over dredge channel to -47 ft MLW •Fill to -42 ft MLW with contaminated sediments •Cap to -40 ft MLW with clay • Capacity=207,000 cy | •Over dredge channel to -49 ft MLW •Fill to -44 ft MLW with contaminated sediments •Cap to -42 ft MLW with clay • Capacity=140,000 cy |
| WATER QUALITY | •Potential for water quality exceedences after 4 hrs up to 4500 ft from dump site. •Permanent loss of up to 204 million gal. of Boston Harbor water capacity | •Potential for water quality exceedences after 4 hrs up to 4500 ft from dump site. •Permanent loss of up to 201 million gal. of Boston Harbor water capacity | •Potential for water quality exceedences after 4 hrs up to 4500 ft from dump site •Permanent loss of up to 64.8 million gal. of Boston Harbor water capacity | •Potential for water quality exceedences after 4 hrs up to 4500 ft from dump site •Negligible effect on current velocity •No change in Harbor volume | •Potential for water quality exceedences after 4 hrs up to 4500 ft from dump site •Negligible effect on current velocity •No change in Harbor volume |
| MARINE INTERTIDAL | Not applicable | | | | |
| MARINE SUBTIDAL | Temporary loss of up to 83 ac. of soft substrate | Temporary loss of up to 79 ac. of soft substrate | •Temporary loss of up to 8.14 ac. of soft substrate •Improved habitat quality for benthic fauna | No habitat loss beyond that caused by improvement dredging project. | |
| SHELLFISH | Short-term impact on softshell clam and lobster populations due to increased suspended sediments | | Short-term impact on softshell clam population due to increased suspended sediments | Potential short-term impacts to nearby resources due to impacts to water quality, although no commercial beds nearby. | |
| FINFISH | • Short-term mortality of fish eggs, larvae, and adults • Temporary reduction of prey available to species which feed primarily on invertebrates • Temporary interference with commercial fishery | | | | |
| FRESHWATER AQUATIC RESOURCES | Not applicable | | | | |
| WETLAND VEGETATION, WILDLIFE | Temporary impact on 83 ac. of subtidal wetland | Temporary impact on 79 ac. of subtidal wetland | Temporary loss of 8.14 ac. of subtidal wetland | No impacts beyond those incurred due to dredging project | |
| THREATENED & ENDANGERED SPECIES | • None expected | | | | |
| HISTORIC & ARCHEOLOGICAL | • None | | | | |
| SOCIOECONOMIC & LANDUSE | Minor temporary impact on boat traffic | Interruption of use of small vessel navigation channel | Temporary impact on boat traffic | Prolonged dredging in navigational channel resulting in additional minor interruption of shipping traffic | |
| TRAFFIC | •Transportation of dredged material by barge •Approx. 450 barge trips •Temporary interruptions in Dorchester Channel | •Transportation of dredged material by barge •Approx. 450 barge trips •Relocation of small vessel channel | •Transportation of dredged material by barge •Approx. 120 barge trips •temporary interruptions in Winthrop Harbor Channel | •Addit. dredging would require 60 days •120 barge trips required to remove clay sediments | • 30 days of additional dredging • 60 barge trips to remove clay |

TABLE 3-10 (CONTINUED). POTENTIAL IMPACTS CAUSED BY USING SPECIFIC SUBAQUEOUS, BORROW PIT AND IN-CHANNEL SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | MYSTIC RIVER IN-CHANNEL | MEISBURGER 2 | MEISBURGER 7 | SPECTACLE ISLAND CAD |
|---|---|---|---|---|
| SITE DESIGN | •Over-dredge to -49 ft MLW<br>•Fill to -44 ft MLW with silt<br>•cap to -42 ft MLW with clay<br>Capacity 318,000 cy | •Dredge pit 5-30 ft deep<br>•Fill with dredged silt<br>•Cap with clay and sand to pre-existing contours<br>•Footprint 86 acres<br>•Capacity 780,000-4,660,000 cy | •Dredge pit 10 ft deep<br>•Fill with dredged silt<br>•Cap with clay and sand to pre-existing contours<br>•Footprint 121 acres<br>•Capacity to 6.1+ million cy | •Dredge existing sediments to -20 ft MLW<br>•Fill with dredged silt<br>•Cap with clay and sand to pre-existing contours<br>•Footprint 20-50 acres<br>•Capacity 600,000-1,450,000 cy |
| WATER QUALITY | •Potential for water quality exceedences after 4 hrs up to 4500 ft from dump site<br>•No change in Harbor volumes | Water quality criteria not exceeded outside site 4 hrs after dump. | Water quality criteria not exceeded outside site 4 hrs after dump. | Potential for water quality exceedences; Construction/mitigation steps would be planned |
| MARINE INTERTIDAL | Not applicable | | | |
| MARINE SUBTIDAL | No habitat loss beyond that caused by improvement dredging project | •Temporary loss of 150 ac. of soft substrate<br>•Beach improvement from excavated material | •Temporary loss of 82-403 ac. of soft substrate<br>•Beach improvement from excavated material | Temporary loss of 20-70 ac. of soft substrate |
| SHELLFISH | Potential short-term impacts to nearby resources due to impacts to water quality | •Short-term impact on lobster population<br>•Temporary interference with commercial fishery | | Potential temporary siltation on nearby mussel beds |
| FINFISH | •short-term mortality of fish eggs, larvae and adults<br>•Temporary reduction of prey available to species which feed primarily on invertebrates<br>•Temporary interference with commercial fishery | | | |
| FRESHWATER AQUATIC RESOURCES | Not applicable | | | |
| WETLAND VEGETATION, WILDLIFE | No impacts beyond those incurred due to dredging project | •No state jurisdictional wetlands ( >80 ft MLW)<br>•Temporary interference with commercial fishery | | Temporary loss of 22 ac. of subtidal wetlands |
| THREATENED & ENDANGERED SPECIES | None expected | None expected, although some species of whales and sea turtles could occur in area incidentally | | Not applicable |
| HISTORIC & ARCHEOLOGICAL | None | | | |
| SOCIOECONOMIC & LANDUSE | Prolonged dredging in navigational channel resulting in additional minor interruption of shipping traffic | Temporary impact on fishing and recreational boating | | •Temporary impact on recreational boating<br>•Possible conflict with construction of fish reef |
| TRAFFIC | •90 days of additional dredging<br>•185 barge trips to remove parent material | •Dredge will be on-site for > 1 year<br>•660 barge trips required to remove sediments<br>•660 barge trips required to transport harbor sediments to site | •Dredge will be on-site for > 1 year<br>•660 barge trips required to remove sediments<br>•660 barge trips required to transport harbor sediments to site | •Dredge will be on-site for> 3 months<br>•660 barge trips required to remove sediments<br>•660 barge trips required to transport harbor sediments to site |

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TABLE 3-11. IMPACTS CAUSED BY USING EXISTING OPEN WATER DISPOSAL SITES FOR BOSTON HARBOR DREDGED MATERIAL DISPOSAL.

| RESOURCE | MASSACHUSETTS BAY DISPOSAL SITE | BOSTON LIGHTSHIP |
|---|---|---|
| SITE DESIGN | Continuous point disposal of silt two weeks after start of dredging;<br>Capping with parent material. | |
| WATER QUALITY | No water quality criteria exceedences after four hours outside the site. | |
| MARINE INTERTIDAL | Not applicable | |
| MARINE SUBTIDAL | •Benthic resources maintained in pioneering stage due to regular disposal<br>•No significant change from existing conditions | Possible mature benthic community now existing.<br>Disposal would temporarily convert to a pioneering community. |
| SHELLFISH | Gills of any shellfish in immediate vicinity of disposal site could become clogged | |
| FINFISH | •Some mortality of demersal fish due to burial<br>•Avoidance of disposal operation | |
| FRESHWATER AQUATIC RESOURCES | Not applicable | |
| WETLAND VEGETATION, WILDLIFE | Designated disposal site | Alteration of subtidal habitat conditions<br>in Tidal Waters |
| THREATENED & ENDANGERED SPECIES | •Endangered whales and turtles are transients in area, and would likely avoid disposal activities | |
| HISTORIC & ARCHEOLOGICAL | None | Needs further review |
| SOCIOECONOMIC & LANDUSE | •Designated dredged material disposal site<br>•No change in current use | Former dredged material disposal site |
| TRAFFIC | •Disposal of parent material and rock would require up to 500 barge trips (4000 cy capacity)<br>•Disposal of silt would require up to 170 barge trips (4000 cy capacity)<br>•Average of two barge trips per day | |

TABLE 3-12. ALTERNATIVE DISPOSAL OPTIONS FOR DISPOSAL OF SILT SEDIMENTS, BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT.

| | TYPE | SITE | CAPACITY (cy)[a] | COST ($/cy)[b] | UPLAND | | | AQUATIC | | | | | UPLAND + AQUATIC | | | | EXISTING AQUATIC DISPOSAL SITE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A1[c] | A2 | A3 | B1[c] | B2 | B3[c] | B4 | B5 | C1[c] | C2 | C3 | C4 | D1 | D2 |
| UPLAND | Landfill | E. Bridgewater | 200(d.c.), 200(fill) cy/day | $56 | X | X | | | | | | | X | | X | | | |
| | | Plainville | 50(d.c.), 250(fill) cy/day | $87 | X | X | | | | | | | X | | X | | | |
| | | Fitchburg/Westminster | 75(fill), 250(d.c.) cy/day | $101 | X | X | | | | | | | X | | X | | | |
| | Inland | Woburn | 158,600 | $61 | | X | X | | | | | | | X | | X | | |
| | | Wrentham | 785,500 | $50 | | X | X | | | | | | | X | | X | | |
| | Coastal | Everett | 70,000 | $76 | | X | | | | | | | | X | | X | | |
| | | Squantum Point | 210,000 | $37-49 | | X | X | | | | | | | X | | X | | |
| AQUATIC | Shoreline | Amstar | 128,000-179,000[d] | $33-37 | | | | X | | | | X | X | X | | | | |
| | | Cabot Paint | 18,000-99,000[d] | $88-278 | | | | X | | | | X | X | X | | | | |
| | | Little Mystic Channel | 303,000[e] | $33 | | | | X | | | | X | X | X | | | | |
| | | Mystic Piers | 98,000-135,000[d] | $31-35 | | | | X | | | | X | X | X | | | | |
| | | Reserved Channel | 14,000-199,000[f] | $38-255 | | | | X | | | | X | X | X | | | | |
| | | Revere Sugar | 85,000-136,000[d] | $30-35 | | | | X | | | | X | X | X | | | | |
| | Subaqueous | Subaqueous B | 278,000-609,000 | $13-21 | | | | | X | | | X | | | X | X | | |
| | | Subaqueous E | 614,000 | $16 | | | | | X | | | X | | | X | X | | |
| | | Winthrop Harbor | 167,000 | $12 | | | | | X | | | X | | | X | X | | |
| | In-Channel (FLIP) | Chelsea Creek | 207,000 | $25 | | | | | | X | | X | | | X | X | | |
| | | Inner Confluence | 140,000 | $25 | | | | | | X | | X | | | X | X | | |
| | | Mystic River | 317,000 | $25 | | | | | | X | | X | | | X | X | | |
| | Borrow pit | Meisburger 2 | 780,000-4,660,000 | $20 | | | | | | | X | X | | | | | | |
| | | Meisburger 7 | to 6,125,000 | $22 | | | | | | | X | X | | | X | X | | |
| | | Spectacle Island CAD | 600,000-1,450,000 | $25 | | | | | | | X | X | | | X | X | | |
| | Existing Disposal site | Boston Light Ship | unlimited | $7-14[g] | | | | | | | | | | | X | X | | |
| | | MBDS | unlimited | $7-14[g] | | | | | | | | | | | | | X | X |
| TREATMENT | | Solidification | 6,000/day | $55 | | | | | | | | | | | | | X | X |
| | | | | | | | | | | | | | | | | | X | |
| MINIMUM NO. SITES NEEDED FOR CAPACITY: | | | | | | | | | | | | | | | | | | |
| | | Landfill | | | NA[c] | 3 | | | | | | | NA[c] | | 1 | | | |
| | | Upland | | | | 2 | 3 | | | | | | | 1 | | 1 | | |
| | | Shoreline | | | | | | NA[c] | | | | 1 | | 2 | 1 | | | |
| | | Non Shoreline Aquatic | | | | | | | 3 | NA[c] | 1 | 1 | | | | 1 | | |
| | | Existing Disposal Site | | | | | | | | | | | | | | | 1 | 1 |

[a] capacity for "silty" sediments, d.c. = daily cover
[b] lower cost applies to larger volume
[c] Use of all sites within option fails to provide needed capacity
[d] aquatic shoreline sites - lower value = cap at MLW, higher value = fill to MHW
[e] Little Mystic Channel only, lower value = cap to -6 ftMLW, higher value = cap to -3 ftMLW
[f] Reserved Channel only, lower value = west end to +9.5 ftMLW, higher value = west end plus fill east end to -6 ftMLW
[g] existing disposal site cost ranges include no cap and capping options

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## TABLE 3-13. COST ESTIMATES FOR LANDFILL SITES FOR DISPOSAL OF SILTS FROM BHNIP.

**Landfills**

| Location | Distance (Miles) | Silt Volume (CY) | Dredging Cost/CY $7.10 | Dewatering Cost /CY $12.00 | Hauling Cost/CY | Hauling Cost | Tipping Fee ($/CY) | Tipping Cost | Total Cost | Unit Cost for Silt ($/CY) |
|---|---|---|---|---|---|---|---|---|---|---|
| East Bridgewater | 25 | 1,319,000 | $9,364,900 | $15,828,000 | $9.20 | $12,134,800 | 28.00 | $36,932,000 | $74,259,700 | $56.00 |
| Plainville | 35 | 1,319,000 | $9,364,900 | $15,828,000 | $12.25 | $16,157,750 | 56.00 | $73,864,000 | $115,214,650 | $87.00 |
| Fitchburg/Westminster | 45 | 1,319,000 | $9,364,900 | $15,828,000 | $12.25 | $16,157,750 | 70.00 | $92,330,000 | $133,680,650 | $101.00 |

**ASSUMPTIONS**

Hauling costs assumed fleet of 20 trucks and 3 loaders working 5 days/wk.
Dewatering cost based on Massport's recent bid for Moran Terminal and includes storage for up to 15 months.
Real estate cost for lands required for dewatering sites have not been included.
Total landfill capacity available is 102,000 CY. Unit cost for silt is valid if less volume is disposed.

TABLE 3-14. COST ESTIMATES FOR LAND-BASED SITES FOR DISPOSAL OF SILTS FROM BHNIP.

**Woburn-11**

| Footprint (Sq Ft) | Perimeter (FT) | Dike Material (CY) | Dike Cost $15.00 /CY | Lining Cost $26.00 /SY | Road Fill $13.00 | Clearing/ Drainage |
|---|---|---|---|---|---|---|
| 617,500 | 3,100 | 63,400 | $951,000 | $1,783,889 | $1,560,000 | $59,200 |

| Silt Volume (CY) | Dredging Cost/CY $7.10 | Hauling Cost/CY $9.30 | Cap Cost/CY $15.00 | Dewatering Cost $12.00 /CY | Treatment Cost $2.00 /CY |
|---|---|---|---|---|---|
| 158,600 | $1,126,060 | $1,474,980 | $525,000 | $1,903,200 | $317,200 |

| Total Cost | Unit Cost for Silt |
|---|---|
| $9,701,000 | $61.00 |

**ASSUMPTIONS**

Footprint (area) planimetered from quad sheet.
Footprint selected to avoid wetlands and power lines. As a result two of three areas were not large enough to use.
Dike volume computed from dike height of 12', top width of 10' and side slopes of 1V to 3H ("CAD CELL" program).
Sediment depth 10' with 2' cap thickness.
Liner consists of geomembrane for positive cut-off, 1' of sand and a geotextile filter.
Also included in cost of liner is a geotextile filter at the cap layer.
Sand cost $12/CY, geotextile $3/SY and geomembrane $16/SY.
Volume of road fill calculated for road within the diked area requiring 120,000 CY.
Clearing costs determined by assuming $2800/acre for 14 acres.
Drainage costs assumed to be rerouting local drainage @ $20,000.
Hauling costs assumed fleet of 30 trucks and 4 loaders working 7 days/wk for 3 months with hauling distance = 30 miles.
Cap was assumed to be trucked from Boston (Boston Blue Clay from Improvement Project).
Dewatering cost based on Massport's recent bid for Moran Terminal and includes storage for up to 3 months.
Treatment of leachate from site is expected to require saline tainted water to be reansported to a local treatment plant, construction of package treatment plant or trucking to the ocean.
Cost of real estate acquisition not included.

TABLE 3-14 (CONTINUED). COST ESTIMATES FOR LAND-BASED SITES FOR DISPOSAL OF SILTS FROM BHNIP.

Wrentham-495

| Footprint (Sq Ft) | Perimeter (FT) | Dike Material (CY) | Dike Cost $11.00 /CY | Lining Cost $26.00 /SY | Road Fill $13.00 /CY | Clearing/ Drainage |
|---|---|---|---|---|---|---|
| 2,551,000 | 8,060 | 185,000 | $2,035,000 | $7,369,556 | $1,950,000 | $188,000 |

| Silt Volume (CY) | Dredging Cost/CY $7.10 | Hauling Cost/CY $12.00 | Cap Cost/CY $11.00 | Dewatering Cost /CY $12.00 | Treatment Cost /CY $2.00 |
|---|---|---|---|---|---|
| 785,500 | $5,577,050 | $9,426,000 | $1,977,800 | $9,426,000 | $1,571,000 |

| Total Cost | Unit Cost for Silt |
|---|---|
| $39,520,000 | $50.00 |

ASSUMPTIONS

Footprint (area) planimetered from quad sheet and added for two separate diked areas.
Footprint selected to avoid wetlands, power lines and residential areas.
Dike volume computed from dike height of 12', top width of 10', side slopes of 1V to 3H ("CAD CELL" program).
Sediment thickness 10' with 2' cap thickness.
Liner consists of geomembrane for positive cut-off, 1' of sand and a geotextile filter.
Also included in cost of liner is a geotextile filter at the cap layer.
Sand cost $12/CY, geotextile $3/SY and geomembrane $16/SY.
Volume of road fill calculated for road within the diked area requiring 150,000 CY.
Clearing costs determined by assuming $2800/acre for 60 acres.
Drainage costs assumed to be rerouting local drainage @ $20,000
Hauling costs assumed fleet of 30 trucks and 4 loaders working 7 days/wk for 15 months with hauling distance = 40 miles.
Cap was assumed to be purchased locally with volume of 179,800 CY determined from "CAD CELL" program.
Dewatering cost based on Massport's recent bid for Moran Terminal and includes storage for up to 15 months.
Treatment of leachate from site is expected to require saline tainted water to be transported to a local treatment plant, construction of package treatment plant or trucking to the ocean.
Cost of real estate acquisition not included.

TABLE 3-14 (CONTINUED). COST ESTIMATES FOR LAND-BASED SITES FOR DISPOSAL OF SILTS FROM BHNIP.

**Squantum - (Trucking)**

| Footprint (Sq Ft) | Perimeter (FT) | Dike Material (CY) | Dike Cost $15.00 /CY | Clearing/ Drainage |
|---|---|---|---|---|
| 782,500 | 4,300 | 87,900 | $1,318,500 | $45,200 |

| Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Dredging Cost/CY | Hauling Cost/CY $5.00 |
|---|---|---|---|---|
| 210,000 | 46,000 | 256,000 | $1,914,200 | $1,280,000 |

| Dewatering Cost/CY $12.00 | Road Fill $13.00 /CY | Total Cost | Unit Cost for Silt |
|---|---|---|---|
| $2,520,000 | $650,000 | $7,728,000 | $37.00 |

**Squantum - (Barging)**

| Footprint (Sq Ft) | Perimeter (FT) | Dike Material (CY) | Dike Cost $15.00 /CY | Clearing/ Drainage |
|---|---|---|---|---|
| 782,500 | 4,300 | 87,900 | $1,318,500 | $45,200 |

| Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Dredging Cost/CY |
|---|---|---|---|
| 210,000 | 46,000 | 256,000 | $1,914,200 |

| Dredging Access (CY) | Dredging Access $9.20 /CY | Rehandling Cost $15.00 | Total Cost | Unit Cost for Silt |
|---|---|---|---|---|
| 160,000 | $1,472,000 | $5,550,000 | $10,300,000 | $49.00 |

**ASSUMPTIONS**

Footprint (area) planimetered from quad sheet.
Footprint selected to avoid wetland.
Dike volume computed from dike height of 12', top width of 10' and side slopes of 1V to 3H time perimeter of 4300'.
Sediment thickness 10' with 2' cap thickness.
Clearing costs determined by assuming $1400/acre for 18 acres.
Drainage costs assumed to be rerouting local drainage @ $20,000.
Hauling costs assumed fleet of 10 trucks and 3 loaders working 7 days/wk for 4.5 months with hauling distance = 10 miles.
Dewatering cost based on Massport's recent bid for Moran Terminal and includes storage for up to 4.5 months.
Volume of road fill calculated for road within the diked area requiring 50000 CY.
The 2700' x 175' access channel assumed to have existing depth of -4'MLW and require a 12' depth.
Dredged material from access channel assumed to be disposed at MBDS.
Rehandling cost is for a barge-mounted crane to unload all scows.
Dredging costs - parent = $9.20, silt = $7.10.
Cost of real estate acquisition not included.
1,975,000 CY of additional parent material remain after capping and requires disposal.

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TABLE 3-14 (CONTINUED). COST ESTIMATES FOR LAND-BASED SITES FOR DISPOSAL OF SILTS FROM BHNIP.

**Everett-04**

| Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Mechanical Dredging Cost/CY | Rehandling Cost/CY | Total Dredging Cost | Bulkhead (LF) | Depth of Piles (FT) | Bulkhead Cost ($30 per SQ FT) |
|---|---|---|---|---|---|---|---|---|
| 37,000 | 18,000 | 55,000 | $7.10<br>$9.20 | $15.00 | $1,253,300 | 400 | 105 | $1,260,000 |

| Dike (CY) | Dike Cost/CY $15.00 | Footprint Area (SQ FT) | Average Depth (FT) | Wier/Silt Curtain Cost | Total Cost | Unit Cost for Silt ($/CY) |
|---|---|---|---|---|---|---|
| 17,100 | $256,500 | 243,936 | 8 | $36,590 | $2,806,390 | $76.00 |

**ASSUMPTIONS**

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Footprint (area) planimetered from quad sheet.
Footprint selected to avoid crossing municipal boundary.
Dike volume computed from dike height of 8', top width of 10' and side slopes of 1V to 3H.
Dike length 1700'.
Sediment thickness varies (assumed to be 8' on upland site and 18' in water) with cap thickness of 2'.
Rehanding cost is for a barge-mounted crane to unload the scows.
Bulkhead costs reflect $30/SF for steel.
Bulkhead assumed to tie to fast ground and only be necessary along fronting water edge.
Wier required and is based on cost of $0.15/CY of material contained.
Dredge costs - parent = $9.20, silt = $7.10.

## TABLE 3-15. COST ESTIMATES FOR AQUATIC SHORELINE OPTIONS

**NEARSHORE**
**AQUATIC SHORELINE**

| | | Volume | | | | | |
|---|---|---|---|---|---|---|---|
| | Fill to level of: | Sediment Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Surface Footprint (SQ FT) | Depth below MLW (FT) | Capacity/ Ft Depth (CY) |
| Revere Sugar | MLW | 86,000 | 18,000 | 104,000 | 160,000 | 17.5 | 6,000 |
| Amstar | MLW | 128,000 | 17,000 | 145,000 | 153,000 | 25.5 | 6,000 |
| Mystic Piers | MLW | 98,000 | 13,000 | 111,000 | 120,000 | 25 | 4,000 |
| Cabot Paint | MLW | 18,000 | 27,000 | 45,000 | 243,000 | 5 | 9,000 |
| Little Mystic Channel | -3 MLW | 303,000 | 70,000 | 373,000 | 630,000 | 19 | 23,000 |
| Reserved Channel-A | -6 MLW | 14,000 | 44,000 | 58,000 | 390,000 | 10 | 14,000 |
| Reserved Channel - B | +9.5 MLW | 186,000 | 37,000 | 223,000 | 334,000 | 8.5 | 12,000 |

| | Dredging/Handling | | | | Bulkhead Cost | | |
|---|---|---|---|---|---|---|---|
| | Dredging Cost/CY (silt) | Dredging Cost/CY (parent) | Rehandling Cost/CY | Total Dredging Cost | Bulkhead (LF) | Depth of Piles (FT) | Bulkhead Cost ($30/SQ FT) |
| Revere Sugar | $7.10 | $9.20 | $15.00 | $1,712,200 | 165 | 105 | $519,750 |
| Amstar | $7.10 | $9.20 | $15.00 | $2,370,200 | 375 | 105 | $1,181,250 |
| Mystic Piers | $7.10 | $9.20 | $15.00 | $1,814,400 | 225 | 105 | $708,750 |
| Cabot Paint | $7.10 | $9.20 | $15.00 | $781,200 | 930 | 105 | $2,929,500 |
| Little Mystic Channel | $7.10 | $9.20 | $15.00 | $6,152,300 | 360 | 105 | $1,134,000 |
| Reserved Channel-A | $7.10 | $9.20 | $15.00 | $1,026,200 | 585 | 90 | $1,579,500 |
| Reserved Channel-B | $7.10 | $9.20 | $15.00 | $3,668,000 | 585 | 90 | $1,579,500 |

| | Wier/Silt Curtain Cost | Design and Const. Mgt Cost | Contingency Cost (25%) | Total Cost | Unit Cost for Silt ($/CY) |
|---|---|---|---|---|---|
| Revere Sugar | $24,000 | $158,000 | $603,000 | $3,016,950 | $35.00 |
| Amstar | $22,950 | $250,000 | $956,000 | $4,780,400 | $37.00 |
| Mystic Piers | $18,000 | $178,000 | $680,000 | $3,399,150 | $35.00 |
| Cabot Paint | $36,450 | $262,000 | $1,002,000 | $5,011,150 | $278.00 |
| Little Mystic Channel | $94,500 | $517,000 | $1,974,000 | $9,871,800 | $33.00 |
| Reserved Channel-A | $58,500 | $186,000 | $713,000 | $3,563,200 | $255.00 |
| Reserved Channel-B | $50,100 | $371,000 | $1,417,000 | $7,085,600 | $38.00 |

**ASSUMPTIONS**

Surface area planimetered from navigation chart vertical sides assumed.
Depth is an average as shown on navigation chart or recent survey.
Dredging cost is not dependent on distance to disposal site.
Rehandling cost is for a barge-mounted crane to unload 60% of the scows (40% of scows to be bottom dumped).
Bulkhead costs reflect $30/SF for steel.
Bulkhead assumed to tie to fast ground and only be necessary along fronting water edge.
Wier required if disposal site to create fast land (cost is $0.15 x surface area).

| | | |
|---|---|---|
| Revere Sugar | 2,003,000 | CY of additional parent material remain after capping and requires disposal. |
| Amstar | 2,004,000 | " |
| Mystic Piers | 2,008,000 | " |
| Cabot Paint | 1,994,000 | " |
| Little Mystic Channel | 1,951,000 | " |
| Reserved Channel-A | 1,977,000 | " |
| Reserved Channel-B | 1,984,000 | " |

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TABLE 3-16. COST ESTIMATES FOR SUBAQUEOUS DEPRESSION OPTION B-2 FOR DISPOSAL OF SILTS FROM BHNIP.

**Subaqueous B**

| | Footprint (Sq Ft) | Existing Depth Below MLW (FT) | Proposed Depth Below MLW (FT) | Volume | | | Costs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Dredging Cost | Design and Const. Mgt Cost | Contingency Cost (25%) | Total Cost | Unit Cost for Silt ($/CY) |
| (North) | 2,498,000 | 21 | 15 | 278,000 | 278,000 | 556,000 | $4,531,400 | $75,000 | $1,152,000 | $5,758,400 | $21.00 |
| (South) | 1,116,000 | 26 | 15 | 331,000 | 124,000 | 455,000 | $3,490,900 | $65,000 | $889,000 | $4,444,900 | $13.00 |
| | | | | | | | | | Weighted Average | | $17.00 |

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**ASSUMPTIONS**

Footprint (area) planimetered from navigation chart.
Two footprint areas result from site being split by Dorchester Channel.
Existing depth calculated from navigation chart soundings within area.
Depth after disposal is finished depth including a 3 foot cap.
Vertical sides of disposal site are assumed.
Material will not flow out of the disposal site into adjacent channel.
Design effort involves minimal site hydrographic survey ($20,000) and benthic and fish studies ($10,000).
Contingency is 25%.
Dredging costs - silt = $7.10, parent = $9.20.

| | | |
|---|---|---|
| North | 1,743,000 | CY of additional parent material remain after capping and requires disposal. |
| South | 1,897,000 | CY of additional parent material remain after capping and requires disposal. |

TABLE 3-16 (CONTINUED). COST ESTIMATES FOR SUBAQUEOUS DEPRESSION OPTION B-2 FOR DISPOSAL OF SILTS FROM BHNIP.

**Subaqueous E (Gov Is and Lower Middle)**

| Footprint (Sq Ft) | Existing Depth Below MLW (FT) | Proposed Depth Below MLW (FT) | Volume | | | Costs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Dredging Cost | Design and Constr. Mgt Cost | Contingency Cost | Total Cost | Unit Cost for Silt ($/CY) |
| 3,451,000 | 15.8 | 8 | 614,000 | 383,000 | 997,000 | $7,883,000 | $109,000 | $1,971,000 | $9,963,000 | $16.00 |

**ASSUMPTIONS**

Footprint (area) planimetered from navigation chart.
Dredged material will not flow from the site
Existing depth calculated from navigation chart soundings within area.
Proposed depth is finished depth including a 3 foot cap.
Vertical sides of disposal site are assumed.
Design cost includes minimal site hydrographic survey ($20,000), and benthic and fish studies ($10,000).
Contingency is 25%.
Dredging costs - silt = $7.10, parent = $9.20.
1,638,000 CY of additional parent material remain after capping and requires disposal.

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TABLE 3-16 (CONTINUED). COST ESTIMATES FOR SUBAQUEOUS DEPRESSION OPTION B-2 FOR DISPOSAL OF SILTS FROM BHNIP.

**Subaqueous (Winthrop)**

| Footprint (Sq Ft) | Existing Depth Below MLW (FT) | Proposed Depth Below MLW (FT) | Volume | | | Costs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Dredging Cost | Design and Const. Mgt Cost | Contingency Cost (25%) | Total Cost | Unit Cost for Silt ($/CY) |
| 374,000 | 27 | 12 | 167,000 | 42,000 | 209,000 | $1,572,100 | $46,000 | $393,000 | $2,011,100 | $12.00 |

**ASSUMPTIONS**

Footprint (area) planimetered from navigation chart.
Existing depth calculated from navigation chart soundings within area.
Proposed depth is finished depth including a 3 foot cap.
Vertical sides of disposal site are assumed.
Material will not flow out of the disposal site.
Volumes shown are dredged volumes (expansion of dredged material has not been applied).
Design effort involves minimal site hydrographic survey ($20,000) and benthic and fish studies ($10,000).
Contingency is 25%.
Dredging costs - silt = $7.10, parent = $9.20.
1,979,000 CY of additional parent material remain after capping and requires disposal.

TABLE 3-17. COST ESTIMATES FOR IN-CHANNEL DISPOSAL OPTION B-3 FOR SILTS FROM BHNIP.

| Location | Trench | | | Volume | | | Cost | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (ft) | Width (ft) | Length (ft) | Trench Excav. (CY) | Silt Volume (CY) | 2' Cap Volume (CY) | Total Dredging Cost | Contingency Cost | TOTAL Cost | Unit Cost for Silt ($/CY) |
| Mystic River | 5 | 441 | 4,400 | 313,000 | 317,800 | 138,800 | $6,412,940 | $1,603,235 | $8,016,175 | $25.00 |
| Reserved Channel | 5 | 371 | 4,050 | 235,500 | 240,000 | 106,800 | $4,853,160 | $1,213,290 | $6,066,450 | $25.00 |
| Inner Confl. | 5 | 891 | 900 | 139,000 | 140,000 | 58,400 | $2,810,080 | $702,520 | $3,512,600 | $25.00 |
| Chelsea Cr. | 5 | 191 | 7,800 | 207,400 | 219,600 | 108,600 | $4,466,360 | $1,116,590 | $5,582,950 | $25.00 |

**ASSUMPTIONS**

Width of trench designed to avoid impacts to berths and their structures.
Trench is designed to avoid known areas of rock (no blasting is required for trench).
Trench excavation is volume of parent material removed to create trench in addition to that req'd for channel deepening.
Cap volume is a portion of parent material dredged from trench and placed 2' thick.
Top of capped trench is @ elev. -42' MLW or -40' MLW for Chelsea Cr. (overdepth elevation).
Dredging cost - Silt=$7.10/CY, Parent and Cap=$9.20/CY
Contingency is 25%.

| | | |
|---|---|---|
| Mystic | 1,882,200 | CY of parent material remain after capping and requires disposal. |
| Reserved | 1,914,200 | " |
| Inner Confl | 1,962,600 | " |
| Chelsea Cr | 1,912,400 | " |

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## Table 3-18. Cost Estimates for Aquatic Borrow Pit Option B-4 for Disposal of Silts from BHNIP

**Melsburger 2**

| Footprint (Sq Ft) | Perimeter (FT) | Existing Depth Below MLW (FT) | Excavate to Depth Below MLW (FT) | Volume | | | Costs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Silt Volume * (CY) | 3' Cap Volume (CY) | Total Volume at Disp site (CY) | Dredging Cost | Design and Constr. Mgt Cost | Contingency Cost (25%) | Value of Sand and Gravel $6.00 /CY | Total Cost | Unit Cost for Silt ($/CY) |
| 3,749,000 | 7,860 | 80 | 93 | 1,319,000 | 412,626 | 1,731,626 | $28,320,762 | $313,000 | $7,080,000 | $9,559,000 | $26,154,762 | $20.00 |

**Melsburger 7**

| Footprint (Sq Ft) | Perimeter (FT) | Existing Depth Below MLW (FT) | Excavate to Depth Below MLW (FT) | Volume | | | Costs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Silt Volume * (CY) | 3' Cap Volume (CY) | Total Volume at Disp site (CY) | Dredging Cost | Design and Constr. Mgt Cost | Contingency Cost (25%) | Value of Sand and Gravel $6.00 /CY | Total Cost | Unit Cost for Silt ($/CY) |
| 5,267,500 | 9,214 | 80 | 90 | 1,319,000 | 580,671 | 1,899,671 | $30,944,804 | $339,000 | $7,736,000 | $10,231,000 | $28,788,804 | $22.00 |

**ASSUMPTIONS**

Existing depth obtained from navigation chart soundings.
Proposed sediment thickness is the difference between existing and excavated depths minus the 3 foot cap.
Side slopes of 1 vertical to 3 horizontal were assumed.
Dredging costs account for dredging borrow pit and Boston Harbor sediments. (Melsburg mat. = $9.49, parent = $9.20, silt = $7.10).
Cap consists of 2 ft of parent material+1 ft of excavated sand and gravel to restore substrate.
Design effort involves minimal site hydrographic survey ($20,000), and benthic and fish studies ($10,000).
Value of excess sand and gravel excavated = $6.00 /CY to be picked up at a shoreline site
Contingency is 25%.
Melsburger 2 1,608,000 CY of parent material remain, after capping and requires disposal.
Melsburger 7 1,440,000 "

TABLE 3-18 (CONTINUED). COST ESTIMATES FOR AQUATIC BORROW PIT OPTION B-4 FOR DISPOSAL OF SILTS FROM BHNIP.

**CAD (Spectacle Island)**

| Footprint (Sq Ft) (acres) | Perimeter (FT) | Existing Depth Below MLW (FT) | Excavate to Depth Below MLW (FT) | Volume | | | Costs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Silt Volume (CY) | 3' Cap Volume (CY) | Total Volume (CY) | Dredging Cost | Silt Curtain Cost ($30/SY) | Design and Const. Mgt Cost | Contingency Cost (25%) | Total Cost | Unit Cost for Silt ($/CY) |
| 1,974,554<br>45 | 4,980 | 8.3 | 31.3 | 1,319,000 | 216,905 | 1,535,905 | $25,936,163 | $96,000 | $289,000 | $6,508,000 | $32,829,163 | $25.00 |

**ASSUMPTIONS**

The CAD is to be located further offshore than CA/T plan to avoid unsuitable material.
Footprint (area) planimetered from navigation chart.
Existing depth calculated from navigation chart soundings within area.
Proposed sediment thickness is the difference between existing and excavated depths minus the 3 foot cap.
Side slopes of 1 vertical to 3 horizontal were assumed.
Dredging costs account for dredging CAD and Boston Harbor sediments. (CAD mat. = $9.49, silt = $7.10, parent = $9.20)
Design includes minimal site hydrographic surveys ($20,000) and benthic and fish studies ($10,000).
Contingency is 25%.
Silt curtain was assumed to consist of two square enclosures 200 ft on a side and 18 ft deep.
No cost was assumed for operations of silt curtain during disposal events.
1,804,095 CY of additional parent material remain after capping and requires disposal.

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TABLE 3-19. ALTERNATIVES SCREENING OF TREATMENT TECHNOLOGIES FOR DREDGE MATERIAL DISPOSAL.

| CRITERIA | | TECHNOLOGY/PROCESS[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | THERMAL | | | | IMMOBILIZATION | | CHEMICAL | |
| | | FLUID BED | ROTARY KILN | VITRIFI-CATION | WET-AIR OXIDATION | CEMENT-BASED | LIME-BASED | ACID LEACHING | SURFAC-TANT |
| Effectiveness | Treat PCBs | X | X | X | X | X | X | X | X |
| | Treat PAHs | X | X | X | X | X | X | X | X |
| | Treat Trace Metal | | | X | | X | X | X | |
| | Project Applicable | X | | X | X | X | X | | |
| | Full Scale Test | X | X | | | X | X | | |
| | Environ. Mitigation | X | X | X | X | X | X | X | |
| Implementability | Comm. Availability | X | X | X | X | X | X | N | N |
| | Min. Site Size (ac)[b] | 4-7 | 5-8 | N | N | 6-9[c] | 6-9[c] | N | N |
| | Lead Time (mo.) | 24-48 | 24-48 | 24-48 | 24-48 | 24-48 | 24-48 | 24-48 | 24-48 |
| | Program Compatibility | X | X | | | X | X | | |
| | Est. Cost $/c.y.[d] | 200-350 | 200-350 | N | N | 50-60 | 50-60 | N | N |

[a]X = meets criterion; Blank = does not meet criterion or undetermined; N = not evaluated.
[b]These estimates represent first order estimates. Estimates do not include site acquisition or preparation costs, but do include receiving/storage and handling area, processing area, load out and transport area. Range represents primarily difference in buffer area assumption.
[c]Processing plant may be barge-mounted.
[d]Cost estimates based upon cost ranges in selected studies included in Reference List.

TABLE 3-20. COST ESTIMATES FOR USING EXISTING DISPOSAL SITES FOR DISPOSAL OF SILTS FROM BHNIP.

**Boston Lightship (BLS)**

| Footprint (SF) | Silt Volume (CY) | 3' Cap Volume (CY) | Dredging Cost | Design and Constr. Mgt Cost | Contingency Cost | Total Cost | Unit Cost for Silt ($/CY) |
|---|---|---|---|---|---|---|---|
| 8,454,800 | 1,319,000 | 1,055,500 | $19,075,500 | $221,000 | $4,769,000 | $24,066,000 | $18.00 |

**Massachusetts Bay Disposal Site (MBDS)**

| Footprint (SF) | Silt Volume (CY) | 3' Cap Volume (CY) | Dredging Cost | Design and Constr. Mgt Cost | Contingency Cost | Total Cost | Unit Cost for Silt ($/CY) |
|---|---|---|---|---|---|---|---|
| 8,454,800 | 1,319,000 | 1,055,500 | $19,075,500 | $221,000 | $4,769,000 | $24,066,000 | $18.00 |

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**ASSUMPTIONS**

Dredge costs - silt = $7.10/CY, parent and cap = $9.20/CY.
Cap volume calculated for 3' cap over footprint of 9,500,000 SF.
Design includes minimal site hydrographic survey ($20,000) for both sites, and benthic and fish studies ($10,000) for BLS only.
965,500 CY of additional parent material remain after capping and requires disposal.

TABLE 3-21. SCREENING MATRIX FOR DETERMINING THE LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE FOR DISPOSAL OF SILT FROM THE BHNIP.

| TYPE | SITE | PERMANENT HABITAT LOSS OR ALTERATION | WATER QUALITY EXCEEDENCES BEYOND DISPOSAL SITE | SOCIOECONOMIC EFFECTS | REASONABLE CAPACITY | BENEFICIAL USE[b] | COST ($/cy) | LEAST ENVIRONMENTALLY DAMAGING ALTERNATIVES |
|---|---|---|---|---|---|---|---|---|
| LANDFILL | E. Bridgewater | no | no | displacement of other users | no | minor | $56 | * |
| | Fitchburg/Westminster | no | no | displacement of other users | no | minor | $101 | * |
| | Plainville/Laidlaw | no | no | displacement of other users | no | minor | $87 | * |
| LAND-BASED-Inland | Woburn | no | no | traffic | no | cap landfill | $61 | |
| | Wrentham | yes | no | traffic | yes | no | $50 | |
| Coastal | Everett | yes | no | minor | no | no | $76 | |
| | Squantum Point | yes | no | neigborhood, traffic | yes | no | $37-49 | |
| AQUATIC Shoreline (Partial Fill) | Amstar | altered | mitigated | displacement of MWRA pier | no | contain contaminants | $37 | * |
| | Cabot Paint | altered | mitigated | minor | no | contain contaminants | $278 | * |
| | Little Mystic Channel | altered | mitigated | neighborhood | yes | contain contaminants | $33 | * |
| | Mystic Piers | altered | mitigated | minor | no | contain contaminants | $35 | * |
| | Reserved Channel | altered | mitigated | neighborhood, traffic | yes | resource enhancement; contain contaminants | $255 | * |
| | Revere Sugar | altered | mitigated | minor | no | contain contaminants | $35 | * |



(Continued)

TABLE 3-21. (CONTINUED)

| TYPE | SITE | PERMANENT HABITAT LOSS OR ALTERATION | WATER QUALITY EXCEEDENCES BEYOND DISPOSAL SITE | SOCIOECONOMIC EFFECTS | REASONABLE CAPACITY | BENEFICIAL USE[b] | COST ($/cy) | LEAST ENVIRONMENTALLY DAMAGING ALTERNATIVES |
|---|---|---|---|---|---|---|---|---|
| Subaqueous | Subaqueous B | altered | yes | minor | yes | no | $17 | |
| | Subaqueous E | altered | yes | minor | yes | no | $16 | |
| | Winthrop Harbor | altered | yes | interference with recreational boaters | yes | no | $12 | |
| In-Channel | Chelsea Creek | no | mitigated | minor | yes | no | $25 | * |
| | Inner Confluence | no | mitigated | minor | no | no | $25 | * |
| | Mystic River | no | mitigated | minor | yes | no | $25 | * |
| Borrow pit | Meisburger 2 | no | no | displacement of fisheries | yes | minable resource | $20 | * |
| | Meisburger 7 | no | no | displacement of fisheries | yes | minable resource | $22 | * |
| | Spectacle Island CAD | no | mitigated | minor | yes | minor | $25 | * |
| Existing Disposal Site | MBDS | no | no | minor | yes | no | $18 | * |
| | Boston Light Ship | no | no | displacement of fisheries | yes | no | $18 | * |
| TREATMENT | Solidification | no | no | minor | yes | potentially | $55 | * |

[a]≥200,000 cy
[b]through site preparation or use of silt, parent material not included since it has universal benefit
[c]cost could be reduced by beneficial use of mined sediments

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TABLE 3-22a. PRACTICABLE ALTERNATIVES (LISTED ALPHABETICALLY) FOR THE BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT

| SITE NAME | CAPACITY (cy) | COST PER CY | PARENT MATERIAL AND ROCK | BHNIP SILT[1] | FUTURE HARBOR MAIN-TENANCE[2] |
|---|---|---|---|---|---|
| HIGH CAPACITY SITES | | | | | |
| Boston Lightship (with capping) | Exceeds BHNIP project and 50-year maintenance needs. Total capacity unknown. | $18 | | X | X |
| Combined In-Channel Locations | 740,000 | $25 | | X | X |
| MBDS | Exceeds BHNIP project and 50-year maintenance needs. Total capacity unknown. | $18 | X | X* (with capping) | X* (with capping) |
| Meisburger 2 | 4,660,000 | $20 | | X | X |
| Meisburger 7 | 6,125,000* | $22 | | X | X |
| Spectacle Island CAD | 1,450,000 | $25 | | X | |

*Disposal-and-capping (of unsuitable material) is prohibited at MBDS until its efficacy can be effectively demonstrated (40 CFR 228.12 [Amended]).



[1]BHNIP silt material consists of approximately 1.3 million cubic yards. Additional material from the BHNIP includes approximately 130,000 cy of rock and 2.0 million cubic yards of parent material.

[2]Future harbor maintenance consists of maintenance dredging approximately 4.4 million cubic yards of material from the Main Ship Channel and 1.8 million cubic yards of material from the tributary channels. These volumes are estimated as the aggregate accumulation over the 50-year life of the project (as calculated beginning in 1997). These volumes are expected to be dredged intermittently over the life of the project as needed. Maintenance dredging of the tributary channels is not likley to be needed for at least 10-years after the BHNIP project, or not until the year 2007. Minor, spot dredging may be required in the President Roads Anchorage Area and Main Ship Channel, Outer Harbor, beginning in the year 2002 if shoaling conditions warrant. More extensive maintenance dredging of the outer channels is not expected to be needed until at least the year 2007.

TABLE 3-22b. POTENTIALLY PRACTICABLE ALTERNATIVES (LISTED ALPHABETICALLY) BUT LIMITED BY CAPACITY AND COST

| SITE NAME | CAPACITY (cy) | COST PER CY | PARENT MATERIAL AND ROCK | BHNIP SILT[1] | FUTURE HARBOR MAINTENANCE[2] |
|---|---|---|---|---|---|
| Amstar | 128,000 | $37 | N/A* | | X |
| Little Mystic Channel | 303,000 | $33 | N/A | X | X |
| Mystic Piers | 98,000 | $35 | N/A | | X |
| Reserved Channel | 185,000 | $255 | N/A | | X |
| Revere Sugar | 85,000 | $35 | N/A | | X |
| Lined Landfills | 102,000 | $56-$101 | N/A | | X |
| Treatment Technologies[5] | Unknown | $55 | N/A | X | X |

*N/A - Not Applicable

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[1]BHNIP silt material consists of approximately 1.3 million cubic yards. Additional material from the BHNIP includes approximately 130,000 cy of rock and 2.0 million cubic yards of parent material.

[2]Future harbor maintenance consists of maintenance dredging approximately 4.4 million cubic yards of material from the Main Ship Channel and 1.8 million cubic yards of material from the tributary channels. These volumes are estimated as the aggregate accumulation over the 50-year life of the project (as calculated beginning in 1997). These volumes are expected to be dredged intermittently over the life of the project as needed. Maintenance dredging of the tributary channels is not likley to be needed for at least 10-years after the BHNIP project, or not until the year 2007. Minor, spot dredging may be required in the President Roads Anchorage Area and Main Ship Channel, Outer Harbor, beginning in the year 2002 if shoaling conditions warrant. More extensive maintenance dredging of the outer channels is not expected to be needed until at least the year 2007.

[5]Screening and evaluation of treatment technologies resulted in solidification as being the only practicable alternative for the BHNIP project. Other technologies were eliminated based on availability, quantity of material to be dredged, throughput requirements and costs which, for some of the technolgoies screened, could run as high as $350 per cy.

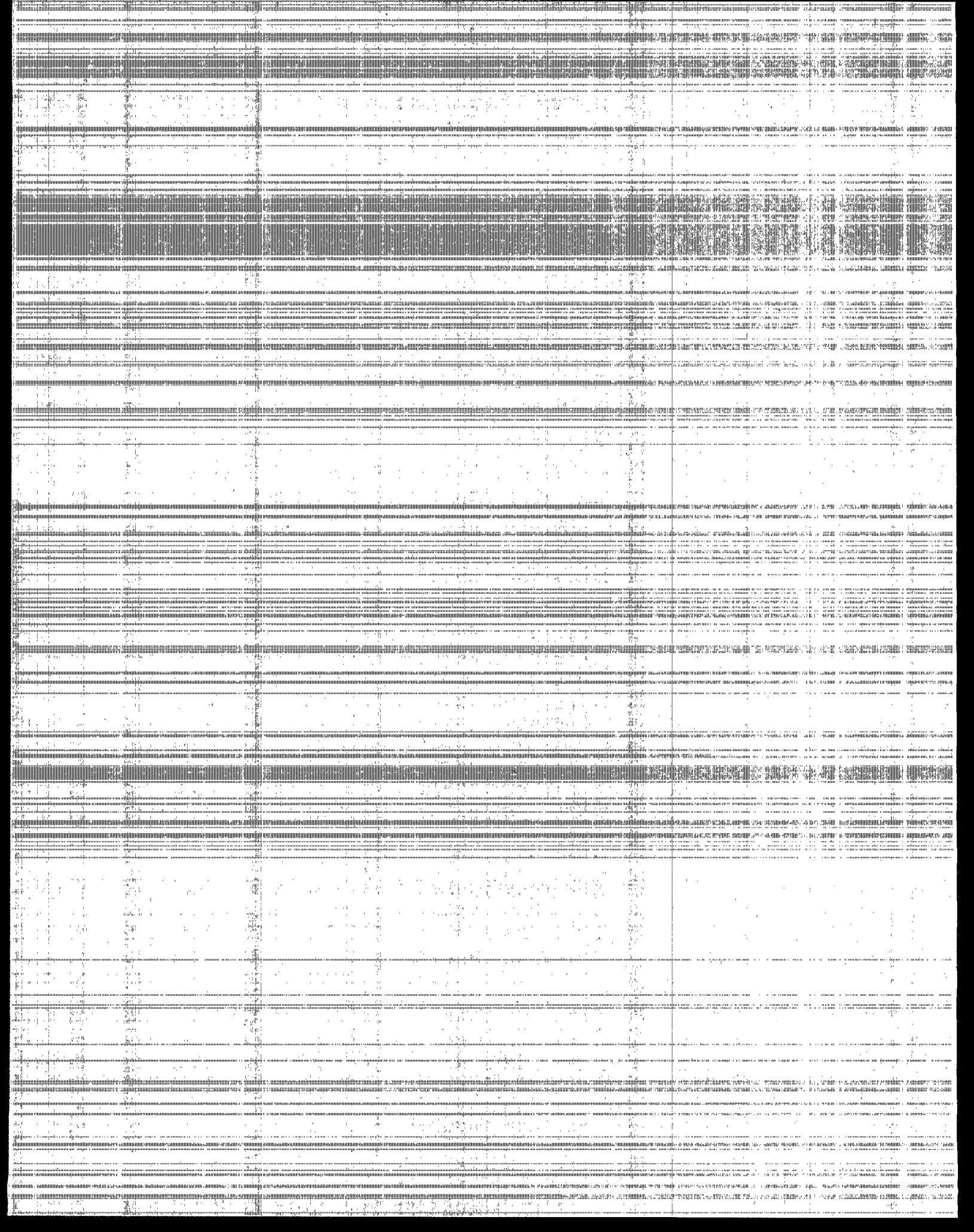
TABLE 3-22c. ALTERNATIVES (LISTED ALPHABETICALLY) EVALUATED BUT FOUND NOT PRACTICABLE DUE TO ENVIRONMENTAL FACTORS OR COST

| SITE NAME | CAPACITY (cy) | COST PER CY | PARENT MATERIAL AND ROCK | BHNIP SILT[1] | FUTURE HARBOR MAINTENANCE[2] |
|---|---|---|---|---|---|
| Cabot Paint | 18,000 to MLW<br>99,000 to MHW | $278 | N/A* | N/A | X |
| Everett | 55,000 | $76 | N/A | N/A | X |
| Squantum Point | 210,000 | $37-$49 | N/A | N/A | X |
| Subaqueous B | 600,000 | $17 | N/A | N/ | X |
| Subaqueous E | 614,000 | $16 | N/A | N/A | X |
| Winthrop Harbor | 167,000 | $12 | N/A | N/A | X |
| Woburn | 158,600 | $61 | N/A | N/A | X |
| Wrentham | 785,500 | $50 | N/A | N/A | X |

*N/A - Not applicable

[1]BHNIP silt material consists of approximately 1.3 million cubic yards. Additional material from the BHNIP includes approximately 130,000 cy of rock and 2.0 million cubic yards of parent material.

[2]Future harbor maintenance consists of maintenance dredging approximately 4.4 million cubic yards of material from the Main Ship Channel and 1.8 million cubic yards of material from the tributary channels. These volumes are estimated as the aggregate accumulation over the 50-year life of the project (as calculated beginning in 1997). These volumes are expected to be dredged intermittently over the life of the project as needed. Maintenance dredging of the tributary channels is not likley to be needed for at least 10-years after the BHNIP project, or not until the year 2007. Minor, spot dredging may be required in the President Roads Anchorage Area and Main Ship Channel, Outer Harbor, beginning in the year 2002 if shoaling conditions warrant. More extensive maintenance dredging of the outer channels is not expected to be needed until at least the year 2007.



## 4.0 DREDGING MANAGEMENT PLAN

The MEPA certificate required that this EIR/S include a dredge management plan to provide an overview of the entire process of dredging and disposal for the project. This section serves as the Plan and includes a description of equipment to be used for the dredging and the sequence of construction. This section also gives an overview of the potential environmental impacts of the dredging operations and likely mitigation measures to be employed.

In this draft stage, and in the absence of a specific disposal plan, the dredge management plan is limited to general descriptions of the practicable alternatives identified earlier (Section 3.0) and is more qualitative than quantitative. When the Preferred Alternative is identified in the final EIR/S the plan will be completed and become site specific with the objective of maximizing efficiency of the operations within the known constraints and being responsive to the comments raised during the public review of the DEIR/S.

## 4.1 SELECTION OF DREDGING METHOD

The selection of a dredging method for a given project, is tied to several factors. These include the physical characteristics of sediments to be dredged, quantities to be dredged, dredging depth, distance to the disposal area, contamination level of sediments, the method of disposal, the dredging rate required and the type of dredges available.

There are three basic types of dredges: hopper, hydraulic and mechanical. Hopper dredges are self propelled dredging plants that drag material off the bottom and pump it into hoppers. The advantages of hopper dredges include their ability to work in rough, open water; move quickly to job sites under their own power; ability to move out of the way of other ship traffic; dredge to project depths quickly; and to economically transport dredged material for long haul distances. Limitations of hopper dredges are that they cannot work in shallow depths; cannot dredge continuously (must empty the hoppers); excavate with less precision; cannot work economically with contaminated sediments requiring segregation and special disposal; and cannot easily dredge hard banks and consolidated substrate.

The second major type of dredge is hydraulic pipeline. Hydraulic dredges are mostly non-self propelled units which have the ability to continuously dredge using a cutterhead that feeds material directly into a pipeline which can place material directly in disposal sites. The advantages of hydraulic dredges include their ability to excavate most types of materials, pump directly to disposal sites, dredge almost continually and dredge some rock types without blasting. Limitations of hydraulic pipeline dredges include limited capability in rough open water; not being able to move quickly under their own power; difficulty with coarse sand in high currents; and obstructing traffic with the pipeline. In addition, hydraulic dredges have limitations related to pumping distances. It may be very economical for cases where disposal sites are nearby but generally at pumping distances over 9,000 feet a booster is required and the percentage of solids pumped per unit volume will decrease.

Mechanical dredging by bucket or clamshell is similar to land based digging operations. The mechanical dredge scoops out material and dumps the contents of the bucket onto a barge which is then used to transport the material to its disposal or use location. The advantages of mechanical dredging are that it is rugged and capable of removing hard packed material, can remove debris, can work in tight areas and is efficient for disposal at long haul distances. Limitations include low production rates compared to the first two methods described and the necessity to employ adequate measures to control contaminated sediments during removal.

The hopper dredge was not selected as the preferred dredge because of several factors, principally the restricted operating areas within the three channels, the haul distance, and the expected difficulty with dredging clay and other undisturbed parent material. The hydraulic dredge, likewise, is not the preferred dredge because of great pumping distances required and the high percentage of water it would entrain in the dredged material. Therefore, the mechanical dredge is most likely to be the selected dredge for both the silt and the parent material to be removed.

### 4.1.1 Mechanical Dredge Plant

Since the mechanical dredge is basically a crane on a barge, there is some flexibility available when choosing the type of clamshell bucket to be used. Studies (Zappi 1991) have shown that a modified, or environmental, bucket, which is nearly watertight when closed, will reduce turbidity in the vicinity of the dredging site. This bucket is designed so that the fines in the dredged material are not washed out as it is drawn up through the water column. Use of a modified bucket is planned when dredging the silt sediments. A standard bucket, capable of higher productivity, is planned for dredging the parent material which is cohesive and does not contain contaminants.

Bucket size is a variable which is dependent on the dredge horsepower. Bucket sizes up to 20 to 22 cy were used by the Third Harbor Tunnel contractor. The Third Harbor Tunnel contractor used the "Super Scoop" which provided 2,100 horsepower. The dredge "Boston", which typically lifts up to an 18 cy bucket, uses a plant with 1,600 horsepower. For estimating purposes, a 15 cy bucket was assumed for use on this project. Actual equipment to be used will be dependent on availability when ready for use by contractor. Based on the amount of material to be dredged a 15 cy bucket would be required at a minimum.

Scows and barges to hold the dredged material range from a very small 500 cy capacity to the typical 1,500 to 2,000 cy to the maximum of 4,000 cy size. Because of their size and initial costs the 3,000 and 4,000 cy scows are likely to be owned only by the larger dredging contractors. Also, ocean going tugs must be large enough to handle the larger scows. The assumed scow size range for the project material suitable for ocean disposal is 2-3,000 cy. Actual equipment to be used will of course be dependent on its availability to the contractor. Small scows or barges would likely be used for nearshore and shoreline disposal where transportation distances are short and maneuvering area is limited.

### 4.1.2 Rock Blasting Plant

The rock blasting plant will typically consist of a deck barge with one or more drilling rigs mounted in such a manner as to allow movement of the rig while the barge is held fast by an anchoring system. In addition to the drill barge, there is need of a tug or tender to move the drill barge or anchors when necessary. An explosive materials barge may also be included in the equipment listing.

## 4.2 SEQUENCE OF DREDGING OPERATIONS

The operations involved in completing a dredging project are interrelated yet diverse. The type of equipment and sequence of dredging and disposal operations depends on the disposal plan. Specific information will be provided in the Final EIR/S. A general description of dredging operations for open water disposal follows.

### 4.2.1 Pre-Dredge Sequence

Surveys of existing channel and berth bottoms and utilities for possible relocation or protection are done

before the dredge plant arrives on site. Also in advance of the dredge arrival, planning for minimal interference with continuous vessel traffic will have to be coordinated with port users. Prior to dredging, turbidity controls must be assessed and selected. Turbidity generated by a typical mechanical dredging operation is the result of sediment resuspension occurring when the bucket impacts on and is pulled off the bottom. Also, because most buckets are not covered, the "surface" material in the bucket and the material adhering to the outside of the bucket are exposed to the water column as the bucket is pulled up through the water column. When the bucket breaks the water surface, turbid water may spill out of the bucket or may leak through openings between the jaws. As stated earlier, to minimize turbidity from the bucket, and to control contaminated sediments, a watertight "environmental" bucket is proposed. Research has shown that the use of watertight buckets can generate 70% less turbidity in the water column than typical buckets (USACOE, 1987). Overall, near-bottom suspended solids are greater than midwater or surface levels indicating that resuspension of bottom material near the clamshell impact point is probably responsible for most of the material suspended in the lower portion of the water column.

One method for physically controlling the dispersion of near-surface turbid water in the vicinity of clamshell dredging operations involves placing a silt curtain or turbidity barrier either downcurrent from or around the operation. Silt curtains are not recommended for operations in the open ocean, in currents exceeding 50 cm/sec (1 knot) or in areas frequently exposed to high winds and large breaking waves.

Silt curtains are impervious, floating barriers that extend vertically from the water surface to a specified water depth. The flexible, nylon-reinforced polyvinyl chloride (PVC) fabric forming the barrier is maintained in a vertical position by flotation segments at the top and a ballast chain along the bottom. A tension cable is often built into the curtain immediately above or below the flotation segments to absorb stress imposed by currents and other hydrodynamic forces. The curtains are usually manufactured in 30-m sections that can be joined together at a particular site to provide a curtain of specified length. Anchored lines hold the curtain in a deployed configuration that is usually U-shaped or circular. The silt curtain does not indefinitely contain turbid water, but instead diverts its flow under the curtain, thereby minimizing the turbidity in the upper water column outside the silt curtain. When properly deployed and maintained, silt curtains can effectively control the flow of turbid water.

Silt curtain effectiveness, defined as the degree of turbidity reduction outside the curtain relative to the turbidity levels inside, depends on several factors: the nature of the operation; the quantity and type of material in suspension within or upstream of the curtain; the characteristics, construction, and condition of the silt curtain as well as the area and configuration of the curtain enclosure; the method of mooring; and the hydrodynamic conditions (i.e., currents, tides, waves, etc.) present at the site. Because of the high degree of variability in these factors the BIINIP dredging design will consider the appropriateness and practicability of silt curtain deployment depending on the dredging location and character of material dredged.

### 4.2.2 Dredging Sequence

When the dredge is ready to begin work, survey ranges must be established to ensure the dredge remains in the proper location. Once the dredge has been set in place and before dredging, any required turbidity controls will be set. If a silt curtain is required, it will be adjusted each time the dredge is moved and each time a barge is towed out or an empty barge is brought into the protected area. Because much of the silt to be removed from Boston Harbor is considered unsuitable for unconfined open water disposal, these sediments will need to be separated from the suitable or parent material. This



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will be accomplished by making two passes over the same area of the channel. During the first pass, the dredge, using the modified (environmental) bucket, will remove the silty maintenance material exposing the parent materials below. Because the modified bucket is expected to have small or no teeth, it will not penetrate deeply into the underlying parent material. Thus, the silty sediments and only a small amount of the parent material will be removed during the first pass. This material will be placed in a scow and disposed by the selected method.

Parent material will be removed during the dredge's subsequent pass. A standard bucket will be used to dredge this material. As this material has been determined to be suitable for unconfined open water disposal, it may be transported by scows and disposed at the Massachusetts Bay Disposal Site, or another site for beneficial use if needed.

During the dredging of silt it is anticipated that debris that commonly litters the harbor floor will be encountered. This debris includes old pilings, cables, ropes, tires and other litter of various sizes. It is impractical to remove debris before dredging because some of it is buried in the silt layer and may not be detectable until exposed by the dredge. Attempts to completely remove this debris before dredging would be very costly and would likely be unsuccessful. Also, removal of debris could cause sediment re-suspension.

The dredge operator will take precautions concerning debris when using the environmental bucket. If the operator encounters debris, that the bucket has picked up, that is large enough to protrude from the bucket and prevent a tight seal, he can hold the bucket just above the bottom and allow sufficient time for the silt to drain out. The debris will be brought carefully to the surface for disposal. Only when the operator can completely close the bucket will he bring it directly to the surface. Smaller debris, which may be undetectable by the operator, can prevent closure of the bucket but silt loss would be minor.

To reduce water transfer to the disposal barge, the operator may hold the environmental bucket above the water surface, within the protected area, to decant water from the top of the load. If small debris has prevented bucket closure then the operator may be required to unload the bucket into the barge without decanting the water. This would reduce the amount of silt returning to the water.

Rock is expected to be encountered at the mouth of the Reserved Channel, in the Inner Confluence and in the Mystic River Channel. When rock removal is required, the overlying layers of silts and parent material will be removed by the dredge first. The drill barge will then be set up, holes drilled and filled with explosives. The vessel traffic will be cleared from the area, and the explosives detonated. When the drilling and blasting has been completed, the dredge will return to remove the broken rock by placing it in scows or on deck barges depending on the final disposal plan. Blasted rock is suitable for unconfined open water disposal and may also be valuable for beneficial uses such as rock reefs for marine habitat.

Dredging operations will be influenced by weather conditions, vessel traffic conditions, and environmental restrictions that might be placed on the project. Winter weather will impact on tug and scow trips to disposal sites. During stormy weather the tug captains will make the decision to go or not to go to the disposal areas. Vessel traffic may have a seasonal impact since the winter heating fuel requirements may generate an increase in tanker traffic. Likewise, recreational traffic will increase during the summer although the three tributaries do not support significant amounts of recreational craft. Environmental constraints such, as anadromous fish movements, require cessation or limits for dredging during the spawning period February 1 through June 15 in the Mystic River and Inner Confluence.

### 4.2.3 Structural Impacts of Dredging

Dredging has the potential to remove material necessary for stability of bulkheads along the shorelines of the project channels. Engineering studies conducted prior to the dredging will ensure that bulkhead stability will not be affected. These studies may require on-site geotechnical and hydrographic investigations and will be done on a case by case basis. Dredging also has the potential to damage utility crossings either from clamshell impact or exposing them to passing vessel traffic. Coordination with utility companies has identified known utility crossings principally in Chelsea Creek which will be relocated or protected by the project. The Chelsea Creek portion of the project will require moving Boston Edison Cables and MBTA cables, removing an MWRA water tunnel and protecting the Boston Gas Siphon.

### 4.2.4 Traffic Considerations

As indicated above, scows will be used to transport dredged material to the open ocean disposal site and to whatever other disposal site is selected for material deemed unsuitable for unconfined disposal. If two dredges are working, each will load a barge in a 12 hour period. It is expected that up to four barge loads of material would be taken out of the harbor daily. Vessel traffic by others in the ship channels will not be much of a concern because the tow line (hawser) will not be let out to full length until after the tug and scow unit has cleared the channel and is underway in the bay. Harbor activities will continue as normal. The dredge will be stationary in the channels. The scows will be tied along side of the dredge. Vessel traffic will be required to navigate around the equipment and only the larger commercial vessels will require special coordination with the dredge operator in order to have the dredge plant move out of the channel.

Blasting operations, previously mentioned, are expected to be required in the Mystic River channel, the Inner Confluence, on the north side of the Reserved Channel near the mouth, and across the Main Ship Channel from the Reserved Channel. During blasting, all vessel traffic will be regulated; the Coast Guard will impose safety zones to ensure that vessel traffic remains a safe distance from the blast.

## 4.3 DISPOSAL OPERATIONS

As mentioned earlier, this dredge management plan focuses on the disposal options identified as practicable in Section 3.0. While a final option awaits the results of the public review of the EIR/S some general operational details can be expected for each category of disposal options.

### 4.3.1 Shoreline Disposal

Disposal of unsuitable material behind bulkheaded areas within the harbor will require rehandling of the dredged material. Hydraulic dredging with a pipeline into these disposal areas is the least costly method but can have adverse water quality impacts. A hydraulic dredge could be used to skim off the silt material in the channels and berths and easily deposit the sediments behind a bulkhead. There would be no need for rehandling. However, due to pumping requirements, the use of a hydraulic dredge would appear to be practical only when the disposal site is within 9,000 feet of the dredge site. If a mechanical dredge is used, unsuitable material would be placed in a scow and towed to the bulkhead. Because of the time it takes to construct the bulkhead, scows could be dumped inside the disposal site as long as the opening in the partially constructed bulkhead is sufficiently large for the scow and tug to enter and exit the site until disposed material reaches the opening. Once the bulkhead closure is completed, a land based or barge mounted crane would be used to unload the remaining scows and place the silts and

capping material. Weirs or stoplog controls would be built into the bulkhead to allow excess water to flow out from behind the bulkhead. Once the material has been placed the material will be capped with parent material (depending on the intended use of the site). The bulkhead would then be cut to allow for tidal exposure unless the area behind the bulkhead is to become dry land.

Shoreline disposal will increase the in-harbor vessel traffic as scows or barges move from the dredge site to the disposal site and back. If hydraulic dredging is used, then the pipeline between the dredge and the disposal site may restrict traffic.

During the placement of the dredged materials, quality of water flowing from the confined area back into the harbor will require monitoring. Measures must be taken to prevent silt from reentering the harbor. This can be accomplished by regulating the stoplog structure at the outlet so that placed material has sufficient time to settle silts.

### 4.3.2 Subaqueous Depressions and Borrow Pits

Disposal of silts at nearshore sites requires site preparation such as constructing dikes to contain the material, excavating, or finding naturally occurring containment areas. Disposal of parent material at these sites does not require containment.

If dredging at the site is required before disposal, the area will require hydrographic surveys to establish existing bathymetry. Placement of dikes, if required for containment, would be accomplished by using scows which would be positioned with buoys and ranges established for the purpose. Water depths at the disposal site must be at least 11 or 12 feet to make the site suitable for bottom dumping. Shallower depths will condition material placement on favorable tides. For shallow sites that would not permit bottom dumping, even during high tide, mechanical removal from the scow will be required. Dike material placed by scows should be able to maintain side slopes of at least 1V:3H. Flatter slopes would consume much of the containment area making the site less efficient.

The borrow pit disposal sites require excavation prior to disposal and require a dredge to be stationed at the site. The open ocean can be dangerous for equipment not designed for that environment. A large dredge plant will be required to withstand weather conditions and quickly finish the job. Material dredged from the borrow pits may have commercial value and as such would likely be placed on a deck barge or in a hopper barge rather than a dump scow for ease of unloading. If the material had no commercial value, then dump scows would be used to carry the material to an ocean disposal site.

When the disposal area preparation is complete the unsuitable silts will be brought to the site by scow and deposited using buoys to pinpoint the disposal location. Depth of material deposited in the area will vary depending on the site but, in general, greater depths can be obtained in excavated areas.

When all the unsuitable sediments have been deposited, or surveys indicate capacity of the site has been reached, the scows will bring material to cap the area. The cap should be a minimum of three feet thick over the entire disposal area and allowance for the cap must be included when determining the capacity of the disposal area.

Winter weather will not have as great an impact on nearshore disposal operations as on offshore operations. However, winter storms can still make for treacherous conditions and the tug captains will be making the decision to put to sea or stay within the harbor. Seasonal constraints may be imposed depending on the biological resources of concern.

The contractor will mark the disposal site clearly to avoid interference with fishermen. The final elevations of the off-shore sites should be no greater than



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10-15 feet above surrounding areas and should not pose a threat to navigation. The shallow water sites are outside of established navigation lanes. The final elevation at those sites would be no higher than the adjacent channel depth.

During construction and disposal operations, additional hydrographic surveys will be required. These will confirm progress on dike construction and track filling in the area. Remote photography may also be employed. Location of the buoys marking the disposal site would be checked after each severe storm since they will be subject to movement under storm conditions.

The contractor will carry an inspector on the tug to record the time and location of each disposal event to insure scows are being dumped at the proper location.

Hydrographic surveys before and after cap placement will be required to confirm cap thickness. The cap should be at least three feet thick and will require coordination during the dredging operation to insure enough suitable material is available when needed.

Mitigation measures will not be required at the disposal sites. The disposal sites will be temporarily impacted from construction activities. When completed, each site will be returned to its original configuration. Pioneer benthic organisms will recolonize the cap material and rework the area for successive trophic level species. Long term monitoring of subaqueous depressions and borrow pits is expected to continue through the Corps' Disposal Area Monitoring System (DAMOS).

### 4.3.4 In-Channel Disposal

Another alternative considered in Section 3.0 was disposal in trenches constructed within the Mystic River, the Inner Confluence and the Chelsea Creek Channels.

This option will require that prior to construction of the first segment of the trench, sediments will be dredged from the overlying area. This material will be stored temporarily on scows. The trench will be excavated into parent material. The stored sediments will then be placed into the trench. Sediments overlying the next segment of the trench will be removed and deposited directly into the previous segment of the trench. The next segment of the trench will be dredged and sediments deposited and so forth until the entire trench is completed. The remaining channel sediments will be dredged and deposited directly into the trench.

Periodic surveys of the excavated trench may be necessary to monitor progress for computing volumes of materials disposed. After capping the trench, follow-up surveys may be used to assure that minimum cap thickness has been attained and that the top of cap does not encroach into the overdepth elevation of the channel bottom.

Once the trench is completed and all sediments are deposited, the remaining dredging of the parent material will be completed. This material may be used to cap the trench. The top of the cap will be no higher than the overdepth elevation. This assures that future maintenance of the channel will not remove the cap and expose the sediments. The remaining parent material will be disposed at MBDS or other suitable site.

Because this disposal option is limited to dredging and disposal operations within the same area that dredging is taking place, all seasonal and weather constraints that are applicable to dredging in the channel also apply to the disposal in that channel. The only environmental constraints apply to the Mystic River and the Inner Confluence as described previously.

In-channel disposal will increase the in-harbor vessel traffic as the dredge plant and scows move along the trench line during excavation, disposal and

capping. The dredge plant will spend more time in the channels being dredged than other alternatives and will require more coordination with other vessel operators to avoid traffic conflicts.

No mitigation is required except for seasonal constraints at the dredging site for spawning anadromous finfish. This option is attractive because disposal will take place in areas that have been previously disturbed.

### 4.3.5 Open Water - Existing Disposal Sites

These sites include the MBDS and Boston Lightship disposal areas. These sites are previously used disposal sites. MBDS requires no site preparation other than siting the disposal buoy(s) at the target location. The Boston Lightship site will require bathymetric surveys. Bottom dump scows will be used to haul and place unsuitable silty material at the target location(s). This sequence will continue until all silty material has been deposited. Prior to capping, surveys of the silt material will be taken and adjustments to the buoy location made to ensure complete coverage by the cap. Bottom dump scows will then place suitable material over the mound of silty material to form a cap of at least 3 feet in thickness.

Vessel traffic along the haul route to the open water disposal site at the Massachusetts Bay Disposal Site is expected to be light. Large commercial vessels will be crossing the route but chances of a tug and scow unit meeting a larger vessel on the haul route are slight. Commercial fishing vessels will have the greatest opportunity for conflict with the towing operation. Past experience has shown that early coordination with the fishermen and a marked haul route is the best course for both the contractor and the fishermen.

Monitoring requirements will focus on periodically confirming the location of the disposal buoy and the haul route buoys. Hydrographic surveys should be performed quarterly to note disposal trends and recommend disposal buoy location. The contractor will carry an inspector on the tug to verify disposal takes place at the disposal site buoy. An electronic recording device or "black box" may also be employed to confirm location at the time of release of the scow's load.

During construction and use of the disposal areas, additional hydrographic surveys will be required. These will track filling of the area. Remote photography may also be employed. Location of the buoys marking the disposal site should be checked after each severe storm since they will be subject to movement under storm conditions.

Hydrographic surveys before and after cap placement will be required to confirm cap thickness. The cap should be at least three feet thick and will require coordination during the dredging operation to insure enough suitable material is available when needed.

Long term monitoring at MBDS is expected to continue through the Corps' Disposal Area Monitoring System (DAMOS). Long term monitoring of the Boston Lightship site also fits in the scope of the DAMOS program.

## 4.4 OVERALL SEQUENCE OF OPERATIONS

Figure 4-1 is a sample timeline showing the sequence of operations for dredging and disposal at the MBDS for each of the navigation channels and the berth areas. The proposed navigation improvement dredging is scheduled to occur over a 12 to 18-month timeframe.

The overall specific sequence of the dredging and disposal operations depends on the disposal site(s) selected and will be shown in the final EIR/S.



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Generally, the final disposal site(s) selected will have impact on the construction schedule. The following overview describes how the schedule may be effected by the preferred disposal plans as compared to that of MBDS as displayed in Figure 4-1:

Shoreline Aquatic Disposal - Before dredging, the disposal site must be prepared. The schedule would include construction of bulkheads, water control structures, other site preparation and mobilization of all equipment required to handle the dredged material at the site. These operations would delay the start of dredging from that shown on Figure 4-1. Once dredging is initiated, the extra handling of the material will add time to each dredge/dispose cycle. The extra time will be partially offset by the shorter travel time from dredge to disposal than that for MBDS. It is estimated that the total construction time will not be significantly different from that shown on Figure 4-1.

Subaqueous Containment and Borrow Pits - Before dredging, the disposal site must be prepared. This duration will delay the start of dredging depending on the site(s) selected and amount of preparation required. Once the disposal site is prepared, the construction would continue as shown on Figure 4-1. Although the borrow pits are closer to the harbor than MBDS the savings in the total schedule would be minor. It is estimated that the overall construction time will be longer than that shown on Figure 4-1.

Open Water and In-Channel Disposal - The schedule shown in Figure 4-1 would apply to any open water site with capping. In-channel disposal requires multiple handling of the silt and parent material that would add time to each dredging step. This additional time may be offset by the significantly shorter travel time from dredge site to disposal trench. It is estimated that the overall construction time will be longer then that shown on Figure 4-1.

## 4.5 ENVIRONMENTAL IMPACTS EXPECTED FROM DREDGING OPERATIONS

This section gives an overview of the potential impacts of dredging on the water quality, sediment, biological, cultural and socio-economic resources.

### 4.5.1 Water Quality/Sediment Quality

The proposed navigation improvement dredging is scheduled to occur over a 12 to 18-month timeframe. The activity will generate high turbidities near the actual operation which decrease rapidly with distance. Some of the exposed particulate silt may be temporarily unsettled and oxygen depleted at the sediment/water interface. Subsequent physical and biological activity will stabilize and oxygenate the substrate over time. Any underlying parent material that becomes exposed from the dredging should remain physically stable. The channel deepening should not alter the flushing rate of Boston Harbor appreciably, given the 150 billion gallon plus diurnal tidal prism that currently exists.

As stated earlier mechanical bucket dredging will be used to excavate the substrate. Only a relatively small percentage of the dredged material becomes suspended in the water column if the appropriate equipment (i.e., an environmental bucket for the silts) is used. More of the material would be released during dredging operations if large debris prevents the dredge bucket from closing. See Section 4.2.2 for descriptions of dredging environmental controls and debris handling. This suspended material is principally restricted to the silt or clay fraction ( < .06 mm) with sand particles ( < .06 mm) settling out immediately after suspension. Grain size analyses (average) of 18 stations in the channel (see Appendix C2) identify the substrate as 86.5% fine grained, 2.3% rock and the remaining material as sand.

The organic material associated with the silt/clay material could depress ambient oxygen concentrations. However, the chemical oxygen demand for all 18 stations sampled averaged 80,509 ppm for surficial samples, a moderate value. The clean parent material (approximately 62% of the material to be dredged) would not exert an oxygen demand on the water column because this material does not contain substantial organic materials. Increased turbidity would reduce light penetration, lessening primary productivity and possibly reducing oxygen release from photosynthetic processes. Finally, upon settling, the suspended sediment load, both sand and silt/clay, could cover non-motile organisms adjacent to the dredging areas. As discussed in Attachment 1 the benthic community in the inner harbor is dominated by species indicative of a disturbed environment. No commercial shellfish species are known to exist in the tributaries. All of these effects are expected to be spatially and temporally limited to the immediate area of the dredge and length of the activity.

Bohlen (1979) analyzed the water column effects of mechanical dredging of a silt/clay substrate in New London Harbor, Connecticut. This research concluded the effects of suspended silt on water quality to be of short duration and localized to the immediate dredge site. While suspended, silt increases water turbidity levels. High turbulence reduces vision and masks odors important to foraging organisms. Suspended silt may also clog or abrade gill structures and interfere with the feeding mechanisms of filter feeders (Profiles Research and Consulting Group, 1980). Turbidity may also interfere with chemical signals important to anadromous migrations. To eliminate interference with anadromous species, dredging would not occur when anadromous species are spawning in the Mystic River. Other finfish species are expected to generally avoid or circumvent the area of high turbidity.

During various dredging operations, scientific analysis of the spatial and temporal persistence of the turbidity/organic plume has been quantified. In the summer of 1977 the extent and duration of the impacts from dredging the Thames River/New London Harbor channels were studied (Bohlen et. al., 1979). The depth of the channel was similar (39 feet) to the navigation channels in Boston Harbor. The mean tidal range was about one-third less than Boston Harbor's mean tidal range. Annual average streamflow of this system over the past five years has varied between 70 and 76 cubic meters per second which is several orders of magnitude greater than the freshwater flow into Boston Harbor. The Thames River material was predominantly silt/clay ( < .06 mm). Analysis of the composition and concentration of the plume indicated the majority of suspended material occurred within 30 meters of the dredge. Suspended material concentrations were reduced by a factor of ten within the first 200 meters downstream of the dredge. Midwater and near bottom concentrations returned to background levels 700 meters downstream of the dredge. All concentrations were substantially less than storm induced perturbations of a magnitude that occur on an average of one to three times yearly in that harbor.

Monitoring results (EA, 1992) of dredging activities for the Central Artery/Third Harbor Tunnel (CA/T) project showed that the Boston Harbor main ship channel dredge plume was quite diffused and dispersed within 500 feet. Background (up-current) total suspended solids ranged from 8-20 mg/l and the plume (500-ft down current) ranged from 8-34 mg/l.

All of the effects associated with increased turbidity in Boston Harbor would occur in the immediate area of the dredge, be transported by currents, and settle. After completion of the dredging activity, these impacts will cease. The motile organisms should generally escape this downcurrent sedimentation by leaving or avoiding the activity area. The remaining organisms will be impacted. However, most organisms inhabiting Boston Harbor are estuarine species that are tolerant of recurring turbidity stresses.

One of the functional characteristics of an estuarine system, such as Boston Harbor, is to serve as a nutrient retention area, increasing the productivity of its subcomponents. Nutrients are effectively "trapped" in the sediments where they are stored. This trapping and storage function also allows for the retention of pollutants in the same substrates, especially in fine grained sediment which have a larger surface area for pollutant adsorption. The physical removal of these sediments by dredging operations has the potential to release some of the sediment bound pollutants.

One group of pollutants that have been of concern for environmental quality analyses are metals such as mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb), copper (Cu), and zinc (Zn). Recent studies (Kay, 1985) have shown that even when metals are found in high concentrations, there is no corresponding substantial release of free (nonbound) metals from resuspension of bottom sediments during dredging. Studies performed by the Corps of Engineers Dredged Material Research Program (Gambrell et al. 1978) conclude that certain trace metals may be released in the parts per billion (ppb) range, while others show no release pattern (Chen, 1976). Chen (1976) also showed that heavy metals are not readily soluble or excessively mobile through a trophic system since they are usually adsorbed to sediments or coprecipitated out of solution. Elutriate testing of Boston Harbor sediments support these conclusions.

Other classes of contaminants of concern are PCBs (Polychlorinated Biphenyls), PAHs (Polycyclic Aromatic Hydrocarbons) and DDT (Dichloro-Diphenyl-Trichloroethane: a chlorinated pesticide). The presence of these chemicals were analyzed by various testing as described in this section. Bulk et. al. (1975) demonstrated that the migration of pesticides from bottom sediments into the water column during dredging is not substantial. Polycyclic Aromatic Hydrocarbons (PAHs) are a by-product of industrialization of estuarine areas. Not all PAHs are readily bioavailable, and most do not attain concentrations in water that are acutely toxic to aquatic organisms (Clarke and Gibson, 1987). However, concern over PAHs as environmental pollutants is based on the acute toxicity of some compounds such as anthracene and phenanthrene, and chronic toxicity of the higher molecular weight compounds (Clarke and Gibson, 1987). The concentrations of PAHs in the proposed project area have been analyzed using the established regional testing protocol (EPA/ACOE, 1991).

Elevated ( > 1.0 ppm) levels of PCBs were found in the Mystic River (only one analysis - Station B). At least one berth from each tributary had elevated PCB levels for a total of seven berths. Additional sediment testing for PCB levels was conducted in conjunction with the bioassay/bioaccummulation testing procedures.

The dredging of the berths and channel areas would be performed in a manner to minimize the possibility of elutriation of sediment contaminants. A review of the levels of sediment chemistry, the ambient water quality and the use of an environmental bucket or clamshell dredge, indicates that a low potential exists for substantial degradation of ambient water quality (given its present state) during dredging. After project completion the benthic substrate of the Boston Harbor will be less contaminated in the dredged areas due to the removal of the surficial sediments which contain a majority of the contaminant load, thus providing a beneficial effect.

### 4.5.2 Biological Resources

The harbor benthic faunal assemblages have been studied in the lower Mystic River and Inner Harbor areas (Stewart 1968, MES 1970; 1972, a, b, c; 1973; 1976, a, b; 1977 a, b). The communities are primarily made up of opportunistic deposit feeders such as polychaetes and amphipods which are associated with the harbor's organic silts. Previous studies have indicated that the lower Mystic River is dominated

by the polychaete *Capitella capitata* (MES, 1977 a, b), as also is shown in the 1986 NED sampling program. The harbor is inherently stressful to benthic populations due to low levels of oxygen and sediment contamination. Benthic organisms which are tolerant of low levels of dissolved oxygen and other stresses, on a cyclic basis, survive and become dominant. Where environmental stresses defaunate the substrate (eliminating non-mobile bottom dwelling organisms), the tolerant species pioneer the vacant substrate as stresses decline to tolerable levels. It is this type of benthic community, in dynamic equilibrium, that is present in Boston Harbor (dynamic in response to environmental stresses and equilibrated to cycles of defaunation). The removal of this assemblage of organisms during dredging will have minimal impact on the ecological productivity of the harbor as a system.

The primary impact of this project on biological resources will be the removal of benthic organisms inhabiting the areas to be dredged. This impact will represent a low (29 organisms/$m^2$) to high (4,800 organisms/$m^2$) loss of benthic organisms depending on the season and area to be dredged. Dredging will expose azoic parent material which will be recolonized by adult and larval benthic organisms. During the recolonization period, there will be a large number of individuals from a few species. Subsequent populations will recruit a greater number of species, each having fewer individuals. Concurrent with this transitional state the clay will be biogenically reworked and mixed with other material until it becomes aerated and acceptable for colonization by more species. It is this large number of pioneering benthic species that biogenically rework the substrate in a short time frame. These organisms are also an important source of forage for juvenile finfish. In Boston Harbor, seasonal depletion of the water column oxygen levels maintain the benthic community of the inner harbor as a pioneering assemblage in a state of dynamic equilibrium. The dredging of the channel will cause a short term loss of benthic productivity that will be rapidly offset through faunal recolonization. This recolonization potential has been recently demonstrated by MWRA studies of harbor areas disturbed by the 1992-93 winter storms. These areas were extensively recolonized by opportunistic species such as *Ampelisca* sp. (J. Kelly, pers. comm. 1993).

Chemical signals essential for anadromous fishery migrations could become masked by the dredging operation's suspension of sediments and associated chemicals. Dredging will be scheduled in non-sensitive areas and periods of the harbor to avoid impacting seasons of critical spawning runs of those species.

Sediment suspension will also displace motile species that will attempt to avoid gill abrasion, lower oxygen levels, and reduced sensory opportunities for predation (masked odors and low visibility) in the dredging area. These would all be temporary and the effects would not have long term detrimental impacts given the recommended mitigation practices.

With the explosive fracturing and mechanical removal of approximately 88,000 cubic yards of bedrock, the potential for mortalities of fish and invertebrates exist. Based on rock density, anticipated explosive size during a single blast, open water fish kill research, and physical characteristics of the harbor, an estimated fish kill zone during blasting activities would range from $30m^2$ to $1400m^2$ surface area. Based on this study's limited fish density data (two seasons of fish trawls and gill net collections) the average density in Boston Harbor is approximately 10 fish/$m^2$. If at any given time the fish were present in the water column directly over the blast and orientated sideways to it, the maximum moralities may range from 300 to 14,000 fish per blasting operation. The number of fish kill at the high end would be unusual. Monitoring of blasting operations during the navigation improvement project in Portsmouth Harbor in New Hampshire did not indicate fish kills close to these maximum ranges. However, the monitoring results recorded only the fish seen floating at the surface. Even if the number of fish

killed per blast are high, they are similar to the range of fish killed in a commercial fish trawl.

Species of marine mammals which may occur in tidal waters in the vicinity of the project area, include harbor seals (*Phoca vitulina*), harbor porpoises (*Phocena phocena*), and grampuses (*Grampus griseus*). However, their presence in the Boston Harbor system is uncommon (Cortell, 1990b). Because most of the dredging impacts will occur well within the Inner Harbor where marine mammals are uncommon, the project is not likely to cause adverse impacts to these species.

### 4.5.3 Threatened and Endangered Species

The intertidal and subtidal areas including and adjacent to the Federal channel area are not known to provide habitat for any Federal threatened and/or endangered species, or State rare species. Letters from the U.S. Fish and Wildlife Service, the National Marine Fisheries Service and the State Natural Heritage Program have confirmed the lack of any threatened, endangered, or rare species in the dredging area.

### 4.5.4 Historical and Archeological Resources

Boston Harbor has been subject to navigation improvement projects since the mid-nineteenth century. The channels and rivers in and around the harbor have been deepened, widened, and straightened. This activity has severely limited the historic and archeological potential of the harbor.

The dredging portion of the navigation improvement project in Boston Harbor will not adversely affect sites of historic, architectural or archaeological significance, as defined by the National Historic Preservation Act of 1966. The Massachusetts Historical Commission reviewed the deep-draft navigation improvement project, including the berthing areas, and determined that dredging the previously maintained channels and berthing areas will not have an adverse impact on any historical or archaeological resources.

The Chelsea Street Bridge is considered to be eligible for the National Register of Historic Places, as it is the only Strauss heel-trunnion bascule bridge known to survive in the Commonwealth. Navigation improvement dredging is not expected to impact this bridge. Any modification to the bridge would require coordination with the Massachusetts Historic Commission to outline mitigation measures.

### 4.5.5 Socio-Economic Environment

In 1992, the combined public and private terminals in Port of Boston handled more than 16 million tons of cargo. Petroleum and liquefied natural gas (LNG) were the dominant bulk cargo, representing 87% of the total cargo tonnage in the Port. Approximately 14 million tons of the petroleum and LNG were delivered to the private terminals along the Chelsea Creek, Mystic River, and Reserved Channel. Massport's public terminals handled approximately one million tons of general cargo, 96% of it containerized.

The economic benefit from the Port in the form of employment, income, sales, and tax revenues were generated by the public and private cargo handling interests. For fiscal year 1992, Massport's terminals handled 1,053,804 tons of containerized and bulk cargo and 34,553 automobiles. As a result of its cargo handling activities, Massport was responsible for generating nearly $1.86 billion in economic benefits for the region and providing employment for more than 6,000 people in jobs directly related to the cargo industry. An additional 3,000 jobs were created in the industrial service sector which supports cargo activity. The total economic impact of the maritime activities at Massport terminals can be summarized as follows:



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- Personal Income$ 386.92 million
- Sales Revenue$ 800.38 million
- Business Income$ 610.09 million
- State/Local Taxes$ 60.19 million

Total Economic Impact$1,857.59 million

The private oil and other bulk terminals contributed additional jobs and revenues, likely substantial but more difficult to quantify because of the privileged (i.e., competitive) nature of information about privately owned operations. The availability and cost of oil products affect the regional economy through manufacturing output, job creation and cost of living. At the national and international scale, aviation fuel located at Chelsea Creek terminals supports Logan Airport's role as a gateway for passengers and air cargo.

The dredging project will have minimal negative effect, and possibly a beneficial effect, on natural or human resources in the project area. Vessel traffic in the channel areas will be required to navigate around the dredging equipment. Only the largest commercial vessels will need to be coordinated separately so that the dredging equipment can move out of the way. Blasting will be required in the Mystic River Channel, the Inner Confluence, the north side of Reserved Channel near the mouth, and across from the Reserved Channel in the Main Ship Channel. Individual berth areas will accommodate dredging in their own manner.

Dredging with a mechanical bucket will produce noise from the engines lowering and lifting the dredge bucket. The noise produced will be similar to other diesel engine equipment in the area. Many of the receptors in the three tributaries are businesses. Residential areas only exist near the mouth of Chelsea Creek and near the Tobin Bridge. Noise may be greater during the warmer time of year when people are outside more frequently and windows are open. Although the dredges are expected to work 24 hours a day, the noise level will be masked by background noise of the Tobin Bridge in the Mystic River, noise levels from Logan Airport activities, and the city noise in Chelsea. In other words, noise generated by this project should not be substantially differentiated from other Harbor baseline noise.

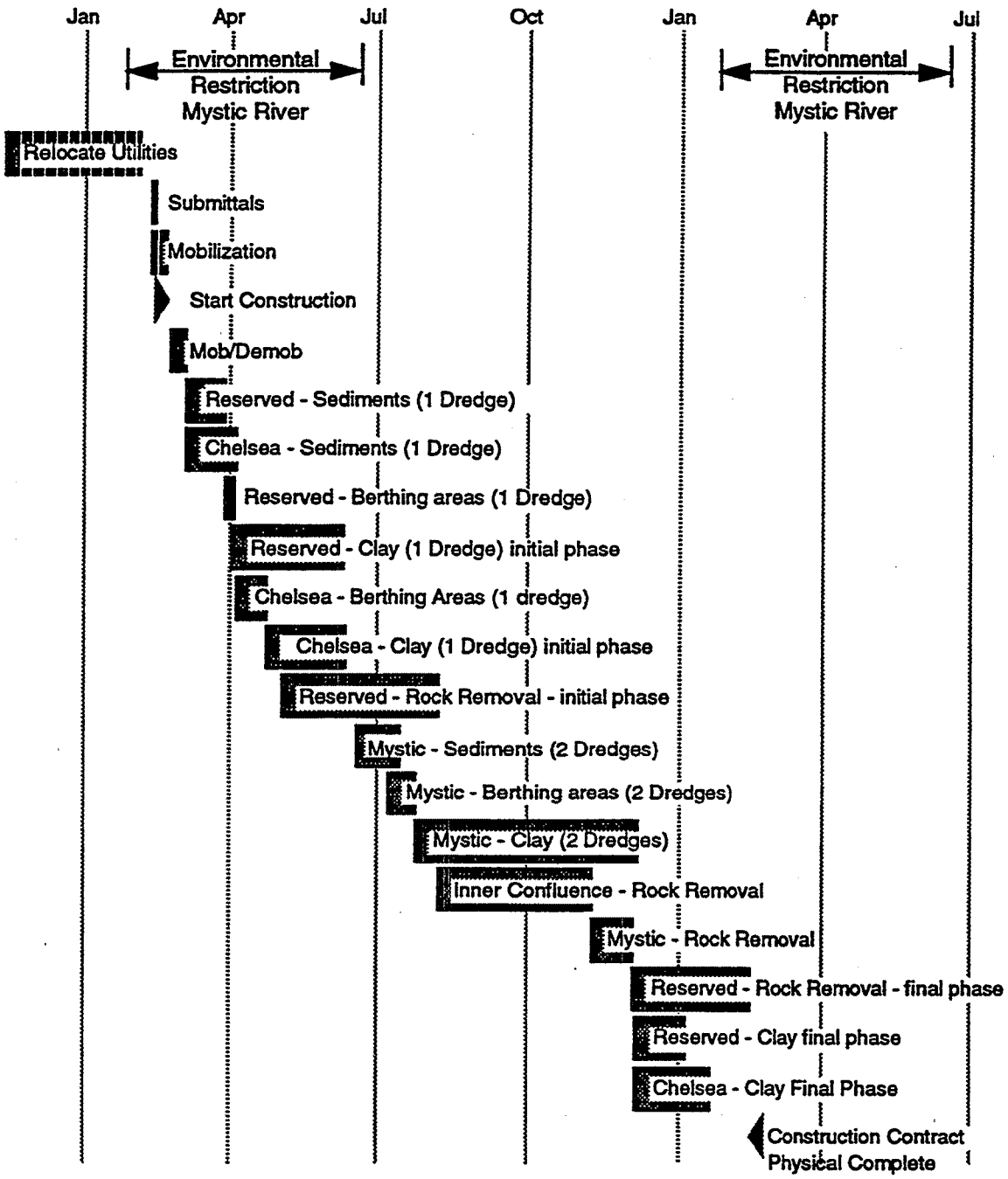
In addition to the noise produced during the dredging operation, odor from dredged material placed on barges may occur. Again the odor impact, if any, would depend on the time of year and the direction of the wind. The number of barges that would be filled range from two to four a day. Therefore the potential impact would be continuous while dredging the silt. Perception of odor would be minimal during the cold months of the year. This is due to the fact that more human activity would occur indoors and the cold temperatures would keep the odor causing bacteria count low. Generally, the dredging activity will be far enough away from population concentrations (tourist areas, residential complexes, restaurants, etc.) that mixing with ambient air is expected to be sufficient to dilute increased odors, except perhaps under worse case conditions.

The navigation improvement project will have an effect on the local economy through anticipated transportation savings of about $3,500,000 annually for Boston Harbor shippers. It is not anticipated that the navigation improvement project would per se result in increased tonnage shipped through the port of Boston. The project should result in somewhat fewer trips, but larger vessels will be utilized in transporting cargo to Boston resulting in economy of scale. As the tonnage of cargo entering Boston Harbor could remain essentially the same, no secondary impacts on the land end of shipping would occur. The navigation improvement project would also reduce light loading, lightering, and tidal delays, thus improving the safety of Boston Harbor by reducing the potential for an oil spill.

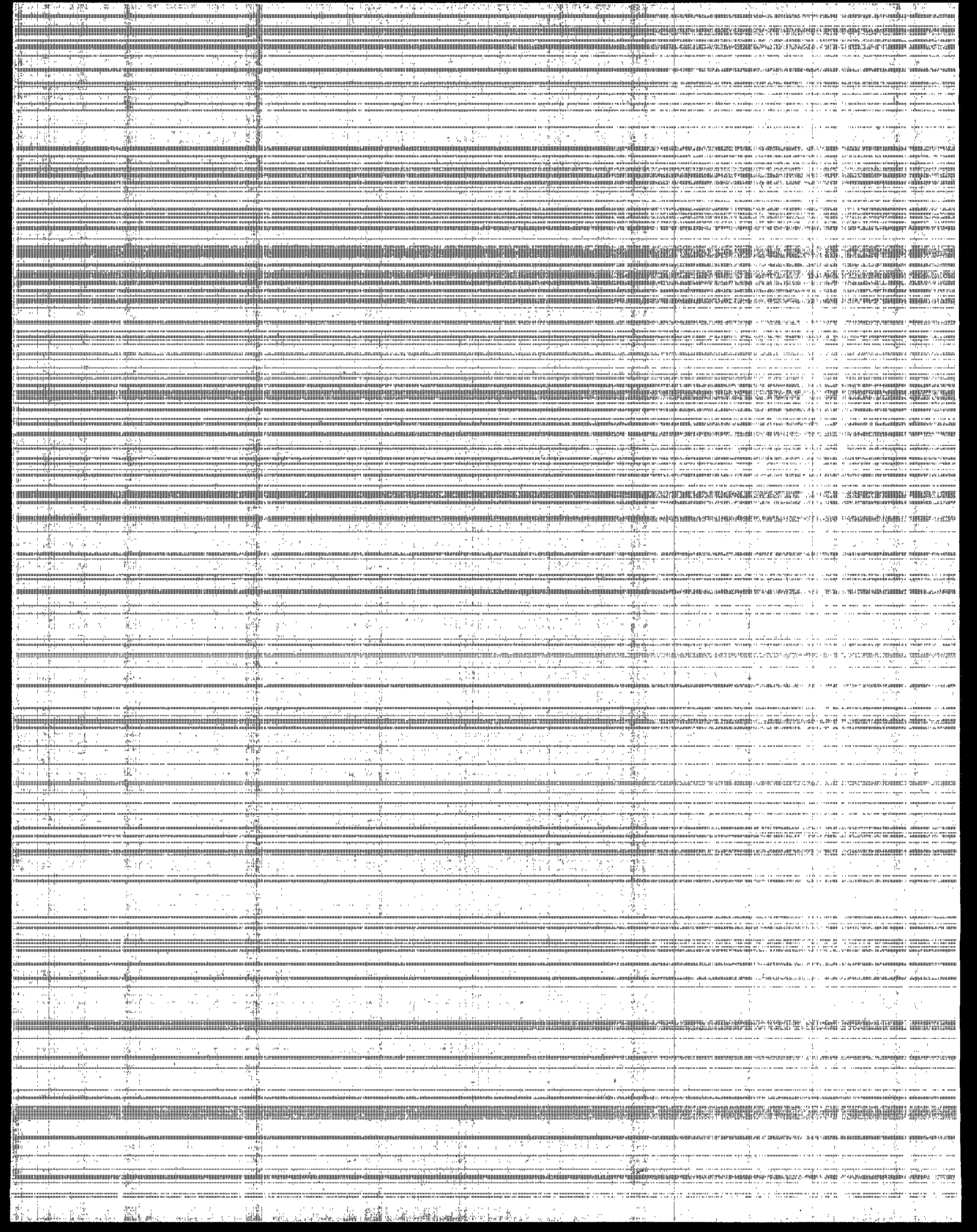
Container ships, part of the economic justification for deepening Boston Harbor, are also important to the competiveness of the harbor. Despite the difficult

economic times for this region and the world, general cargo tonnage handled in the Port has remained stable. Containerized cargo has been growing at a rate of about 1.8% annually since 1985. While economic recovery is the top priority of the public and private business leaders, the Port of Boston has to continue to generate revenues and provide jobs. Looking beyond the economic recovery and into the future, Port of Boston would strive, once again, to become a growing east coast and world cargo distribution center.

Another potential benefit of the navigation improvement project would be to reduce the quantity of contaminated sediment exposed to marine organisms. The current level of contamination in the inner harbor could have an effect on the structure of the benthic community as well as the potential for bioaccumulation by higher trophic levels which feed in Boston Harbor. Removing the contaminated sediment and sequestering the associated chemicals could reduce the risk to human health as well. Therefore the project may benefit the ecosystem and human health by removing these sediments from exposure. Given the other clean-up activities in the harbor (primarily by MWRA) this project could contribute to the cumulative positive impacts to Boston Harbor.




| | | |
|---|---|---|
| **Boston Harbor Dredging Project EIR/S** | | *Figure 4-1* Example Schedule Disposal at Mass. Bay Disposal Site |
| | | *Source:* New England Division, Corps of Engineers |



## 5.0 COMPLIANCE REQUIREMENTS

Prior to the implementation of this project, a variety of federal, state and local permits will need to be obtained. Acquisition of these permits will confirm that the project has complied, or will comply, with these particular regulatory requirements. Other laws and regulations simply call for consultation between federal agencies. Exactly which regulations will apply to the project will vary depending on the disposal option ultimately selected. This section briefly identifies the key federal and state regulations which will likely be triggered by the dredging and disposal operations. Section 5.2 lists the federal statutes and executive orders which the U.S. Army Corps of Engineers must comply with in performing the federal portion of the project. Finally, Section 5.3 contains an outline of a draft Section 404(b)(1) evaluation to be prepared by the Corps for the BIINIP.

## 5.1 REGULATORY COMPLIANCE

Chapter 21H: This law and attendant regulations, administered by the Massachusetts Department of Environmental Protection, provide for the regulation of solid waste facilities. Among the powers are the selection of sites for landfills, their design, and operation. Site assignment powers are vested in local boards of health.

Chapter 91: Administered by the Massachusetts Division of Wetlands and Waterways, the Chapter 91 program regulates any dredging, or the building of structures or the placing of fill below the mean high tide line (i.e., in tidelands). If permitted, such projects may be required to provide compensatory water-related benefits to the public. The law also applies to former tidelands which were subsequently filled.

Clean Water Act of 1977: Section 401 regulates discharges to surface waters of the United States, and as such will impose water quality standards on the dredging itself, on surface water runoff from upland disposal, and on the disposal of dredged material in waters of the United States (seaward to the 3 mile limit). The water quality certification program is administered by the Massachusetts Dept. of Environmental Protection, Division of Water Pollution Control. (The Code of Massachusetts Regulations, in 314 CMR 9.00, classifies dredge or fill material on the basis of its chemical and physical characteristics). Section 404 controls the disposal of dredged material in waters of the United States (again, seaward to the 3 mile limit); this program is administered by the Corps, subject to review by EPA.

Coastal Zone Management Act of 1972, as amended: Under the provisions of this act, the Massachusetts Coastal Zone Management Program conducts reviews of all proposed federal projects, and other projects requiring federal permits, within the coastal zone to determine their consistency with applicable CZM regulatory (13) and non-regulatory (14) policies.

Endangered Species Act of 1973, as amended: The law requires that any federal agency authorizing, funding, or carrying out a project shall insure that the action is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction of such habitat. A similar state law is administered by the Massachusetts Natural Heritage and Endangered Species Program. Consultation with state and federal resource agencies is continuing.

Fish and Wildlife Coordination Act, as amended: Any party proposing to impound, divert, or deepen the channel of a water body is required to consult with the U.S. Fish and Wildlife Service, other federal agencies (e.g., the National Marine Fisheries Service), and the head of the state counterpart fish and wildlife agency with the objective of eliminating, minimizing, or mitigating adverse impacts to fish and wildlife resources.

Marine Mammal Protection Act: The law regulates or prohibits the taking of marine mammals. The Marine Mammal Commission may designate certain



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species or stocks as "depleted", and subsequently develop and promulgate conservation plans. The act is administered by the National Marine Fisheries Service.

Marine Protection, Research, and Sanctuaries Act of 1972, as amended: This law regulates the transportation of dredged material for ocean disposal activities seaward of the 3 mile limit. Under Section 102, the U.S. Environmental Protection Agency is authorized to designate sites for ocean disposal of dredged material. Under Section 103, the Corps administers a permit program regulating the use of designated sites (in this area, the Massachusetts Bay Disposal Site). As evidenced in the title, MPRSA also is the enabling legislation which permitted the designation of Stellwagen Bank as a National Marine Sanctuary.

Massachusetts Environmental Policy Act: MEPA requires the filing of an Environmental Notification Form (ENF) to evaluate whether a proposed project may cause significant damage to the environment. Environmental Impact Reports (EIRs) are required, if so determined by the Executive Office of Environmental Affairs. Partial compliance has been achieved by publication of this Draft EIR/S. Full compliance will follow issuance of the Final EIR/S.

Massachusetts Wetlands Protection Act (Chapt. 131, Sec. 40): This law confers jurisdiction to local Conservation Commissions for the regulation of dredging, filling, removing or altering inland or coastal wetlands through issuance of an Order of Conditions. Resource Areas, protected by the act, include bordering vegetated wetlands; banks, beaches and dunes; land subject to flooding; and land under water.

National Historic Preservation Act of 1966, as amended: Requires coordination with Massachusetts Historical Preservation Commission to consider the impact of a project on historic or archaeological resources and to minimize or avoid harm to those resources. The Commission also administers a similar state law. Commission files were reviewed for all disposal sites evaluated in the EIR/S.

National Environmental Policy Act of 1969, as amended: NEPA requires the preparation of a detailed statement of environmental impact for each major federal action which may significantly affect the quality of the human environment. Preparation of this EIR/S signifies partial compliance with NEPA. Full compliance will be noted at the time the Final EIR/S is promulgated and the Record of Decision is signed.

Rivers and Harbors Act of 1899, as amended: Section 10 of this law authorizes the Corps to regulate structures and work in or over navigable waters of the United States.

Safe Drinking Water Act of 1972, as amended: This act would apply to the project only in the event that an upland disposal site might jeopardize a sole source drinking water aquifer; it is administered by EPA.

## 5.2 COMPLIANCE WITH FEDERAL STATUTES AND EXECUTIVE ORDERS

### 5.2.1 Federal Statutes

1. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: A Section 404 (b)(1) Evaluation and Compliance Review have been incorporated into this EIR/S. An application shall be filed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.

2. Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq.

Compliance: Circulation of this report for public review, including an evaluation and findings concerning the transportation of dredged material for disposal



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in ocean water pursuant to Sections 102 and 103 signifies compliance with this Act.

3. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: The project was coordinated with the State Historic Preservation Office to determine whether historic or archaeological resources would be affected by the proposed project.

4. Preservation of Historic and Archaeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq. This amends the Reservoir Salvage Act of 1960 (16 U.S.C. 469).

Compliance: Not applicable; project does not require mitigation of historic or archaeological resources.

5. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the National Marine Fisheries Service has determined that a Biological Assessment pursuant to Section 7 of the Endangered Species Act is required. The results of this Biological Assessment has been included in this report.

6. The Estuary Protection Act (16 U.S.C. 1221).

Compliance: Not applicable; the navigation improvement project is authorized by Congress.

7. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the U.S Fish and Wildlife Service, National Marine Fisheries Service, and the appropriate State Fish and Wildlife agencies through the Public Notice signifies compliance with the Fish and Wildlife Coordination Act. The Division Engineer has given full consideration to fish and wildlife conservation in evaluating this project.

8. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4341 et seq.

Compliance: Preparation of this report signifies partial compliance with NEPA. Full compliance shall be noted when the Record of Decision is issued.

9. Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 et seq.

Compliance: Not applicable; this project is not located in a listed river (Section 2) or proposed for inclusion (Section 3) in the Act.

10. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1456 et seq.

Compliance: A CZM consistency determination shall be provided to the State for review and concurrence that the proposed project is consistent to the maximum extent practicable with the approved State CZM program.

11. Clean Air Act, as amended U.S.C. 7401 et seq.

Compliance: Public notice of the availability of this report to the Regional Administrator of the Environmental Protection Agency for review pursuant to Sections 176c and 309 of the Clean Air Act signifies compliance.

12. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Not applicable.

13. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-1.

Compliance: Public notice of the availability of this report to the National Park Service and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

14. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for Corps projects or programs authorized by Congress. The proposed navigation improvement project has been Congressionally approved. However, berth dredging is regulated by this Act.

15. Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C. 1001 et seq.

Compliance: Not applicable.

### 5.2.2 Executive Orders

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, May 13, 1971 (36 FR 8921, May 15, 1971).

Compliance: This order has been incorporated into the National Historic Preservation Act of 1980.

2. Executive Order 11988, Floodplain Management, May 24, 1977, amended by Executive Order 12148, July 20, 1979.

Compliance: Not applicable.

3. Executive Order 11990, Protection of Wetlands, May 24, 1977 (42 FR 26961, May 25, 1977).

Compliance: Not applicable.

4. Executive Order 12372, Intergovernmental Review of Federal Programs, July 14, 1982 (47 FR 3959, July 16, 1982).

Compliance: Not applicable.

5. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, January 4, 1979.

Compliance: Not applicable.

### 5.2.3 Executive Memorandum

1. Analysis of Impacts on Prime or Unique Agriculture Lands in Implementing NEPA, August 11, 1980.

Compliance: Not applicable.

## 5.3 EVALUATION OF SECTION 404(B)(1) GUIDELINES FOR BHNIP

The following pages consist of a draft evaluation of 404(b)(1) compliance for the disposal of dredged material from the BHNIP. The evaluation will be finalized after review and comment on this draft EIR/S and when a final disposal option is selected.

**CLEAN WATER ACT**
**SECTION 404 (B)(1) GUIDELINES FOR**
**SPECIFICATION OF DISPOSAL SITES FOR DREDGED OR FILL MATERIAL**

**Boston Harbor Navigation Improvement Project**

## I. PROPOSED PROJECT

*A. Project Location* - Boston Harbor and Massachusetts Bay.*

*B. Project Description* - The proposed project would deepen the Reserved Channel and Mystic River from 35 feet MLW to 40 feet MLW and deepen Chelsea Creek from 35 feet MLW to 38 feet MLW. In addition, the berthing areas listed in Table 1 would also be dredged.

The dredged material could be disposed at one or more of the following preferred sites: Spectacle Island CAD, and Meisburger sites 2 or 7 (see figures 3-6, 3-4, and 3-5 in the DEIR/S). Material disposed at the Boston Lightship or Massachusetts Bay Disposal Site (MBDS) will be evaluated under Section 103 of the Marine Protection, Research and Sanctuaries Act.*

*C. Project Authority and Purpose* - This project has been Congressionally authorized in the Water Resources Development Act of 1990 (P.L. 101-640). The project has been authorized to reduce tidal delays and limits on vessel size and loading restrictions.*

*D. General Description of the Dredged Material* - Approximately 2.9 million cubic yards of material will be dredged from the three tributaries and berthing areas. Of this volume about 88,000 cubic yards is rock, 1.7 million cubic yards is parent (clay, gravel) material and 1.1 million cubic yards is silt. The silt (maintenance) material overlays the parent material and will be treated as unsuitable for unconfined open water disposal. The parent material does not contain elevated levels of contaminants.*

*E. Description of Disposal Method* - All of the channels and berth areas will be dredged using a mechanical bucket dredge and scow. An environmental bucket will be used for removal of the silt material. A pit would need to be dredged first at the three offshore sites (Spectacle Island CAD, and Meisburger sites 2 and 7). A mechanical dredge would be used to remove the material from the pit. The

* Please refer to the Boston Harbor Navigation Improvement Environmental Impact Report/Statement for additional details.



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## TABLE 1

## BERTHING AREAS TO BE DREDGED IN BOSTON HARBOR

| NAME | LOCATION | VOLUME (CY) |
|---|---|---|
| Conley 11-13 | Main Ship Channel/ Reserved Channel | 46,000 |
| North Jetty | " | 16,000 |
| Boston Army 1-9 | " | 129,000 |
| Boston Edison Intake | " | 1,000 |
| Boston Barge Berth | " | 16,000 |
| Conley 14-15 | " | 7,000 |
| Prolerized | Inner Confluence/ Mystic River | 8,000 |
| Distrigas | " | 14,000 |
| Moran | " | 7,000 |
| Revere Sugar | " | 13,000 |
| Mystic Piers 2, 49, 50 | " | 45,000 |
| Mystic Piers 1 | " | 18,000 |
| Eastern Minerals | Chelsea Creek | 40,000 |
| Gulf Oil | " | 12,000 |

material removed from the pit would be used for beneficialuse, if appropriate, or taken to the MBDS for disposal if there is no use for the material. The scow would transport the dredged material to the disposal site and release the material through doors located on the bottom of the scow. The silt material would be deposited into the pit and then covered with cap material.*

* Please refer to the Boston Harbor Navigation Improvement Environmental Impact Report/Statement for additional details.

## II. ASSESSMENT OF IMPACTS

The following is an assessment of the potential short-term and long-term effects of a proposed discharge of dredged or fill material on the physical, chemical and biological components of the aquatic environment for those activities pursuant to Section 404 of the Clean Water Act. This assessment shall provide information required to determine compliance with 404 (b)(1) Guidelines in accordance with Subpart B, 40 CFR Part 230.

*A. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).*

*1. Substrate (230.20): (consider impacts to (1) the physical and chemical characteristics of the substrate, (2) substrate elevation or contours, (3) dredged material movement, (4) the benthos).*

**Spectacle Island CAD** - Spectacle Island is located southeast of Logan Airport. The construction of the Spectacle Island CAD would require dredging a pit in the shallow subtidal flat east of the island. Contaminated silt material would be deposited in the pit and capped to existing bottom elevation. Circulation in the vicinity of the island is dominated by tidal currents. No changes in circulation or fluctuation should occur once construction is complete. The benthic community now existing at this site may change from a community dominated by benthos adapted to a sandy substrate to a benthic community dependent on the make-up of the cap. Original substrate could be deposited onto of the cap to facilitate recolonization.

**Meisburger sites 2 and 7** - These sites are located offshore approximately 7.5 miles east of Deer Island. Both of these sites are in the proximity of the MWRA's proposed ocean outfall. The existing sediment (sand and gravel) would be removed to create a pit for the silt material and then capped. The removed material would be used beneficially for beach nourishment or construction. The



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sites would be restored to their original bathymetry and physical substrate conditions. No long term impact to the benthic community is expected.

*2. Current patterns and water circulation (230.23): (consider impacts to (1) current patterns, (2) water circulation, (3) direction or velocity flow, (4) thermal stratification and (5) indirect impacts such as alteration of the hydrologic regime, shoreline erosion and deposition rate of suspended particulates).*

The proposed disposal sites should have negligble long term impacts on current patterns and water circulations in Boston Harbor and Massachusetts Bay. The offshore sites will be returned to their original elevations.

*3. Water (230.22): (consider impacts to water quality such as (1) clarity, (2) color, (3) odor, (4) taste, (5) pH, (6) nutrients, and (7) eutrophication).*

Temporary impacts to water quality are expected from disposal of dredged material. Clarity will be reduced and nurtrients could be released from the suspended solids. The release of nutrients is not likely to have an affect on eutrophication due to the tendancy of nutrients to adhere to silt and clay particles.

*4. Salinity gradients (230.25): (consider the direct and indirect impacts to existing salinity gradients and patterns).*

None of the proposed disposal sites would change the composition of freshwater or salinity gradients in Boston Harbor or Massachusetts Bay.

*5. Normal Water Fluctuations (230.24): (consider the direct and indirect impacts to the physical, chemical and biological components of the aquatic ecosystem).*

No long term impact from disposal at the offshore sites to normal water fluctuation is expected as the bottom surface will be returned to its original elevation.

*6. Suspended particulates/turbidity (230.21): (consider impacts to the physical and chemical properties of the water column such as (1) light penetration and rate of photosynthesis, (2) dissolved oxygen, (3) toxic materials, (4) aesthetics and (5) those indirectly related to sight/filter feeding organisms).*

All of the potential disposal sites would have some characteristics in common. It can be expected that disposal



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operations would cause localized and temporary increases in suspended solids concentrations (and turbidity) in the water column. None of the sites proposed for disposal would impact (through water quality violations) any shellfish beds in the area. Water quality impacts would be mostly confined to the disposal site. Impacts to dissolved oxygen concentrations in the water column would be expected to be localized and temporary. Spectacle Island CAD and Meisburger sites are located in areas with active flushing. The water may appear turbid from the release of suspended solids.

*7. Contaminant determinations*

*a. To the best of your knowledge, does the proposed project area have any past history of:*

*1) chemical or oil spills or discharge?*
Yes_X_ No___

*2) upstream or on-site industrial or municipal discharge*
Yes_X_ No___

*3) chronic pollutant loading from port or harbor use and/or other indirect sources of pollutants?*
Yes_X_ No___

*To expedite processing for any affirmative answer, provide as much historical information as you have, including dates, amounts, concentrations, etc., of such spills or discharge.*

Boston Harbor is an active shipping port with many industrial complexes along its shore. It is expected that spills and discharges have occurred without being reported. Due to the complexity of the port it would be easy to predict that there have been oil spills, discharges from metal plants and processing plants.

*b. What is the expected frequency of maintenance dredging of this project?*

It is estimated that 1.8 million cubic yards of material will need to be dredged from the tributaries in Boston Harbor within the next 50 years. The dredging schedule will depend on the triburary. The Mystic River and Chelsea Creek will need to be maintained more frequently than the Reserved Channel.

*c. Description of the Material to be Dredged*

*1) Grain Size Analysis*

Size Fraction % of total by weight

| | |
|---|---|
| coarse gravel 64 mm | ____ |
| fine gravel 2-64 mm | ____ |
| sand .063-2 mm | ____ |
| silt .004-063 mm | 39 % |
| clay .004 mm | 61 % |

*2) Chemical Analysis of Sediment*

| | | Mystic | Chelsea | Reserved |
|---|---|---|---|---|
| PCBs | (ppb) | 88.6 | 73.4 | 85.3 |
| Total PAH | (ppb) | 5270.0 | 7275.0 | 1415.0 |
| mercury | (ppm) | 0.9 | 0.7 | 0.9 |
| cadmium | (ppm) | 3.2 | 3.2 | 2.8 |
| lead | (ppm) | 194.4 | 163.4 | 119.0 |
| chromium | (ppm) | 106.8 | 151.4 | 133.3 |
| copper | (ppm) | 121.1 | 77.4 | 110.2 |

This is the average of the silt material from each tributary. The averages are taken from 1986 and 1990 data. PCB data is from 1990 only. All of the clay material had low (Class I) level metals and organics.

*State test methods used for each test in A) and B) above.*

The method outlined in the draft regional protocol prepared by the Corps/U.S. EPA titled "Guidance for Performing Tests on Dredged Material to be Disposed of in Open Water"

*8. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).*

*a. Threatened and endangered species (230.30): (consider the direct and indirect impacts to Federally-listed threatened or endangered species and their habitat; reference coordination results with the Department of Interior).*

No impact to threatened or endanged species will occur from disposal at the Spectacle Island CAD site. Impacts to threatened or endangered species could occur from disposal at the Meisburger sites. A Biological Assessement has been prepared for the National Marine Fisheries Service which evaluates potential impacts to these species. Based on the findings of the Biological Assessment prepared for the



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National Marine Fisheries Service, no substantial long term impacts are anticipated from disposal activities at the Meisburger sites.

*b. Fish, crustaceans, mollusks and other aquatic organisms in the food web (230.31): (consider temporary and permanent effects on populations of aquatic organisms concerning (1) habitat alteration, (2) spawning migrations, (3) reproduction, (4) food supplies, (5) displacement and (6) food chain interaction).*

There will be a temporary disruption of the benthic community at the disposal site during construction activities. The offshore sites will be returned to their original elevations. Within a couple years the disposal site should be supporting a benthic community. None of the disposal sites are known to be unique or unusual in their habitat.

*c. Wildlife (230.32): (consider the direct and indirect impacts to (1) breeding and nesting habitat, (2) escape cover, (3) travel corridors, (4) food supplies, (5) introduced species and (6) plant and animal diversity and biological productivity).*

The disposal sites are not known to be significant wildlife habitat. They have not been recognized as important breeding, nesting, resting or food sources for wildlife.

*9. Potential Impacts on Special Aquatic Sites (Subpart E).*

*a. Sanctuaries and/or refuges (230.40): (consider the impacts of (1) disrupting breeding, spawning and migratory activity of resident or transient fish and wildlife (ACEC/APR) (See CZM regulations)*

All of the sites are located several miles from the Stellwagen Bank National Marine Sanctuary. The Meisburger sites (the closest to the NMS) are located 10 to 12 miles from the sanctuary where many of the migratory species (whales) are found. These species are infrequently found in the area of the Meisburger sites. Mobile species such as finfish and whales would be expected to avoid the temporary construction activity.

*b. Wetlands (230.41): (habitat loss, alter current patterns, reduce capacity to to retain storm floods or dissipate storm surge runoff).*

Not applicable.

*c. Mud Flats (230.42): (consider same impacts as above).*

The Spectacle Island CAD site will be returned to its original bathymetry. The benthic community will be dependent on the type of cap used; either the parent material or some of the original surficial material.

*d. Vegetated Shallows (230.43): (consider same impacts as above).*

Not applicable

*B. Description of the Disposal Site(s) for Dredged Material.*

*a. What is the length, width, depth and volume of the proposed project?*

**Spectacle Island CAD** - Approximately 45 acres large and in water with depths of 4 to 15 feet MLW.

**Meisburger sites 2 and 7** - Site 2 lies in 80 to 105 feet of water and is about 4,100 feet long. This site could yield a minimum of 780,000 to 4.7 million cubic yards of material. Site 7 has similar characteristics to site 2 but could hold a greater volume of material (up to 19.5 million cubic yards). Water depths would range from 90 to 110 feet MLW.

*b. Has the site been designated by the state or E.P.A. as a dredge disposal site?* Yes___ No_X_

*If yes, supply any available documentation as to effects of other authorized dumpings that have been made in the dumping area (e.g., heavy metal background reading and organic carbon content).*

*If no, give a description of the characteristics of the proposed disposal site and an explanation as to why no previously designated site is feasible.*

The characteristics of the site are described above and in the Boston Harbor Navigation Improvement EIR/S. There is no currently designated site that is approved for the disposal of the silt material which is considered unsuitable for unconfined open water disposal. The Massachusetts Bay Disposal Site is not available for the silt material until issues concerning capping are resolved.

*3. Is the anticipated disposal site located within a designated ocean sanctuary as established by Federal law or G.L.C. 132A, 13?* Yes___No_X_



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*4. If disposal is anticipated to occur on land, indicate drainage characteristics from the results of test pits, borings and percolation tests, as applicable.*

Not applicable.

*5. How long is the disposal site estimated to be in use? Indicated the duration of this disposal action and anticipated future use of site.*

Construction activities are anticipated to occur for approximately one to one and one-half years. Future use of Spectacle Island CAD for dredged material is not expected because of its limited capacity. The Meisburger sites could be used for the future use of this project or others.

*6. Mixing zone determination (consider factors in Section 230.11 (f)(2)).*

ADDAMS DUMP models were performed at the Meisburger sites and Spectacle Island CAD site. All of the models indicated that water quality violations would not occur outside the mixing zone. Refer to the Boston Harbor Environmental Impact Report/Statement for addtional details.

*7. Municipal and private water supply*

Not applicable

*8. Recreational and commercial fisheries*

Dredging and disposal activities will have minor impacts to commercial and recreational fisheries. None of the sites are commercial shellfish beds and are not known to be of unusual or rare habitat types. There will be a temporary and localized loss of benthos. However, the area to be impacted is small compared to the rest of Boston Harbor and Massachusetts Bay. As stated above, release of contaminants and water quality exceedances are expected to be confined to the disposal site. This is a temporary impact.

*9. Water related recreation*

The project is not anticpated to have any substantial affects on the recreational community. Boston Harbor is a working port with few beaches or boating facilities in the project area.

*C. Determination of Cumulative Effects on the Aquatic Ecosystem*

No other project is known to propose the use the

disposal site(s). Although the identification of these sites as acceptable for unsuitable material may allow their use by other agencies. It is not anticipated that all of the above sites would be used by this project.

*D. Determination of Secondary Effects on the Aquatic Ecosytem*

No known secondary effects are anticipated from the use of any or all of the proposed disposal sites.

## *III. Findings of Compliance or Noncompliance*

The proposed disposal sites for discharge of dredged or fill material complies with the Section 404 (b)(1) guidelines.....

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Date

BRINK P. MILLER
Colonel, Corps of Engineers
Commander New England Division



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## 5.4 PROJECT FEASIBILITY STUDY AND ENVIRONMENTAL ASSESSMENTS

During the period 1986-88, the Corps conducted a feasibility study and environmental assessment for deep draft navigation improvements to Boston Harbor and published a report of its findings (U.S. Army Corps of Engineers, 1988). During the course of the studies, coordination was maintained with the following federal, regional, state and local agencies:

### Federal Agencies

U.S. Environmental Protection Agency
U.S. Coast Guard
U.S. Maritime Administration
National Park Service
Bureau of Outdoor Recreation
U.S. Public Health Service
National Marine Fisheries Service
U.S. Fish and Wildlife Service
Economic Development Administration
U.S. Geological Survey
Federal Highway Administration
Federal Aviation Administration

### Regional Commissions

New England Regional Commission
New England River Basins Commission
New England Interstate Water Pollution Control Commission

### State Agencies

Mass. Executive Office of Environmental Affairs (EOEA)
Mass. Dept. of Environmental Management (MADEM)
Mass. Dept. of Public Works
Mass. Office of Coastal Zone Management (MACZM)
Mass. Turnpike Authority
Mass. Dept. of Environmental Quality Engineering (MADEQE)
Mass. Pilots Commission
Mass. Historical Commission
Mass. Water Resources Authority (MWRA)
Metropolitan District Commission (MDC)
Mass. Bay Transportation Authority (MBTA)
Massachusetts Port Authority (Massport)

### Local Communities and Agencies

Boston Redevelopment Authority (BRA)
Boston Conservation Commission
Boston Harbormaster
Boston Economic Development and Industrial Corporation (EDIC)
Boston Harbor Commission

| | |
|---|---|
| Town of Hull | City of Quincy |
| Town of Hingham | City of Revere |
| Town of Weymouth | City of Chelsea |
| Town of Winthrop | City of Everett |

### Interested Organizations

Maritime Association of Greater Boston
Metropolitan Area Planning Council (MAPC)
Boston Marine Society
Boston Harbor Pilots Association
Propeller Club of the United States - Port of Boston
American Institute of Merchant Shipping

### Harbor Users

Massport
Boston Fuel Transportation Inc.
Boston Edison
White Fuel Corporation



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Distrigas of Massachusetts
U.S. Gypsum Company
Boston Towboat Company
Boston Gas Company

Coordination was also maintained with all concerned state, local or regional interests and all private groups and individuals who expressed an interest in this study. Information exchange and coordination was accomplished through workshops, mailings, formal public meetings, study progress briefings, and distribution of reports as needed to maintain an effective public involvement program.

### 5.4.1 Federal EIS Scoping

In June 22, 1992, the Corps issued a public notice of its intent to prepare an Environmental Impact Statement for the Boston Harbor Navigation Improvement Project. A scoping meeting was advertised and held on July 28, 1992, from 2-5 p.m. and 7-10 p.m.

Scoping comments were received from individuals, private organizations, and governmental agencies both in person and by mail. Communications generally contained one or more of the following elements:

- support for the proposed dredging to maintain the viability of the Port of Boston,
- concern for the proper handling of harbor sediments known or presumed to contain contaminated material,
- skepticism about the effectiveness of capping silt with clean material at depths of 300 feet, and
- apprehension that use of the MBDS for disposal of unsuitable material might jeopardize the Stellwagen Bank Marine Sanctuary and, more broadly, Massachusetts Bay.

These comments and others are contained in their entirety in Appendix E.

Because of a decision by the Corps and Massport in the spring of 1992 to prepare a joint EIS/R, and because Massport's Boston Harbor Dredging Project Advisory Committee and Technical Working Groups were established and functioning, most of the subsequent coordination was conducted in those forums (see 5.4.3 below).

### 5.4.2 Berth Dredging Project Environmental Notification Form

Massport's project for the dredging of berthing areas in Boston Harbor was described in its April 30, 1991, filing of an Environmental Notification Form (ENF) with the Massachusetts Executive Office of Environmental Affairs (See Appendix A). On June 7, 1991, then Secretary Susan Tierney issued the Certificate in response to the ENF. The Certificate determined that the project would require an Environmental Impact Report (EIR). It further spelled out scoping issues to be addressed in the EIR (See Appendix A). These principally related to project description, sediment characterization, dredging methodology and dredging impacts, feasibility of disposal alternatives, and mitigation measures. Finally, the Certificate ordered that copies of the EIR be distributed to commenters on the ENF and attendees at the ENF scoping session.

### 5.4.3 Boston Harbor Dredging Project Advisory Committee

To enhance coordination with agencies and interest groups over the course of environmental studies and the preparation of the DEIS/R, Massport convened a Boston Harbor Dredging Project Advisory Committee which met for the first time in March, 1992. Membership in the Committee included federal and state regulatory agencies, harbor user organizations, and environmental groups (Appendix B). Over the subse-

quent fifteen months, the Advisory Committee met seven times. To assist it with highly technical issues, the Advisory Committee created two Technical Working Groups, one of which met eight times and the other six (See Appendix B for lists of participants and meeting minutes/notes). These forums provided excellent opportunities for the exchange of information and frequently for the resolution of differences. The Sediment Characterization Technical Working Group provided advice and oversight in the development of the Sediment Sampling and Analysis Plan and in the interpretation of test results. The Disposal Options Technical Working Group helped select criteria for screening disposal options and reviewed the results of applying those criteria to individual potential sites.



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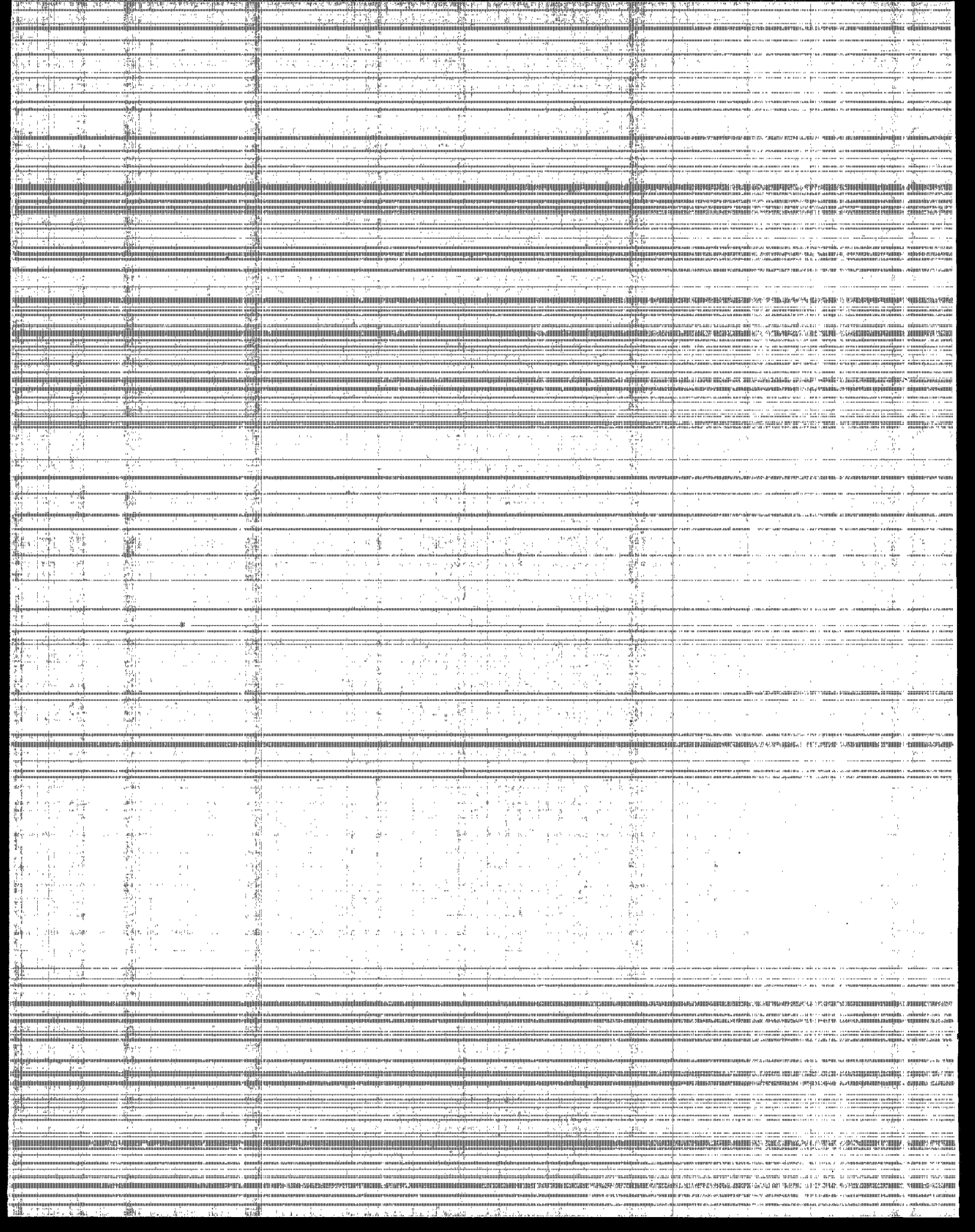

## 6.0 LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM THE BOSTON HARBOR DREDGING PROJECT DEIS/R WAS SENT

**United States Senators:**

The Honorable Edward M. Kennedy
U.S. Senate
Room 409
JFK Federal Building
Boston, MA 02203

The Honorable John F. Kerry
U.S. Senate
One Bowdoin Sq., 10th Floor
Boston, MA 02114

**United States Congressmen:**

The Honorable Peter I. Blute
U.S. House of Representatives
1029 Longworth House Office Building
Washington, D.C. 20515-2103

The Honorable Barney Frank
U.S. House of Representatives
2404 Rayburn House Office Building
Washington, D.C. 20515-2104

The Honorable Joseph P. Kennedy, II
U.S. House of Representatives
1210 Longworth House Office Building
Washington, D.C. 20515-2108

The Honorable Edward J. Markey
U.S. House of Representatives
2133 Rayburn House Office Building
Washington, D.C. 20515-2107

The Honorable Martin T. Meehan
U.S. House of Representatives
1216 Longworth House Office Building
Washington, D.C. 20515

The Honorable John J. Moakley
U.S. House of Representatives
235 Cannon House Office Building
Washington, D.C. 20515

The Honorable John Olver
U.S. House of Representatives
1323 Longworth House Office Building
Washington, D.C. 20515-2101

The Honorable Gerry E. Studds
U.S. House of Representatives
237 Cannon House Office Building
Washington, D.C. 20515-2110

**State Governor:**

The Honorable William F. Weld
Governor
Commonwealth of Massachusetts
State House
Boston, MA 02133

**State Senators:**

The Honorable Thomas F. Birmingham
State Senator
Massachusetts State House, Room 212
Boston, MA 02133

The Honorable Walter J. Boverini
State Senator
Massachusetts State House, Room 333
Boston, MA 02133

The Honorable William M. Bulger
Senate President
Massachusetts State House, Room 330
Boston, MA 02133

The Honorable Robert E. Travaglini
State Senator
Massachusetts State House, Room 416A
Boston, MA 02133

The Honorable W. Paul White
State Senator
Massachusetts State House, Room 309
Boston, MA 02133

**State Representatives:**

The Honorable James T. Brett
State Representative
Massachusetts State House, Room 42
Boston, MA 02133

The Honorable Salvatore DiMasi
State Representative
Massachusetts State House, Room 138
Boston, MA 02133

The Honorable Thomas M. Finneran
State Representative
Massachusetts State House, Room 243
Boston, MA 02133

The Honorable Paul J. Gannon
State Representative
Massachusetts State House, Room 446
Boston, MA 02133

The Honorable John Klimm
State Representative
Massachusetts State House, Room 146
Boston, MA 02133

The Honorable Emmanuel G. Serra
State Representative
Massachusetts State House, Room 481
Boston, MA 02133

The Honorable Richard A. Voke
State Representative
Massachusetts State House, Room 343
Boston, MA 02133

**Municipal Government:**

The Honorable Thomas M. Menino
Mayor, City of Boston
Boston City Hall
Fifth Floor
Boston, MA 02201

Lewis H. Spence, Receiver
Chelsea City Hall
500 Broadway
Chelsea, MA 02150

The Honorable John R. McCarthy
Mayor, City of Everett
484 Broadway
Everett, MA 02149

The Honorable James A. Sheets
Mayor, City of Quincy
1305 Hancock Street
Quincy, MA 02169

Marie T. Turner, Chair
Winthrop Board of Selectmen
1 Metcalf Square
Winthrop, MA 02152

**Federal Agencies:**

Massachusetts Bays Program
100 Cambridge Street - Room 2006
Boston, MA 02202
Attn: Diane Gould, Ph.D.

National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930-2298
Attn: Richard Roe, Director
John Catena
Chris Mantzaris

National Park Service
Charlestown Navy Yard
Charlestown, MA 02129
Attn: David Rose

New England Fisheries Management Council
5 Broadway
Saugus, MA 01906-1097
Attn: Patricia Fiorelli

NOAA/ORCA22
7600 Sand Point Way, N.E.
Bin No. C 15700
Seattle, WA 98115-0070
Attn: Jo Linse

U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149
Attn: Karen Kirk Adams, Section Chief
Tom Bruha

U.S. Coast Guard
Marine Safety Office
455 Commercial Street
Boston, MA 02109-1045
Attn: Lt. Chris Fahy
Lt. Chris Oelschlegel

U.S. Coast Guard
First Coast Guard District
408 Atlantic Avenue
Boston, MA 02110
Attn: Lt. Patrick G. Foran

U.S. Environmental Protection Agency
Region 1
JFK Federal Building
Boston, MA 02203
Attn: John DeVillars, Regional Administrator
Phillip Colaruso
Kymberlee Keckler
Ed Reiner
Patience Whitten

U.S. Fish and Wildlife Service
Ralph Pill Marketplace
22 Bridge Street - 4th Floor
Concord, NH 03301-4901
Attn: Gordon Beckett, Supervisor
Vernon Lang

U.S. Geological Survey
Branch of Atlantic Marine Geology
Quissett Campus
Woods Hole, MA 02543
Attn: Brad Butman

U.S. Dept. of Interior
Office of Environmental Project Review
Washington, D.C. 20240
Attn: Bruce Blanchard, Director

U.S. Maritime Administration
Office of Port and Intermodal
Transportation
400 Seventh St., S.W.
Washington, D.C. 20590
Attn: Joan Yim, Deputy Administrator

**State Agencies:**

Cape Cod Commission
3225 Main Street
Barnstable, MA 02630
Attn: Richard Armstrong, Chairman

Massachusetts Bay Transportation Authority
500 Arborway
Jamaica Plain, MA 02130
Attn: Peter Walworth, Manager
Environmental Engineering

Massachusetts Department of
Environmental Management
Division of Waterways, 14th Floor
100 Cambridge Street
Boston, MA 02202
Attn: Peter Webber, Commissioner
Leslie K. Lewis

Massachusetts Department of
Environmental Management
Scenic Rivers Program, Room 1404
100 Cambridge Street
Boston, MA 02202
Attn: Cassie Thomas

Massachusetts Department of
Environmental Management
Office of Water Resources
Ocean Sanctuaries Program
100 Cambridge Street, 13th Floor
Boston, MA 02202
Attn: Michael Gildesgame
Katie Harkens

Massachusetts Department of
Environmental Protection
One Winter Street
Boston, MA 02108
Attn: Daniel S. Greenbaum, Commissioner

Massachusetts Department of
Environmental Protection
Division of Solid Waste Management
One Winter Street
Boston, MA 02108
Attn: Joel Hartley

Massachusetts Department of
Environmental Protection
Division of Water Pollution Control
One Winter Street, 8th Floor
Boston, MA 02108
Attn: Brian Donahoe, Director
Steve Lipman
Judy Perry

Massachusetts Department of
Environmental Protection
Division of Waterways & Wetlands
One Winter Street, 8th Floor
Boston, MA 02108
Attn: Carl Dierker
Mitch Ziencina

Massachusetts Department of Fisheries,
Wildlife and Environmental Law Enforcement
100 Nashua Street, Room 910
Boston, MA 02214
Attn: John C. Phillips, Director

Massachusetts Department of Fisheries,
Wildlife and Environmental Law Enforcement
Division of Marine Fisheries
100 Cambridge Street
Boston, MA 02202
Attn: Phillip Coates
Leigh Bridges

Massachusetts Department of Fisheries,
Wildlife and Environmental Law Enforcement
Natural Heritage and Endangered
Species Program
100 Cambridge Street
Boston, MA 02202
Attn: Jay Copeland

Massachusetts Executive Office of
Communities & Development
100 Cambridge Street, Room 1804
Boston, MA 02202
Attn: Mary Padula, Commissioner

Massachusetts Executive Office of Economic Affairs
Division of Energy Resources
100 Cambridge Street, Room 1500
Boston, MA 02202
Attn: Stephen J. Remen, Commissioner

Massachusetts Executive Office of
Environmental Affairs
100 Cambridge Street
Room 2000
Boston, MA 02202
Attn: Trudy Coxe, Secretary

Massachusetts Executive Office of
Environmental Affairs
Board of Underwater Archeology
100 Cambridge Street
Boston, MA 02202
Attn: Vic Mastone, Director

Massachusetts Executive Office of
Environmental Affairs
Coastal Zone Management Program
100 Cambridge Street, Room 2006
Boston, MA 02202
Attn: Peg Brady, Director
Deerin Babb-Brott
Judith Pederson

Massachusetts Executive Office of
Environmental Affairs
Division of Conservation Services
100 Cambridge Street
Boston, MA 02202
Attn: Joel A. Lerner, Director

Massachusetts Executive Office of
Environmental Affairs
Division of Energy Resources
100 Cambridge Street, Room 1500
Boston, MA 02202
Attn: Joanne McBrien

Massachusetts Executive Office of
Environmental Affairs
MEPA Unit
100 Cambridge Street
Boston, MA 02202
Attn: Nancy Baker

Massachusetts Highway Department
Central Artery/Tunnel
One South Station
Boston, MA 02110
Attn: Curtis A. Meininger
Stacy A. Richards
Peter Zuk

Massachusetts Office of Inspector General
1 Ashburton Place
Boston, MA 02108
Attn: Robert A. Cerasoli

Massachusetts Maritime Academy
101 Academy Drive
Buzzards Bay, MA 02532-3400
Attn: Capt. Jeffrey Monroe

Massachusetts State Historical Commission
80 Boylston Street
Boston, MA 02115
Attn: Judith McDonough, Executive Director

Massachusetts Water Resources Authority
Charlestown Navy Yard
100 First Avenue
Charlestown, MA 02129
Attn: Maggie Debbie
Mary Lou Moffola
Mark Radville

Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
Attn: Martin Pillsbury

Metropolitan District Commission
20 Somerset Street
Boston, MA 02108
Attn: Julia O'Brien

Urban Harbors Institute
University of Massachusetts
100 Morrissey Boulevard
Boston, MA 02125
Attn: Richard Delaney
Jack Wiggins

**Municipal Offices:**

Boston Conservation Commission
Boston City Hall, Room 805
Boston, MA 02201
Attn: Christopher Kelly, Executive Secretary

Boston Department of Public Works
One City Hall Square
Boston, MA 02201
Attn: Joseph Casazza, Commissioner
Peter Scarpignato

Boston Environmental Department
Boston City Hall
Boston, MA 02201
Attn: Arthur Pugsley
Naomi Schusster

Boston Police Department
Harbor Patrol Unit
154 Berkeley Street
Boston, MA 02116
Attn: Lt. Eric Hahn, Harbormaster

Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201
Attn: Richard B. Mertens

Boston Water & Sewer Commission
425 Summer Street
Boston, MA 02210
Attn: Robert J. Ciolek, Executive Director

Newburyport Harbor Commission
City Hall
Newburyport, MA 01950

**Public Libraries:**

Boston Public Libraries:
Main Library, 666 Boylston Street
Charlestown Branch, 179 Main St., Charlestown
East Boston, 276 Meridan Street, E. Boston
Kirstein, 20 City Hall Avenue
North End, 25 Parmenter St.
Orient Heights, 18 Barnes Avenue, E. Boston
South Boston, 646 E. Broadway
Boston Redevelopment Authority Library
Chelsea Public Library
Everett Public Library
Falmouth Public Library
Hyannis Public Library
Provincetown Public Library
Quincy Public Library
Transportation Building Library, 10 Park Plaza, Boston
Winthrop Public Library

**Public Interest Groups:**

The Boston Harbor Association
374 Congress Street, Suite 609
Boston, MA 02210
Attn: Vivien Li, Executive Director

Conservation Law Foundation
62 Summer Street
Boston, MA 02110-1008
Attn: Ellie Dorsey
Grace Perez

Friends of the Boston Harbor Islands
P.O. Box 9025
Boston, MA 02114

League of Women Voters of Lower Cape Cod
P.O. Box 460
West Chatham, MA 02669
Attn: Marina Zellner, President

Massachusetts Association of Conservation Commissions
10 Juniper Road
Belmont, MA 02178

Massachusetts Audubon Society
South Great Road
Lincoln, MA 01773
Attn: Don R. Hickman, Director of Media Relations

Massachusetts Audubon Society
346 Grapevine Road
Wenham, MA 01984
Attn: Cindy DelPapa

Move Massachusetts 2000
294 Washington Street, Suite 628
Boston, MA 02108
Attn: Ann Donner

Save the Harbor/Save the Bay
25 West Street, 4th Floor
Boston, MA 02111
Attn: Joan LeBlanc
Sheila Lynch
Dave Effross

Sierra Club
3 Joy Street
Boston, MA 02108
Attn: Priscilla Chapman
Dellabarre Sullivan

Sierra Club - Cape Cod
18 Treetop Lane
E. Falmouth, MA 02536-4814
Attn: David Dow, Chair

**Private Entities:**

Bay State Cruise Company
67 Long Wharf
Boston, MA 02110
Attn: Carolyn Kiley

Bay State Towing
Pier 1, East Bremen Street
East Boston, MA 02128
Attn: Michael F. Duarte

Boston Line & Service Co.
1 Black Falcon Avenue
Boston, MA 02210
Attn: Brian J. Cox

Boston Harbor Docking Pilots
36 New Street
East Boston, MA 02128
Attn: Capt. Dave Galman

Boston Pilots
Pier 1 - South Bremen Street
East Boston, MA 02128
Attn: Capt. Arthur Whittemore

The Boston Shipping Association
Charlestown Navy Yard
33 Third Avenue
Boston, MA 02129-4516
Attn: Al Frizelle

C-Core
Memorial University
St. Johns, Newfoundland
Canada, A1B 3X5
Attn: Ian McDermott

Center for Coastal Studies
P.O. Box 1036
59 Commercial Street
Provincetown, MA 02657
Attn: Russell DeConti, Director

EA Engineering
2 Commercial Street
Sharon, MA 02067
Attn: Forest Henderson

GEI Consultants
1021 Main Street
Winchester, MA 01890
Attn: Richard F. Murdock

The Gillette Company
1 Gillette Park
Boston, MA 02127-1096
Attn: Anthony Termine

I.E.P. Inc.
P.O. Box 1840
Sandwich, MA 02563
Attn: Wetlands Group

New England Aquarium
Central Wharf
Boston, MA 02110
Attn: Sharon E. Dean, Conservation Coordinator
William Robinson
Alexis Runstadler, Research Department

Patterson, Wylde & Co., Inc.
West Building 2 - Suite 305
Boston Fish Pier
Boston, MA 02210
Attn: Capt. A. Ross Pope

Woods Hole Oceanographic Institute
Coastal Research Center
Woods Hole, MA 02543
Attn: Bruce Tripp

**Private Individuals:**

Patricia Bonanno, Buzzards Bay, MA
Elizabeth Bowen, Washington, D.C.
Gloria Brundage, Yarmouth Port, MA
Beverly Carney, Orleans, MA
Shelli Costa, Brewster, MA
Edith DeAngelis, E. Boston, MA
John Geddie, Albuquerque, NM
Douglas Gifford, Cambridge, MA
John Hegarty, Dorchester, MA
Edward Mahoney, Y. Yarmouth, MA
Stan Murphy, Needham, MA
Bud & Louise Palmer, E. Sandwich, MA
Arv Poshkus, Stoughton, MA
Michael & Robert Russo, E. Boston, MA
George Strawl, Staten Island, NY
Ray Sutherland, Gloucester, MA
Halsey Taylor, Corpus Christi, TX
Gerry Villeneuve, Berlin, NH



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_____. 1979b. Disposal Area Monitoring System Annual Data Report -Proceedings of Symposium 14-15 May 1979. Volume II, Biological Observations. New England Division, Corps of Engineers.

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Marine Environmental Services (MES). 1973. Ecological Field Survey in the Mystic River. Prepared for Stone and Webster Engineering Corp., Hanover, New Hampshire, 28 pp.

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Marine Environmental Services (MES). 1977b. Ecological Field Survey in the Mystic River. Prepared for Stone and Webster Engineering Corp., Hanover, New Hampshire, 21 pp.

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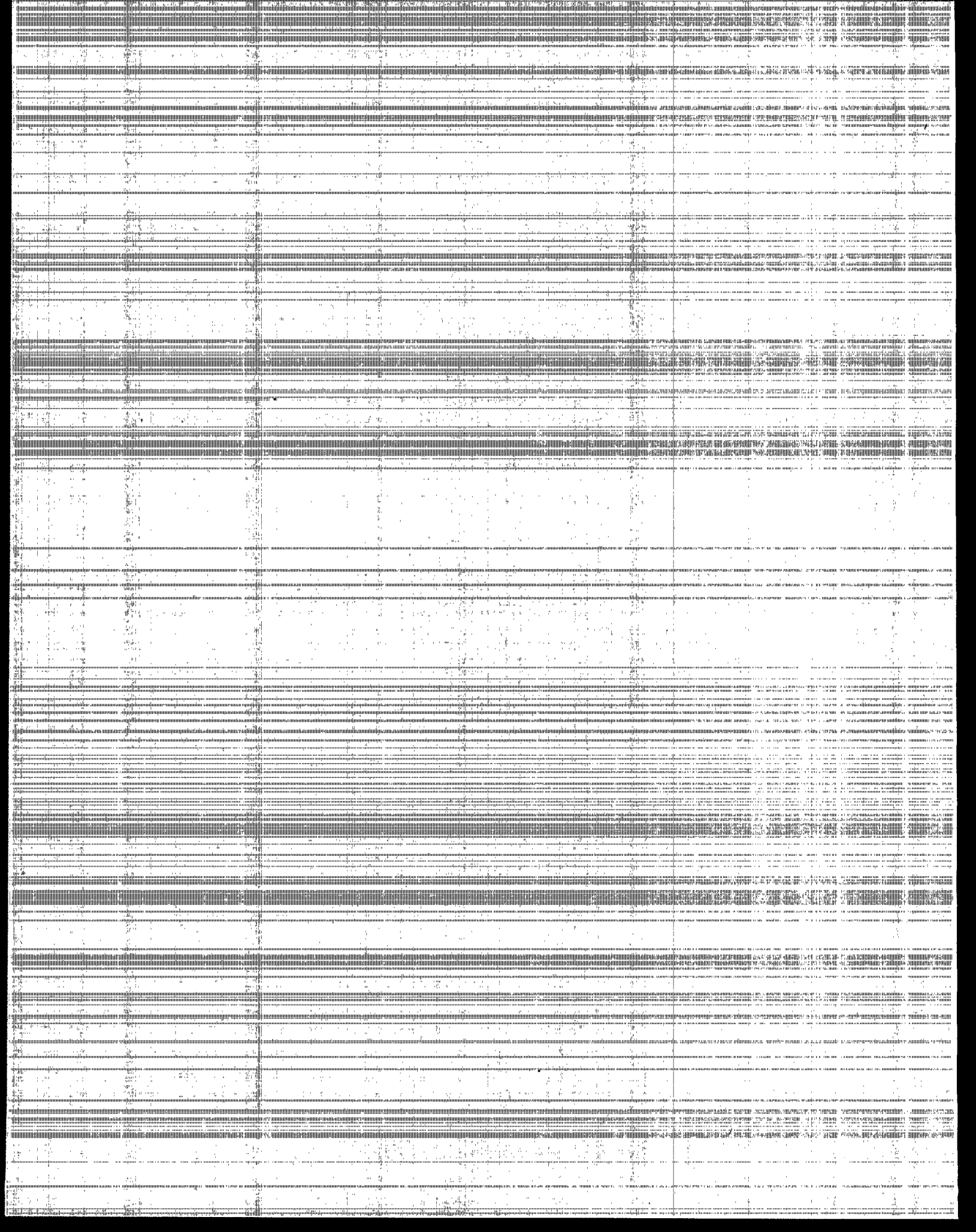


## 8.0 GLOSSARY OF TERMS

ADDAMS model - Acronym for Automated Dredging and Disposal Alternatives Management Systems; a computerized program developed by the U.S. Army Corps of Engineers Waterways Experiment Station to model and assess the impacts of waterborne contaminants due to disposal of dredged material in open water.

aerobic - Having the presence of oxygen.

amphipod toxicity tests - A laboratory testing procedure using a sensitive marine crustacean to determine the potential acute toxicity of proposed dredged material intended for ocean disposal. This testing is part of the U.S. EPA and Corps of Engineers national and regional testing protocol.

anadromous - Pertaining to fish that ascend freshwater rivers and streams from the sea to spawn.

Anaerobic bioreclamation - The process of transforming an organic contaminant into another less threatening form by using biological organisms (microbes) in a non-oxygenated environment.

anchorage - A designated area, usually adjacent to the navigation channel, for temporary mooring of vessels; the Boston Harbor anchorage is used principally for lightering and ship traffic control.

aquatic borrow pit - A disposal site located offshore in a manmade pit; this type of disposal site is intended for containment of material.

aquatic shoreline - A diked disposal site (for dredged material) located in coastal water but attached to shore.

aquatic subaqueous - A (dredged material) disposal site located below the intertidal zone, usually offshore.

Areas of Critical Concern (ACECs) - Areas within the Commonwealth of Massachusetts that have been designated for special protection or management because of their importance; examples include coastal beaches, estuaries, barrier beach systems, salt marshes, shellfish concentration areas and habitat for threatened, rare or endangered species.

artificial reefs - A man-made structure located in the ocean for the purpose of habitat enhancement.

August Effect - A substantial reduction in the amount of dissolved oxygen which occurs in certain shallow estuaries and harbors during the late summer. This change is felt to cause a corresponding depression in biological activity in the affected area.

azoic parent material - Sediment, rock or other material that has been in place since geologic time and presently supports no life.

bathymetric - Pertaining to ocean depths in order to determine sea floor topography.

beneficial uses - Utilization of (dredged) material for an economic, environmental or other useful purpose.

beneficiaries - Those ship terminals and other water related facilities that would benefit economically by deepening the Federal channel in the Boston Harbor Navigation Improvement Project (BHNIP).

benthic infauna - Aquatic animals which live in the bottom sediment of a body of water.

benthic organisms - Aquatic animals which live on or in the sea floor substrate.

BHNIP - Acronym for Boston Harbor Navigation Improvement Project which is the Federal (Corps) portion of this EIR/S.

bioaccumulation - The uptake of a contaminant in a living organism and the increase in concentration of a chemical of interest in an animal when exposed to proposed dredged material for a specified period of time. This testing is part of the national and regional testing protocol regulated under the Ocean Dumping Act.

biota - Environmental life forms; examples include fish, lobster, crabs, marine worms and clams.

Boston Blue Clay - Naturally occurring clay parent material commonly found in Boston Harbor.

bulk cargo - Goods that are transported in large ocean going vessels; examples include salt, coal, petroleum and grain.

bulk chemical analyses - The laboratory testing of sediment to determine the chemical concentrations of key parameters of interest. This testing is part of the U.S. EPA/Corps Regional testing protocol.

bulkheading - To partition off a section of shoreline by constructing a vertical wall for containment of (dredged) material.

capping - The process of isolating contaminated dredged material by covering (capping) with a layer of clean material of sufficient thickness.

Central Artery/Third Harbor Tunnel (CA/T) - A major dredging project in Boston Harbor involving removal of several million cubic yards of sediment and its disposal using several alternatives.

chelation - A chemical process involving the retention of a hydrogen or metal atom between two atoms of a single molecule.

colonization - The establishment of a viable population of benthic animals.

containerized cargo - Dry bulk goods that are transported on large ocean going vessels in steel containers.

CSOs - Combined sewer outfalls; there are many CSOs that discharge into Boston Harbor.

cy - The abbreviation for cubic yards; approximately 1 cubic yard of dredged material weighs about 1.5 tons.

DAMOS - Disposal Area Monitoring System; acronym for the open water disposal of dredged material monitoring program conducted by the U.S. Army Corps of Engineers, New England Division).

demersal - Living at or near the bottom of the sea.

dewatering - The process of removing excess water from (dredged) material; dewatering includes removal of ponded or surface water and could also include removal of water bound into the sediment (pore water).

digestion - The process of breaking down a material or chemical compound into an absorbable and/or simpler chemical form.

dredge - The mechanical device that is used to remove sediment from a channel, berth or other portion of a waterbody. The three basic types of dredges are mechanical, hydraulic and hopper.

dredged material - Marine sediment that has been removed by dredging activity; dredged material was historically referred to as "spoil."

early benthic phase lobster - A term used to identify a post-larval stage of development in which animals are large enough (5 mm to 35 mm) to swim and gain a negative buoyancy. This phase is the most critical period in the life and recruitment of lobsters.

EBP - Early benthic phase.

elutriate testing - A testing method designed to evaluate the extent to which chemicals are released from sediment to the water column while agitated during the dredging and disposal processes.

entraining - The process of carrying material suspended in the water column.

environmental bucket - A specially designed clamshell dredge bucket that is relatively watertight to minimize the release of material to the water column during the dredging process.

estuarine - Relating to a semi-enclosed coastal waterbody that is measurably diluted with fresh water from rivers or other significant freshwater sources.

existing aquatic - An existing open water site for unconfined open water disposal; an example is the Massachusetts Bay Disposal Site.

expansion factor - A method of accounting for the increase in volume of consolidated material due to changes during dredging which include: 1) particle structure rearrangement; 2) reduction in confining pressure; and 3) increase in water content.

fastland - Land created by filling an area previously occupied by water.

filter feeders - An organism that traps particles suspended in water to facilitate the feeding process.

furan homologs - Various organic compounds of a group represented by a diunsaturated ring of four carbon atoms and one oxygen atom.

Green Book - The national guidance manual developed by the U.S. EPA and Army Corps of Engineers used to evaluate impacts of dredged material disposal in ocean waters. This provides the technical framework for performing a stepwise or tiered evaluation in conformance with the Ocean Dumping Act.

hopper dredge - A self-propelled floating dredge that removes sediment by hydraulically pumping the material and water into an onboard hopper. The dredged material is transported to the disposal site by the vessel and material removed by bottom operating doors.

hydraulic dredge - A floating dredge that removes sediment by hydraulically pumping the material and water through a floating pipeline to the discharge area.

hydrographic surveys - Exploration of a body of water to determine depth and bottom contour.

improvement dredging - The dredging of an area to a new deeper depth and possibly a new width. Dredged material removed in improvement dredging is often termed parent material, that is, material which has never been dredged before.

incineration - The process of burning a material at a very high temperature to break down the chemical structure of the material.

intertidal - Pertaining to the part of the coast that is subjected to the rise and fall of the tides.

landfill - Specified land based disposal sites for a variety of material, including household garbage, refuse, construction material and other wastes including dredged material. Some landfills are lined to protect groundwater from leachate.

leachate - The product of a substance or chemical that was able to separate or dissolve into solution and be transported; an example is the separation of a chemical from sediment into water which seeps into a nearby site.

least environmentally damaging alternative - The disposal alternative that will result in the least impact to the environment.

lightering - The process of removing cargo from a vessel before it enters port in order to allow the vessel to proceed into shallower water; in Boston Harbor petroleum tanker ships are commonly lightered before entering Boston Harbor for offloading the remaining load.

LNG - Liquified Natural Gas, a commodity brought into Boston Harbor by tanker vessels.

MADEP - Massachusetts Department of Environmental Protection.

MBDS - Acronym for Massachusetts Bay Disposal Site which is located about 20 miles east of Boston Harbor. The site is utilized for dredged material disposal that meets the Ocean Dumping Act criteria.

maintenance material - Silt material which has accumulated due to settling by migration from another location.

MANHESP - Massachusetts Natural Heritage and Endangered Species Program.

Massachusetts CZM - Massachusetts Office of Coastal Zone Management.

Massachusetts DEP - Massachusetts Department of Environmental Protection.

Massport - Massachusetts Port Authority - local sponsor for the BHNIP.

mechanical dredge - A barge mounted crane that uses a clamshell bucket to remove sediment. The material is typically placed into an awaiting barge or scow to hold and transport the material to be offloaded on land or dumped at sea.

MEPA - Acronym for Massachusetts Environmental Policy Act (301 CMR 11.00-12.00) which is regulated by the Executive Office of Environmental Affairs; the purpose of this EIR/S is to satisfy the requirements established under MEPA for dredging and disposal of the proposed material.

MHC - Massachusetts Historical Commission.

mitigation - The process of reducing or compensating for adverse impacts; examples for dredging projects include time of year restrictions, use of turbidity control curtains, environmental bucket.

MLW - The abbreviation for mean low water.

MWRA - Massachusetts Water Resources Authority.

National Historic Preservation Act of 1966 - Section 106 of this Act provides for the identification, assistance and protection of historic properties, structures or sites that may be affected by proposed projects. The BHNIP is subject to review and coordination with the Massachusetts Historical Commission in determining compliance with this Act.

nautical mile - A unit of distance used principally in navigation; one nautical mile equals 6080.27 feet or 1.1516 statue miles.

NEPA - Acronym for National Environmental Policy Act (40 CFR 1500-1508) directs Federal agencies to prepare an environmental impact statement (EIS) for any major Federal action significantly affecting the quality of the human environment; the Corps is voluntarily preparing an EIS for the BHNIP as a joint effort with Massport who is preparing the EIR.

non-Federal cost sharing partner - The project proponent (local sponsor) who participates with the Corps by providing a share of funds needed to carry out the design and construction of the project.

non-Federal interests - Participants in the project that are not Federal agencies or Federally funded. They include the sponsor, project beneficiaries, and others who contribute to or benefit from the project.

non-halogenated semivolatiles - Those organic compounds (PAHs) and metals that are semi-volatile but do not contain any elements of the halogen family (i.e., fluorine, chlorine, bromine, iodine, and astatine).

nucleophilic substitution - A chemical process used to remove chlorine from chlorinated compounds to change their chemical structure.

organic - Containing plant and other decaying matter; examples include peat and muck soils. Silty dredged material may or may not contain organic material.

parent material - Formerly undisturbed sand or clay which has never been dredged.

polychlorinated biphenyls (PCBs) - A colorless liquid used as an insulating fluid in electrical equipment. PCBs are a known carcinogen.

polynuclear aromatic hydrocarbons (PAHs) - Hydrocarbon molecules with two or more nuclei; examples include benzene, benzo(a) pyrene and naphthalene.

practicable - A reasonable combination of logistics, technology and cost.

Project Cooperation Agreement (PCA) - An agreement by the Federal Government and the non-Federal sponsor which is made prior to construction of a planned Federal project.

prop wash - The result of ship propellers in shallow water disturbing the bottom sediments.

protocols - Established procedures for conducting a specified activity.

pyrolytic process - To subject organic compounds to very high temperature for decomposition.

rare and endangered species - Those plant and animal species that are identified by Federal and state regulatory agencies as being at risk of elimination and warrant special protection.

River and Harbor Act of 1899 - This Act (33 CFR 320-330)authorizes the U.S. Army Corps of Engineers to maintain Federal navigable channels, anchorages, etc. and regulate all work in navigable waters through a permit program.

SA waters - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.

SB waters - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting with depuration (Restricted Shellfish Areas).

SC waters - Waters assigned to this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

Section 101 of WRDA 1986 - That portion of the Water Resources Development Act that describes the cost sharing requirements of the non-Federal sponsor.

silt material - Sediment that is finer than sand but coarser than clay. Silt is usually the main component of maintenance dredge material in the Boston Harbor area.

siltation rate - The rate at which sediment falls out of suspension from the water column and accumulates on the seafloor. This is usually measured as thickness of settled material in centimeters or inches per year.

sole source aquifer - A water reservoir having only one locale or source for replenishment.

Stellwagen Bank - An area in Massachusetts Bay about 15 miles east of Boston Harbor that is included as part of Federal Marine Sanctuary. The MBDS is located just west of this area.

substrate - The physical make-up of the seafloor; substrate typically consists of clay, silt, sand, gravel and rock.

subtidal - Pertaining to the part of the ocean that is below the plane of mean low water.

tankers - Ocean going vessels designed to carry large volumes of petroleum and other liquid products.

Tier I - The initial evaluation step as provided in the Green Book. This phase includes the review of existing information to determine whether sediment testing will be required (Tiers II and III).

Tier II - The second step in evaluating a perspective dredging project according to the Green Book. This phase includes bulk chemical analyses of the sediment and a mathematical assessment of the bioaccumulation potential and water quality impacts.

Tier III - The third step in evaluating a prospective dredging project according to the Green Book. This phase includes biological testing to determine acute toxicity and bioaccumulation potential for target contaminants.

toxicity - The measure of mortality a substance incurs on a target organism.

treatment technologies - Various methods used to remove or stabilize contaminants in dredged material.

tributary channels - Channels connected to the Main Ship Channel.

trophic level - Any of the feeding levels which allows the passage of energy through an ecosystem; examples are finfish feeding on marine worms and bivalves (clams) feeding on the waterborne nutrients.

turbidity - A measure of clarity of the water column due to the amount and type of particles in suspension.

turbidity plume - A cloud of material suspended in the water column; dredging can create a turbidity plume consisting of fine grained sediments.

unconfined open water disposal - Disposal of dredged material in open water such that the material is not contained by a physical structure.

upland coastal - A land based disposal site located in proximity to the coast.

upland inland - A land based disposal site located away from the coast.

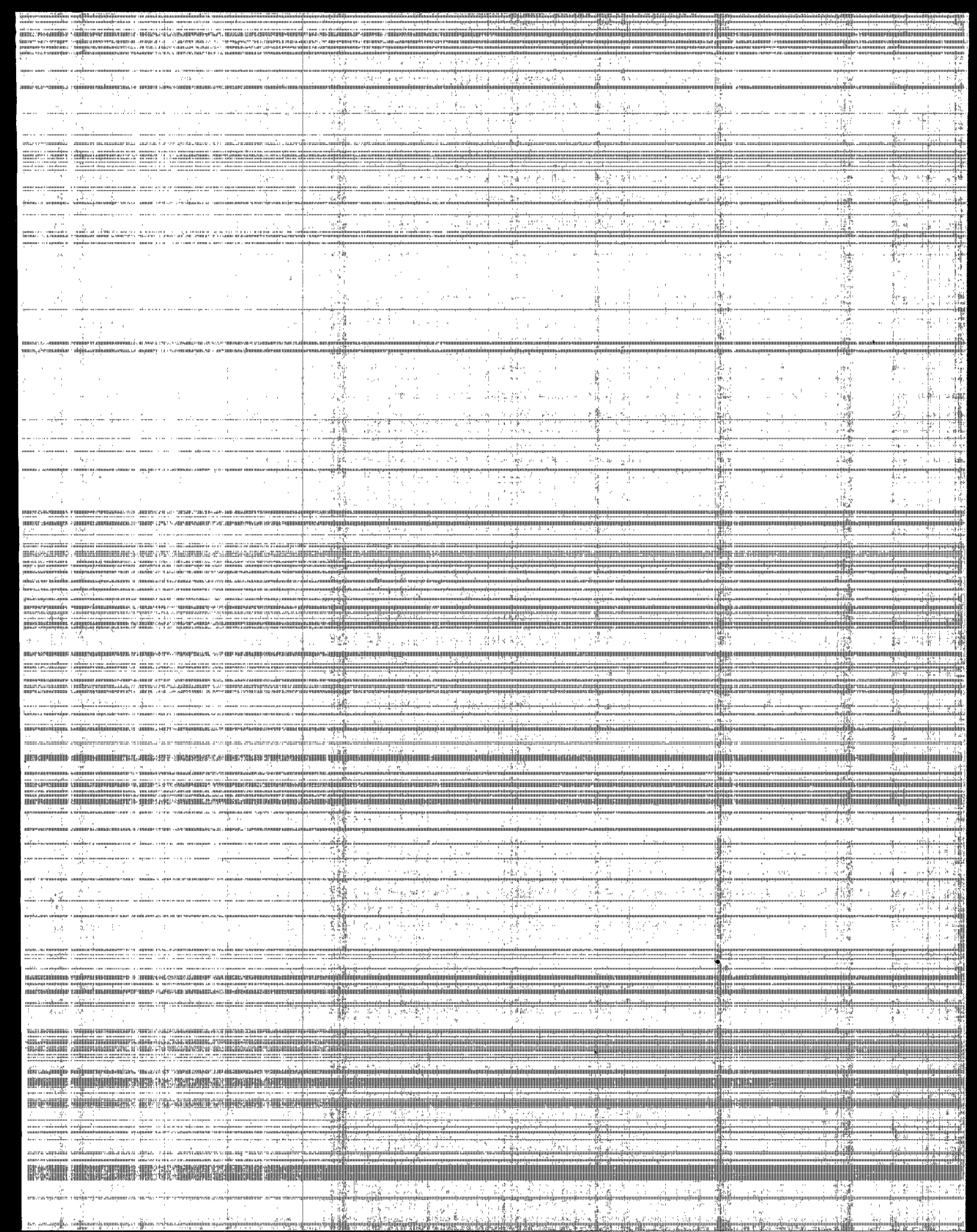
USACOE - U.S. Army Corps of Engineers (New England Division).

vitrification - The process of formation of a glassy or noncrystalline material.

water column - The entire vertical length of water that would be involved; an example would be the travel distance of a dredge bucket from the harbor bottom to the water surface as the bucket is raised during the dredging process.

water quality criteria - EPA established concentration levels of chemicals of interest above which may produce toxic or sublethal effects.

Water Resources Development Act of 1990 - the Act passed by Congress and signed by the President, which includes the authorization to construct the BIINIP.



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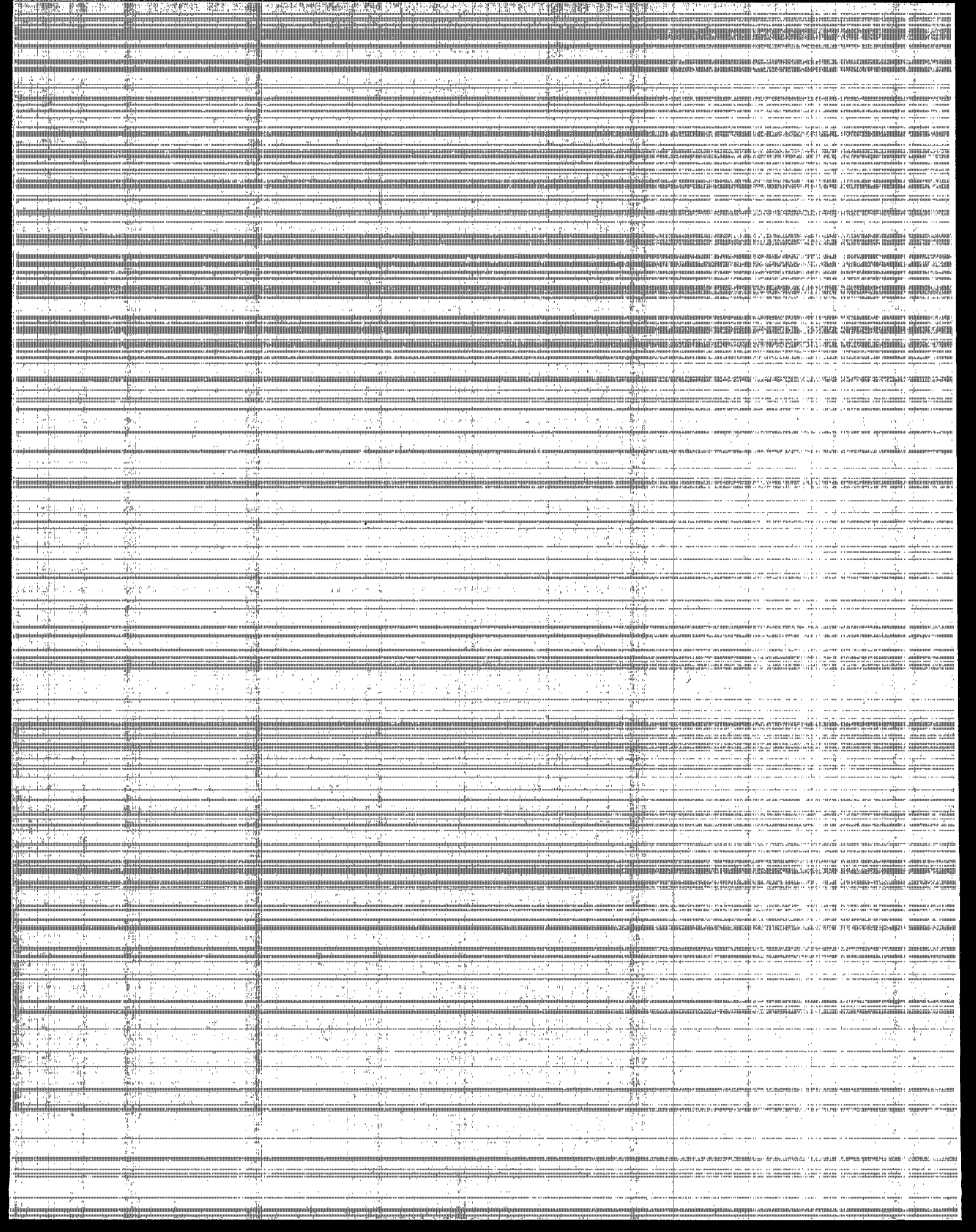

ATTACHMENT 1:

# AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES EVALUATED FOR POTENTIAL DREDGING AND DISPOSAL SITES

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# ATTACHMENT 1: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES EVALUATION AT POTENTIAL DREDGING AND DISPOSAL SITES

## 1.0 INTRODUCTION

The purpose of this Affected Environment and Environmental Consequences Evaluation is to provide more detailed descriptions of dredging sites and potential disposal sites, as summarized in Sections 2.0, 3.0 and 4.0 of this EIR/S. Described herein are the baseline environmental conditions, proposed site uses and potential environmental consequences from dredging or disposal at each site. This evaluation is designed to provide a description of both the "existing conditions" and "environmental consequences" at the potential sites, in accordance with the MEPA EIR and Federal EIS guidelines.

Although the full project, in its entirety, is sponsored by Massport, the dredging activities (and sites) are broken down into two components:

1) Federal Project: This includes deepening portions of the federal channels to 40 feet including areas within the:

   - Mystic River
   - Chelsea Creek (to 38-feet MLW)
   - Inner Confluence
   - Main Ship Channel
   - Reserved Channel

   This portion of the project is being administered by the Army Corps of Engineers-New England Division (ACOE NED).

2) Non-federal Project: This includes the dredging of several berth areas throughout the Inner Harbor, Mystic River, Chelsea Creek, and the Reserved Channel. This portion of the project is administered by Massport and includes the following sites:

   - Prolerized
   - Distrigas
   - Moran
   - Mystic Piers
   - Eastern Minerals
   - Gulf Oil
   - North Jetty
   - Army Base
   - Boston Edison Intake
   - Boston Edison Barge Berth
   - Conley

The project is described in Section 2.1, Volume 1 of the Environmental Impact Report/Statement (EIR/S). This evaluation focuses on the environmental conditions and impacts at the disposal sites.

## 2.0 ENVIRONMENTAL EVALUATION: DISPOSAL SITES

As part of this EIR/S process, an extensive site screening process (Section 3.0 in EIR/S) was undertaken to identify potential disposal sites for this project's dredged material. As a result of this process, 24 candidate sites were deemed potentially suitable for material disposal. They are grouped according to site type as follows:

Land-Based Coastal Sites
Squantum Point (QUI-03)
Everett (EVR-04)

Land-Based Inland Sites
Woburn (WOB-11)
Wrentham (WREN-495)
Plainville Sanitary Landfill
Fitchburg/Westminster Sanitary Landfill
BFI-Northern Disposal, Inc. (East Bridgewater)

Aquatic Sites
In-Channel Disposal (3 sites)
Subaqueous Containment Site B
Subaqueous Containment Site E
Winthrop Harbor

Nearshore Aquatic Sites
Mystic Piers (Massport 49 & 50)
Revere Sugar
Amstar
Cabot Paint
Little Mystic Channel
Reserved Channel

Borrow Pit Sites
Spectacle Island Contained Aquatic Disposal (CAD)
Meisburger Sites 2 and 7

Existing Open Water Sites
Massachusetts Bay Disposal Site
Boston Lightship Disposal Site

Locations of these potential sites are shown in Figure A1-1 and presented in more detail on figures contained in the following sections. The sites are described generally in the order given above; their order has no bearing on their status as an acceptable or preferred alternative.

The environmental evaluation process included a review of previous environmental studies and reports followed by site investigations to supplement and fill primary data gaps. Field groups were comprised of senior scientists in disciplines such as wetland ecology, wildlife ecology, marine ecology, estuarine ecology, water quality planning, and engineers experienced in environmental issues at landfills, materials disposal, site drainage, and site planning. During the in-field site investigations, these experts recorded their findings for baseline environmental conditions for each candidate site. Outer harbor and offshore sites were not field surveyed, but relied on available information for this assessment.

This evaluation examines impacts to each potentially sensitive resource at each of the candidate sites. Summaries of project impacts at each candidate site are presented in Section 3.0 of the EIR/S.

## 2.1 SITE EVALUATIONS: LAND-BASED COASTAL SITES

### 2.1.1 Squantum Point (QUI-03)

#### 2.1.1.1 Existing Conditions

The Squantum Point site is depicted on Figure A1-2.

**GEOLOGY/SOILS**

The site appears to consist of historic tidelands that were filled for the construction of a small naval air station. The area is generally flat and surrounded on the shoreline perimeter by an eroded and dilapidated metal and concrete seawall. Soils in the project area are primarily Udorthents, which are classified as areas filled with excavated materials (SCS 1989a). Thickness of material is generally six feet or more, although the actual depth of fill at this site is unknown.

The type of bedrock underlying the site can only be inferred since no outcrops of bedrock are evident. Based on the mapping by Kaye (1980) this area may be underlain by conglomerate or by tuffaceous sediments. Depth to bedrock is unknown.

**HYDROLOGY/WATER QUALITY**

The hydrology of the site is not fully understood and is complicated by remains of the old airport's storm drain system (observed during site walks by project staff, November 1990, and May 1993). After a heavy rainstorm, water was observed in small pools in the upland areas, while the wetland did not appear to be storing any runoff. Closer observation revealed a graded storm drain on the edge of the wetland and an outfall pipe to Dorchester Bay that, at that time, was clearly discharging water. It is not known whether the wetland was the sole source of this storm water flow or if other storm drains contributed as well. Water in the wetland drain was later observed to have reversed direction, flowing back into the wetland. This indicates that the wetland area is hydrologically connected to Dorchester Bay and influenced by tides, although the wetland plant community reflects only mildly brackish conditions. The erosion behind the decayed seawall indicates that overland flow to the bay does occur, although the erosion is in part due to tide and wave action.

No information concerning groundwater resources at this site was available. However, groundwater appears strongly influenced by tides and could be highly saline. Any groundwater at this site should not be suitable for public water supply.

The Neponset River and Dorchester Bay are both classified as SB by the Massachusetts Department of Environmental Protection, hereafter referred to as MADEP, in the surface water regulation (314 CMR 4.00). This classification protects saline water bodies for the following uses: propagation of fish and aquatic life and wildlife, primary and secondary contact recreation, and shellfish harvesting with depuration. Abundant shellfish beds are present in the tidal flats off Squantum Point as noted during a site visit in October 1990. However, as these shellfish cannot be reliably depurated, Massachusetts Department of Marine Fisheries (MADMF) has closed the area for harvesting except for bait (Ralph Stevens, MADMF, 1993, personal communication).

Limited water quality data are available for the Neponset River at its confluence with Dorchester Bay; however, water quality in the river is likely influenced by combined sewer overflows (CSOs) and non-point source pollution (NAI 1990). Historical data have shown high variability in fecal coliform concentrations at the mouth of the Neponset River (NAI 1991a). Bacteria and dissolved oxygen are likely the two most limiting factors on water quality in Dorchester Bay, although a complete assessment of water quality cannot be made at this time.

## AQUATIC RESOURCES

There are no freshwater streams or ponds on the Squantum Point site, although several depressions may intermittently retain surface water.

Marine resources are influenced by conditions in both the Neponset River and Dorchester Bay. Thus, although the intertidal area is broadly defined as tidal flat with a fringing, patchy salt marsh, substrate conditions vary dramatically, depending on exposure. The following description of intertidal communities is based on studies performed by NAI in 1990. Physical conditions appeared little changed in subsequent site visits by NAI in May 1993.

The intertidal zone was narrowest (65 feet) in the easternmost portion of the site, broadening to more than 1000 feet at the northwest corner. Salt marsh vegetation was patchy and best developed along the western side of the parcel. Sediments in the upper intertidal zone were predominantly sand, grading to pebbles and then silty sand within about 50 feet of the bulkheaded shoreline. At the northern end of the point, sandy sediments extended 100+ feet from the shoreline. Seaward, sediments were silty sand/sandy silt with large quantities of shell hash. There were extensive blue mussel (*Mytilus edulis*) beds in the lower intertidal zone along much of the northern border of the site.

Dominant benthic infauna of the northerly exposed tidal flat included the spionid polychaetes *Streblospio benedicti*, *Polydora cornuta* and *Pygospio elegans*; oligochaetes; soft-shell clam spat (*Mya arenaria*); and nematodes (NAI 1990). These species typically exhibit wide temporal fluctuations in abundance but represent potentially important food resources for higher trophic levels because of their high abundances. These same taxa were also abundant in the areas of intertidal sandy beach. The additional prevalence of the longer-lived maldanid polychaete, *Clymenella torquata*, in the beach community suggests that environmental conditions have exhibited consistent patterns in the recent past, allowing the establishment of a stable benthic community. A microfloral community appeared to be established along the north-facing tidal flat. The chlorophyll *a* concentrations indicated a moderate to high potential for utilizing nutrients contributed by the Deer Island treatment plant and other sources (NAI 1990).

The intertidal substrate along the western border of the site was primarily fine-grained sediments with large quantities of shell hash. Salt marsh broadened from about 5 to 15 feet moving south along the site. Mussel beds were extensive about 600-700 feet offshore. The benthic community along the western boundary of Squantum Point exhibited the typical opportunistic dominants, spionids and oligochaetes, as well as abundant soft-shell clam spat. Less abundant taxa add to the diversity and food-resource value of the flat (NAI 1990) and contribute substantially to the biomass available for consumption by foraging fish, megainvertebrate fauna and shorebirds. The sediment surface yielded high values for chlorophyll *a* (NAI 1990).

The tidal flats were described as being productive clam beds by Chesmore et al. (1971). There continues to be a large soft-shell clam population in this area, averaging 16.5 clams per square foot (NAI 1990). Clams were sparsest along the northern boundary and most abundant at the northwest corner. Mean size was 5.3 cm with 62% of the clams being larger than 5 cm (harvestable size). Presently, harvesting of shellfish is prohibited except for bait because of contamination (Ralph Stevens, MADMF, 1993, personal communication). Live razor clams (*Ensis directus*) were also observed.

The blue mussel beds were dense aggregations with abundances averaging 58/foot$^2$, and over 90% alive (NAI 1990). Benthic infauna were very abundant in the vicinity of the mussel beds. Unlike the other parts of the intertidal zone, the mussel beds supported a variety of arthropods (mostly amphipods) and



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other mollusks, with soft-shell clams being numerically dominant. Dominant annelids were the same ubiquitous taxa. Few burrowing species were represented. Chlorophyll *a* values were moderate to high.

Finfish and epibenthic fauna were not investigated. The abundance of and diverse habitat available for benthic infauna indicate the suitability of the Squantum Point intertidal zone to provide trophic support for these consumers. Species such as Green crabs (*Carcinus maenas*) and other crabs (*Cancer* sp.) are likely to forage among the mussel beds and open tidal flats and, in turn, be preyed upon by wading birds. Flounder and other demersal fish, particularly juvenile stages, use intertidal areas extensively for feeding. The MADMF officially recognizes the Neponset River as a spawning run for rainbow smelt. MADMF considered the anadromous fishery resource of the Neponset River to include a large smelt run, a limited shad run and a river herring (alewife and blueback) run (MADMF 1990, personal communication).

An area of potential concern in the vicinity of the Squantum Point site is a bed of submerged vegetation in the Neponset River that extends from Commercial Point to an area beyond Tenean Beach (MWRA 1987). The extent and character of this resource has not been determined.

The Squantum Point intertidal area was rated as having a high potential for aquatic diversity and abundance and a moderate-to-high potential for nutrient retention/transformation (NAI 1990). The extensive shellfish beds around the entire flat and fine sediments on the western shoreline suggest a high potential for sediment/toxicant retention. This site has a high potential for shellfish habitat as indicated by the variety of substrate conditions and mollusk species present. The large food resources in this tidally influenced area indicate a moderate-to-high potential for providing fish habitat. Similarly, the tidal flat resources are potentially important for migratory shorebirds. The breadth of the intertidal area offers sediment and shoreline stabilization, although the open exposure to the north and erosion behind the sheetpile wall indicate that storm tides reach the upland edge of the site.

## VEGETATION

Random seed dispersal and tolerance of the degraded and artificial substrates remaining after past uses have influenced the type of vegetation that has developed on the site. Vegetation has not developed to the point of presenting well-defined classes with good structure and habitat, owing at least in part to the compacted fill substrate which serves as soil. Two broad upland vegetation classes currently exist within the confines of the seawall: early successional shrubland, approximately 10-15 feet tall; and old field encroaching on the abandoned runways and perimeter road.

Most of the site is covered by aggressive plant species, able to withstand disturbed conditions. The mixture of shrubs, grasses and forbs is dominated by sumac (*Rhus typhina*), bayberry (*Myrica pensylvanica*), poison ivy (*Toxicodendron radicans*) and multiflora rose (*Rosa multiflora*), making foot travel difficult. Grass species include quackgrass (*Agropyron repens*), upland bent (*Agrostis perennans*) and broom beardgrass (*Schizachyrium scoparium*), while the forbs are predominantly Eurasian invaders, including wild carrot (*Daucus carota*), mugwort (*Artemisia vulgaris*), heath aster (*Aster ericoides*) and tansy (*Tanacetum vulgare*).

## WETLAND RESOURCES

The on-site and adjacent wetland areas described herein were field delineated by NAI in 1990 using the 1989 Federal identification methodology (NAI 1990) and are those areas estimated to fall within the review of Section 404 of the Federal Clean Water Act. Also documented are those associated wetland resource

areas, identified from published references or by field observation, that are protected under the jurisdiction of the Massachusetts Wetlands Protection Act (MGL c 131, s 40) and its implementing regulations (310 CMR 10.00). These include: 1) Land Under the Ocean, 2) Coastal Beach, 3) Salt Marsh, 4) Land Containing Shellfish, 5) Fish Run, 6) Land Subject to Coastal Storm Flowage, and 7) Bordering Vegetated Wetland. Also present is a regulated buffer zone extending 100 feet inland and/or upland of the coastal beach, salt marsh, and bordering vegetated wetland.

During the 1990 wetland delineation, on-site construction activities associated with the Deer Island staging facility had continuously changed terrestrial site characteristics. Therefore, the team of wetland scientists had problems clearly identifying on-site conditions. Although the 1993 site visit indicated more stable conditions. Existing fill soils and transitional vegetation greatly complicate wetland delineation. Should Squantum be chosen for final design a comprehensive wetland resource evaluation and boundary delineation will be required using the current state and federally approved methodologies.

Several acres of salt marsh are found on Squantum Point, outside and adjacent to the seawall. These are interspersed with areas of tidal flat and coastal beach. The largest band of salt marsh lies on the northwest corner, outside the wall, and runs southward beyond the site. This salt marsh band consists almost entirely of cordgrass (*Spartina alterniflora*), with minor sea lavender (*Limonium* cf. *nashii*) and seaside goldenrod (*Solidago sempervirens*), and has a substrate of sand and cobbles. The width of the marsh averages approximately 30 feet, with its upper limit coinciding with the high tide level. A strip of coastal beach approximately 10 feet wide included the apparent mean high tide line, above which beach grass (*Ammophila brevigulata*) dominated to the base of the seawall. Several small patches of salt hay (*Spartina patens*) were interspersed with beach grass.

Landward of the seawall, fills and disturbed surfaces dominate the area. The hydrology is very difficult to discern, owing to the presence of an old subsurface drainage system of unknown extent. At one culvert break along the northern wall, erosion has initiated a depression along 15 feet of the wall, now colonized by some beach and salt marsh species: cordgrass (*S. alterniflora*), reed (*Phragmites australis*), sea-blight (*Suaeda linearis*), seaside goldenrod (*S. sempervirens*) and saltwort (*Salicornia europaea*).

The northwestern shore supports a more patchy, irregular salt marsh which extended seaward from the base of the seawall. Dominated by cordgrass, this marsh was obviously situated in a high energy environment as indicated by the eroding peat on its seaward face, and the deteriorating condition of the seawall behind it.

A 1.0± acre brackish wetland with an ephemeral hydrologic connection with Dorchester Bay lies about 300 feet inside the seawall, and is surrounded by upland vegetation and soils. Appearing as an open herbaceous community, the plant species include a mixture of freshwater and salt-tolerant plants. It is dominated by red-top (*Agrostis alba*), rushes (*Juncus effusus* and *Juncus gerardi*), cattail (*Typha angustifolia*), three-square sedge (rush) (*Scirpus americanus*), purple loosestrife (*Lythrum salicaria*) and seaside goldenrod (*S. sempervirens*). This wetland drains to the northwest through a low-lying iron catch basin and culvert placed at such an elevation and slope that allows the highest spring and storm tides to back flow through the culvert, bringing salt water into the wetland's northwest corner. The wetland soil is mineral, and clearly hydric. It has some permeability but little or no organic content, as would be expected with recently formed soil. Immediately following a two-day, 2 to 4 inch rainfall, the wetland had no ponded waters, but the fill substrate was fully saturated. Approximately 0.1 cubic feet per second (CFS) was running out of the culvert. Other small areas of wetland may occur in slight depressions among early-succession shrublands and would

require delincation if this site was selected for final design.

In 1990, the inland wetland was evaluated using the Hollands-Magee freshwater wetland model (NAI 1990). Results indicated that the wetland had a very low hydrologic and structural diversity, resulting in low biological value. Scores for nine of ten wetland functional elements using the Hollands-Magee model rated below median; only aesthetics rated above median, mostly due to the abundance of showy flowering plants. This means that this wetland ranks below most New England inland wetlands in the NAI database for all the Hollands-Magee values but aesthetics.

## WILDLIFE

The old-field portion of the site is somewhat diverse, with an intricate mix of shrub and herb layers providing habitat/edge conditions. The shrub layers form an interconnecting network, providing habitat for numerous ground animals, including cover and food for small to medium-sized mammals and resident, migratory and wintering bird species. Observed on-site mammal species included: muskrat, house cat, mouse (evidence); and several bird species: common grackle, ring-necked pheasant, northern flicker, American goldfinch, song sparrow, Eastern kingbird, gray catbird, American robin, yellow warbler and short-cared owl. The tangles of poison ivy and multiflora rose provide cover and food (e.g., berries) for many of these species. Small trees, such as red cedar and poplar, provide nesting places for birds with substantial height requirements (e.g., American goldfinch, Eastern kingbird), whereas the rose-ivy tangles are excellent for low nesters (e.g., song sparrow: Harrison 1975). Animal movement into and out of the area is restricted mainly to urban species, aquatic species, and birds because of the site's isolation from other wild or open areas.

Little wildlife value can be attributed to the inland wetland community, due to the low food value of the plants and low value for cover. Outside the seawall, however, the mixture of salt marsh, beach and tidal flats provides extensive habitat for migrating and resident shorebirds. These interspersed resources, combined with the high diversity of marine invertebrates, provide excellent food resources for birds such as turnstones, yellowlegs, sanderlings and smaller sandpipers. During field visits, double-crested cormorants were observed utilizing open water, with herring gulls, great black-backed gulls, ring-billed gulls, brant, greater yellowlegs, black-bellied plovers and mallard ducks in the beach and tidal flat areas.

## THREATENED AND ENDANGERED SPECIES

The Massachusetts Natural Heritage and Endangered Species Program (MANHESP) records did not identify any protected species or habitats which occur on the site (MANHESP, letter dated March 1, 1993).

A short-eared owl was observed on-site during fieldwork on November 5, 1990. This species is listed by Massachusetts as an endangered breeding species. This species is of worldwide distribution. In New England, it is most commonly seen as a migrant and winter visitor in coastal fields, airports and salt marshes (Johnsgard 1988). It is known to actually breed in a very few locations in New England, mostly coastal. It prefers open grassland habitats where abundant small mammals are available as prey - especially meadow voles (*Microtus pensylvanicus*). Brackish marshes connected to tidal flowage and wet grassland areas often have an abundance of such small mammals.

This owl is presumed to have been migrating from the more populated Canadian tundra breeding grounds or occupying a wintering ground at the time it was seen. Most short-eared owls in the east breed much farther north in open country and then winter



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from northern New England south to the Chesapeake Bay (Johnsgard 1988). This species may utilize any wet meadow habitat in the Boston Harbor area during the winter. The Squantum Point area is unlikely to provide suitable habitat for breeding, due to small size, urban setting and high present levels of disturbance.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

Detailed information regarding historical and archeological resources on Squantum Point was obtained in 1990, when the site was under consideration for development (NAI 1990). For that study, documentary research for assessing possible historical and archeological resources included consultation of the State Register of Historic Places, files and materials at the Massachusetts Historical Commission (MHC), the Quincy Historical Society and the Boston Landmarks Commission as well as insurance atlases and maps. Data on known prehistoric sites were collected from the MHC, interviews with local archaeologists and individuals, and cultural resource management reports. USDA soil surveys were examined for stratigraphic data. A site walk was conducted to locate surface cultural remains and to assess the archeological sensitivity of the site. The 1990 study and a follow-up file review at MHC in 1993 revealed no known historic resources on the site or its environs.

Approximately 11 prehistoric sites are recorded from the Squantum area. These sites include shell middens as well as dog and human burial areas, which primarily date to the Late Woodland, Contact and Early Historic periods. No sites are recorded for the project area.

## SOCIO-ECONOMIC/LAND USE

This former naval air station, a 44± acre site, is now owned by the Metropolitan District Commission (MDC), which intends to build a waterfront park as funds become available. Part of the site is used as a ferry docking facility to transport construction personnel to Deer Island for the Boston Harbor Clean-up Project (reference). This facility includes parking for 930 vehicles. The ferry facility will be made available to the MDC upon completion of the construction of the sewage treatment plant at Deer Island. The remainder of the site is a mixture of paved area and shrubs. To the east of the site is the Village at Marina Bay, a mixed-use development including residences, a marina, offices, restaurants and shops.

Quincy has a long history, beginning as a prosperous farming community and the home of two Presidents. Major industrial facilities including the former Fore River Shipyard now line its coast along with residential uses. Much of the land area in Quincy is devoted to park use. The population of 86,182 is 90% white and 6% Asian. The median family income is $44,184. Higher-income households have settled in Quincy with the development of new housing in and adjacent to Marina Bay.

Access to the subject site is via I-93 south to Neponset Circle, Route 3A to Quincy Shore Drive, an MDC parkway and from there, to a connector road to Commander Shea Boulevard. Existing mudflats around Squantum Point presently constrain marine access unless dredging is undertaken.

### 2.1.1.2 Environmental Consequences

## GEOLOGY/SOIL

The placement of 935,880 cy of dredged material (predominantly silts) should not severely impact the previously altered site geology and soil conditions.



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These silts would not be placed in or on any existing resources (e.g., wetlands), and will be placed with appropriate containment (capping) sedimentation/erosion controls.

Assuming the disposed silts are appropriately contained, the placement of dredge materials at this site should not pose a threat to continued surrounding site usage or sensitive receptors (e.g., Dorchester Bay and shellfish beds); future development of the site would have to consider the presence of this confined silt material.

## HYDROLOGY/WATER QUALITY

Groundwater impacts are difficult to anticipate due to the complex drainage system currently underlying the site, but are expected to be minor because of the likely dominance of marine hydrology. Surface water from runoff will be directed so as to minimally alter current hydrologic budgets of surrounding lands and tidal flats. The site's flat topography will naturally limit impacts from altered runoff patterns.

Because the quality of groundwater resources at this site is unknown, potential impacts cannot be fully addressed. However, a liner would be required by the MADEP and should minimize leachate contamination of the groundwater.

Primary impacts to surface water quality will be necessary for the dewatering process during the dredge disposal phase. The dredged material would be partially dewatered on the barge prior to reaching the site. Final dewatering would occur on-site via an outflow weir with stop logs to control primary settling. Water would then pass through a sedimentation basin prior to being discharged into Dorchester Bay. This process is expected to remove most of the suspended particles from the water column; however, the smallest size fraction, the clays, would remain suspended and therefore would pass with the discharge waters. Sediment characterization studies for the dredging project indicate that the silts are unsuitable for ocean dumping, although it is likely that a small amount of clay from the underlying substrates would incidentally be excavated during the sediment dredging process. It is expected that most of the potential contaminants would be removed with the silts. This should effectively reduce the probability that harbor waters would become recontaminated by the dewatering process.

The dewatering discharge outfall should empty into subtidal water so as to minimize impacts to aquatic resources. Two alternatives exist and include: 1) into the bottom of the barge channel, and 2) below the low-tide line into the Neponset River. Should Squantum Point be selected as a disposal site, a better understanding of circulation patterns surrounding the site would help to properly locate the outfall in an area of maximum flow. By discharging directly into the water column, impacts to the intertidal zone would be minimized. Discharge waters and suspended clays are expected to dissipate with tidal currents. The clays would not settle out of the water column quickly, so they would be widely dispersed. However, no substantial adverse impacts from this process are anticipated.

In the 2± years anticipated for the dredge disposal phase, the outfall will be discharging in a regular pulse pattern, where supernatant water will be drawn off in a single event from each barge-load of dredged material. The plume from the outfall will very likely be visible due to its suspended clay load. This visibility may detract from the aesthetics of the site, and may somewhat reduce primary productivity in the path of the plume. This latter effect would be minor in its magnitude and extent, due to both the pulsing nature of the discharge, which would allow photosynthesis to resume in between discharge events, and the varying location of the plume depending on tidal conditions. After capping and closure of the site, dewatering and discharge through the outfall would cease.

## AQUATIC RESOURCES

Dredged material would most likely be delivered to the site via barge, requiring dredging of a 60-foot-wide channel from the Deer Island ferry channel to the northeast corner of the site. This dredging would impact approximately 1.4 acres (13,000 cy) of subtidal habitat, and 0.3 acres (6500 cy) of intertidal habitat, some of which may include a narrow band of salt marsh. Impacts to aquatic resources would include destruction of existing benthic communities in the dredged channel, although the new channel bottom, which would be an average of 6 feet deeper than present depths, is likely to be re-colonize by benthic organisms similar to those impacted. Increased turbidity and redeposition of suspended sediments during the dredging process could cause temporary impacts to adjacent benthic communities.

Channel dredging in the 0.3± acre intertidal zone would result in the conversion of tidal flats and approximately 0.3± acre of salt marsh to subtidal habitat. It is presumed that the tidal flats and salt marsh between them provide protection of wildlife habitat and of marine fisheries including shellfish, storm damage prevention, groundwater supply, flood control and prevention of pollution. Primary functional losses include a 0.3 acre reduction in migratory bird nesting and feeding areas, intertidal productivity, water quality treatment and shoreline stability. Impacts to migratory bird habitat will include the permanent loss of the dredge channel area as well as temporary impacts in the vicinity due to disturbance from project activity. Loss of intertidal productivity will be greatest in the salt marsh area where primary productivity is highest. Nutrient transformation is significant in both tidal flat and salt marsh habitats, although the shallow subtidal dredge channel, when recolonized, will also perform that function to some extent. Shoreline stability will be affected by both loss of the buffering capacity provided by existing gentle grades, and the disruption of the erosion-resistant salt marsh peat that currently forms a continuous band along the northeastern (exposed) side of the site. Engineered protection against storm-driven waves and long-shore currents or refilling the access channel after disposal may be required to minimize erosion.

Impacts to intertidal resources are not anticipated from the dewatering process. Subtidal impacts may include a reduction in primary productivity due to clouding by clay particles suspended in the discharge plume; however, this impact is expected to be variable and ephemeral. Adverse impacts on infauna by discharge waters in the vicinity of the outfall are also a possibility, as a result of relatively constant exposure to the fine particulates.

Upon capping and closure of the project, freshwater runoff will be directed via swales to outfalls on the north and west sides of the site. The outfalls would open at the concrete/sheetpile seawall, and runoff would then cross the bands of salt marsh. During storm events, freshwater flow across the intertidal zone may impact infauna by creating osmotic stress. This would be most significant for species whose recruitment period is limited, such as soft-shell clams. Adults can isolate themselves from short-term perturbations by retracting their siphons. Spat are located at the sediment surface. Those located in the runoff path may die if freshwater runoff coincided with low tide.

Runoff would reach mussel beds only during major storm events, due to the location of this resource in the lower intertidal zone. This would likely be of little impact due to the animal's ability to seal itself off, and to the short duration of exposure in each tidal cycle.

Loss of productivity on the tidal flat would depend on the design of the outfall and quantity of flow. The overall ability of the tidal flat to support finfish and shorebirds could be reduced by the intermittent loss of productivity in the runoff path, both by benthic microflora and invertebrates. However, this may be a minor impact since only a relatively small



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portion of the Flat would be affected. Other functions of the intertidal area would be little affected.

No freshwater ponds or streams occur on the Squantum Point site, so there will be no impacts on these resources.

## VEGETATION

The placement of dredge spoil and any containment features will smother all existing tolerant and opportunistic terrestrial plant species within the footprint. Once the disposal activities cease and capping, the site will re-vegetate and undergo an early-successional process as is presently occurring.

## WETLAND RESOURCES

The avoidance of any filling or other activity directly affecting protectable resource areas were established as one of the design criteria for the containment facility. Therefore, impacts are limited to dredging a barge access route, and are described in the previous section. A detailed final investigation will be required to confirm that no other jurisdictional wetland resources occur in the shrub tangles on the site. Encroachment into the buffer zone associated with the Coastal Beach would be minimal, limited to a drainage discharge from the proposed sedimentation basin in the site's southwest corner. No encroachment into the buffer zone associated with the Bordering Vegetated Wetland is proposed.

The performance standards for projects affecting Coastal Beach state that any project shall not have an adverse effect by increasing erosion, decreasing the volume or changing the form of any such Coastal Beach or an adjacent or downdrift Coastal Beach. Furthermore, water-dependent projects shall be designed and constructed, using best available measures, so as to minimize adverse effects on marine fisheries and wildlife habitat. Clearly, the proposed encroachment into the buffer zone associated with the Coastal Beach (drainage pipe) would be in conformance with all required performance standards.

## WILDLIFE

Disposal of materials on the upland old-field areas would impact the existing upland wildlife habitat values until after capping and revegetation are complete. The final use of this site will determine the wildlife community that re-establishes on the site.

Wildlife habitat of the salt water and wetland resources would also be temporarily disturbed for the duration of the project because of fugitive dust, altered runoff patterns, noise and activity. These impacts could be lessened or avoided by proper site design and monitoring.

## THREATENED AND ENDANGERED SPECIES

The site is not designated to contain any threatened or endangered species (MANHESP), although a short-eared owl, a Massachusetts breeding endangered species, was observed on the site in November 1990. This individual was probably overwintering or migrating through. Impacts of materials disposal on the grassy areas of Squantum Point would have a direct impact on the utilization of the site by short-eared owls. This is because microtine rodents, found in grass areas, would no longer be available as prey.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

Because there are no listed historical or archeological resources at or near the proposed Squantum Point site, no impacts are anticipated. However, the site is an artificially filled landform, and cultural or



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prehistoric resources could lie buried below. No adverse impact is expected as long as no subsurface activity is conducted. If excavation is required, then machine-excavation with archeological monitoring is recommended to determine the existence of potentially significant remains from either the Naval Air base or small, isolated, intact prehistoric sites.

## SOCIO-ECONOMIC/LAND USE

The site is proposed for development of a waterfront park by the MDC. Use of Squantum Point for dredge disposal may delay and potentially alter these plans. Potential mitigation for loss of the planned park would be to design a park that would be compatible with the site after it was capped.

Odor and noise from the dredge disposal could affect residences and businesses in the Village at Marina Bay. Odor could be minimized by covering the disposal daily with clean material. If trucking were selected as the transport option, truck traffic into the site would increase noise and traffic in the Village at Marina Bay and could create safety and odor problems as well. The road through the Village at Marina Bay ends at the Deer Island staging area. It is used primarily for access to the village, the marina and the ferry parking area, which has parking for 930 vehicles. There appears to be little existing truck traffic. Transporting the dredged material by barge to the site would eliminate these transportation-related impacts.

### 2.1.2 Everett (EVR-04)

The site is depicted on Figure A1-3.

#### 2.1.2.1 Existing Conditions

**GEOLOGY/SOILS**

Soils on the site consist primarily of Udorthents with a wet substratum. Udorthents are defined as fill soils over former tidal marshes, and other wetland resources (SCS 1989a, 1989b). The depth of fill ranges from 2 to 20 feet or more, with seasonal high groundwater ranging from 3 to 5 feet below the surface.

Based upon the mapping of Kaye (1980), the central portion of the site is underlain by bedrock consisting of sandstone or quartzite while the northern and southern portion of the site is underlain by sandstone argillite, with minor interbedded sandstone and/or quartzite. Bedrock has been mapped as outcropping near the site and the average depth to bedrock on site may be relatively shallow.

**HYDROLOGY/WATER QUALITY**

There are no surface waters on the site, so the hydrology is fairly simple. The topography of the site is flat, therefore most precipitation will infiltrate to the groundwater or be taken up through evapotranspiration. Any water that does run off most likely will run into the Mystic River.

The site consists of low-yield aquifers ( < 100 gpm) with half the site being classified as low and the other half as very low (MADEP Groundwater Overlay Maps). There are no wells on site or within 0.1+ mile. Groundwater quality is influenced by tidal action and is probably saline in nature. Also, there are several hazardous waste sites near the site which may have an influence on groundwater quality. The site is not suitable as a drinking water supply. No data were available for groundwater quality at the site.

The Mystic River is classified as Class SC by MADEP. Waters under this classification are saline and designated for the protection and propagation of marine life and for secondary contact recreation. Water quality in the vicinity of the site is most likely influenced by several NPDES discharges into the Mystic River.

Water quality data for the Mystic River are available from sampling done by MADEP in 1982-1986 (Menzie-Cura and Associates 1991). Samples were taken downstream and near the confluence of Island End River. Results of this sampling indicate that the average concentration for cadmium, copper, and lead exceeded the chronic criteria for aquatic life. The acute aquatic life criteria for cadmium, chromium, copper, lead, and zinc were exceeded at least on one occasion.

**AQUATIC RESOURCES**

The aquatic resources near the Everett site were not sampled; however, substrates appeared to be made up of fine-textured sediments in the exposed intertidal areas. It is likely that the subtidal communities are similar to those observed in the Mystic River and pier areas of Mystic Piers, Revere Sugar, and Amstar (as detailed in later sections). The intertidal areas may support soft-shell clams (*M. arenaria*), but are likely to have small populations due to the fine-textured substrates.

**VEGETATION**

The upland portion of the site is flat and dominated by early-successional grasses, forbs and scattered saplings. Plant cover is sparse on approximately 50% of the site, where gravel and old asphalt domi-

nate. These areas have poor quality rooting substrates and also appear to be periodically used by vehicles entering the site. The remainder of the site has better herbaceous cover: dominant species include several clovers (*Trifolium* spp.), grasses including broom beardgrass (*Schizachyrium scoparium*), mugwort (*Artemisia vulgaris*), goldenrods (*Solidago* spp.), milkweeds (*Asclepias* spp.) and bird's foot trefoil (*Lotus corniculatus*). Scattered saplings of cherries (*Prunus* sp.), trembling aspen (*Populus tremuloides*), gray birch (*Betula populifolia*), and staghorn sumac (*R. typhina*) occurred across the site, and are most prevalent on the western leg of the parcel. This leg in general appeared to be less disturbed, with better herbaceous and sapling cover.

Common reed (*P. australis*) occurred in patches around the periphery of the inlet at the top of the bulkheads. Because the bulkheads appear to be well above the high tide line, and would not impound freshwater, these stands of common reed appear to be opportunistic, occurring in upland settings. One exception may be the seaward edge of a small stand in the northwest corner of the inlet. In this area the fill behind the bulkhead has collapsed and may be exposed to tidal inundation during exceptionally high tides.

## WETLANDS RESOURCES

No delineation of jurisdictional resources was performed at Everett; however, areas of tidal waters will fall within the purview of Section 404 of the Federal Clean Water Act. Massachusetts jurisdictional resources ((MGL c.131, s.40, and 310 CMR 10.00)) on the site include coastal bank, tidal flats, coastal beach and land under the ocean. A 100-foot buffer area, inland of the tope of the coastal bank occurs on the east and west portions of the site. Small areas of coastal beach and coastal bank occur along the seaward end of the east and west portions of the site. These resources are composed of eroding fill, and have been partially reinforced by boulders and rubble.

With the possible exception of the seaward edge of the common reed stand as described in the previous section, no vegetated freshwater wetlands occur on site. During the site visit, a pool of standing freshwater was observed in an asphalt depression in the northeast corner of the site. The lack of requisite soils and vegetation preclude this as a wetland.

## WILDLIFE

The paucity of vegetation and the surrounding urbanization limit the value of the Everett site for terrestrial wildlife. Animals typical of urban settings, such as rock doves, European starlings, house sparrows, and house mice might use the site, as would birds that nest on bare ground, such as killdeer. The western leg of the site, which is somewhat more densely vegetated, also would support species typical of herbaceous or "old field" habitats: for example, common yellowthroat, song sparrow, and meadow vole (DeGraaf and Rudis 1986). A song sparrow was heard in this area during 1993 site visits.

The intertidal flats and river bordering the site would be of more value to wildlife than would the site. Herring gulls and great black-backed gulls were observed feeding on the intertidal flat between the inlet and Route 99 on May 12, 1993. On May 25, 1993, a black-bellied plover, a semipalmated plover, and a killdeer were observed foraging on the intertidal flat along the Mystic River on the southwest corner of the project area. Common terns, a Massachusetts Species of Special Concern (321 CMR 10.60) were observed courting and apparently nesting on the dilapidated pier on the western side of the inlet. While only pilings remained for most of the length of the pier, the outermost section remained intact and formed an isolated platform on which the birds were seen. A great black-backed gull, a potential nest predator, also seemed to be sitting on a nest on the



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same platform on May 12, but a gull observed on May 25 exhibited no nesting behavior.

## THREATENED AND ENDANGERED SPECIES

MANHESP records indicate that no protected species or habitats occur on the site (MANHESP, letter dated March 1, 1993).

Common terns feeding and courting were observed near the Everett site during two site visits in May 1993. As stated above, the common tern is a Species of Special Concern in Massachusetts. Four terns were sitting on the dilapidated pier in the inlet on May 12. One was seen to stand and pull material on the ground closer to itself. This activity and the posture of the birds suggested that they were sitting on nests on the old pier. During a subsequent field visit on May 25, six common terns were observed to exhibit nesting behavior. Terns were also observed foraging in the Mystic River near the site.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources on the Everett site. A jackknife bridge was inventoried by MHC within 1000 feet upstream of the site. It has been for sale since 1990 and may have been dismantled (Mr. W. Smith, MHC, pers. comm.).

## SOCIO-ECONOMIC/LAND USE

This site is a narrow basin abutting 28± acres of vacant land on the north side of the Mystic River in Everett. It is surrounded by industrial uses including a Boston Edison power station. A rail line abuts the western boundary of the site. There is a park and playground facility across Broadway and to the north of the site.

Everett was originally a territory of Charlestown, its neighbor across the Mystic River. A farming community for 150 years, Everett evolved into an industrial city with the advent of the railroads that facilitated transportation to Boston. Factories for brick manufacturing and the production of chemicals, located in Everett in the 19th century, have been joined by facilities for metal product fabrication and machinery in the past 100 years. The predominant land use in Everett is residential. Everett's population of 35,701 is predominantly white with a median family income of $37,397.

Land access to the site is from I-93 to Sullivan Square in Charlestown, and traveling north on Route 99 (Broadway) across the Mystic River. The parcel surrounding the basin abuts Route 99 to the east. Mud flats extend along the Mystic River edges, making access for vessels difficult. Some dredging would be required to accommodate barges related to the material disposal project.

### 2.1.2.2 Environmental Consequences

## GEOLOGY/SOILS

As with Squantum Point, the on-site udorthents represent an unnatural/altered site condition. Therefore, the placement of dredge spoils should not severely alter or change existing geological and/or soil conditions.

## HYDROLOGY/WATER QUALITY

Because of the Everett site's proximity to tidal waters, impacts to hydrologic conditions from dredge material disposal, capping and closure should be minimal. Infiltration would be eliminated by the liner system required by MADEP, minimizing

impacts to groundwater flow. Surface runoff will be directed to minimize alterations to current hydrologic budgets of surrounding lands and tidal flats.

Minor impacts to surface water quality may occur due to discharge from the dewatering process entering tidal waters adjacent to the site. The dewatering process would be similar to that proposed for Squantum Point. The risk of concentrated settling and bioaccumulation is potentially lower at the Everett site because the steep bathymetry along the Mystic River would allow the discharge to be pumped directly into a deep water area, which will aid dispersion and dilution. Clays and fine silts in the discharge waters will be borne away from the project site and productive shallow waters by both tidal flushing and the Mystic River flow. Impacts to aesthetics and primary productivity by a reduction of water clarity in the path of the plume would also be a possibility at the Everett site, although the increased dispersion should serve to lessen the plume's impacts. Dewatering sedimentation controls would work to minimize this problem in the first place

## AQUATIC RESOURCES

The preferred route to provide barge access to the site is to deepen the inlet channel to reach the existing granite bulkhead, and would require dredging of approximately 0.3 acres (2300 cy) of subtidal habitat. The dredging process would destroy any benthic communities in the dredging corridor, although it is likely that similar benthos would re-establish in the deepened channel. Existing depths average 5.0 feet, therefore dredging an additional 5.0 feet would be necessary to achieve a final 10.0 foot channel depth. Turbidity and redeposition of suspended sediments may cause temporary impacts to adjacent benthic communities during the dredging process.

A second possible approach for barge traffic would provide access from the western leg of the site. However, this would require dredging of 0.2± acres (5000 cy) of intertidal, and 0.03 acres (200 cy) of subtidal habitats. This approach would also impact an area of coastal beach, coastal bank and buffer. Because of the variety and extent of impacts to protected resources, this approach is considered a less desirable alternative than the inlet channel.

No freshwater runoff impacts at site closure are anticipated because runoff could be discharged directly into subtidal waters, therefore eliminating impacts to intertidal communities.

## VEGETATION

The placement of dredge spoils and the proposed containment facility would eliminate all existing vegetation within the disposal footprint. Upon completion of all on-site activities, natural recruitment and early stage succession of tolerant and opportunistic species should occur.

## WETLAND RESOURCES

Under the preferred barge access route, no wetland resources other than Land Under Ocean would be impacted (see previous section). The containment facility footprint will not impact any protected resources.

## WILDLIFE

The site is a vacant lot in an urban setting, and as such offers habitat for typical urban species such as song sparrows, rock doves, and house mice. Most of this habitat would be impacted with the construction of the containment facility, and the resident animals displaced or destroyed. Upon capping and closure of the project, its value as open space in an urban setting would be restored, and most of the species currently using the site should return.

Activities during construction of the facility and dredge disposal may discourage use of the adjacent tidal flats by shorebirds; however, this is a limited resource in terms of area and location, so the interruption is not expected to be an adverse impact. Use of the site by these birds should resume after capping and closure.

## THREATENED AND ENDANGERED SPECIES

Noise and disturbance during construction and operation of the containment facility may disrupt use of the dilapidated pier by nesting common terns. The extent of use and success of these small, isolated, urban breeding sites is poorly understood, therefore impacts from adjacent construction activities are difficult to assess. It is likely that the birds would abandon the breeding site during project operation, and may return upon project closure.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

Because there are no identified historical or archeological resources at the Everett site, no impacts are anticipated. The jackknife bridge upriver of the project would not be impacted.

## SOCIO-ECONOMIC/LAND USE

The project site is divided into two parcels by the Boston-Everett City boundary line. The part of the site in Boston is owned by the City of Boston; therefore, the Project would not cause any loss of tax revenue to the city. The Everett parcel is owned by Boston Edison Company. Use of this land by the project would result in a loss of taxes by Everett.

The site is partially used by the MDC as a pumping station, and is located in an industrial area. It eventually could be developed as an industrial or commercial venture if it is not used by the project. The project may affect certain future uses.

A playground is located a block away from the site, and a school is less than a half-mile away. Odor from the site and from trucks travelling to the site would be the greatest impact to these sensitive receptors. Daily cover of the dredged material may be required, reducing final storage capacity. Truck traffic already is heavy along Route 99, so the increase in safety hazard and noise caused by transportation of the dredged material may need to be evaluated, although increases over existing levels may not be noticeable. It is unknown to what extent any increase in truck traffic would result in additional traffic delays. If barges are used to transport material to the site, traffic impacts would be eliminated. Noise from industries and traffic already occurs in the area. Therefore, it is not expected that the increase in project noise would be a problem.

## 2.2 SITE EVALUATIONS: LAND-BASED INLAND SITES

### 2.2.1 Woburn (WOB-11)

The site is depicted on Figure A1-4.

#### 2.2.1.1 Existing Conditions

**GEOLOGY/SOILS**

The topography of the Woburn site is irregular with rounded uplands separated by relatively flat lowlands. The topography of the site reflects the surficial and bedrock geology of the area. The surficial deposits at the site consist of stratified drift and glacial till. The low lying areas of the site are underlain by stratified drift which includes kame and kame terrace deposits of sand and gravel (Castle 1959). Portions of the lowlands have been mined to extract the sand and gravel for use as aggregate material. The upland portions of the site are underlain by dense, poorly sorted glacial deposits of silt, sand and gravel.

Outcrops of bedrock have also been observed (Castle 1959). The bedrock underlying the site has been mapped as Precambrian age metamorphosed mafic to felsic intrusive and volcaniclastic rocks (Zen 1983). These rocks are part of a large fault-bound block which trends northeast to southwest.

The majority of the soils on site are classified as landfill or udorthents (SCS 1989b). Two udorthents are distinguished: on the southern parcel is a sandy udorthent with 3-8% slopes; and on the eastern parcel is a udorthent with a wet substratum. The depth of fill over wetland material is unknown, and within the udorthent series can range from 2-20 feet. (SCS 1989b). Small areas of native soil occur on the northern boundary (Charlton-Hollis-Rock complex, 3-8% slopes) and adjacent to the stream in the southern parcel (Windsor loamy sands, 3-8% slopes).

**HYDROLOGY/WATER QUALITY**

The site is located in the Mystic River Basin immediately south of its drainage divide with the Ipswich River Basin. Runoff at the site appears to flow to a small stream in the middle of the property, which flows west to east across the site and then south into Hall's Brook (also known as Willow Brook). Locally, groundwater is recharged by the infiltration of precipitation into the surficial deposits. Groundwater appears to flow through the stratified drift deposits to the southeast and then discharge to the valley fill deposits of the Aberjona River.

Most of the site consists of low and very low yield aquifer with 20% of the site consisting of medium yield aquifer (100-300 gpm) (MADEP Groundwater Overlay Maps). There are no groundwater quality data available for the site. It is not known if water quality has been degraded by the existing landfill on the site. The Woburn residential areas near the site rely on Quabbin water through the MWRA, so no private drinking water wells are known to occur downgradient of the site.

At its northern boundary, the site is approximately 1200 feet away from the nearest boundary of the Wilmington Groundwater Protection District A. This district is designated to protect the "zones of contribution of the existing municipal supply wells" (Town of Wilmington 1990). The nearest Wilmington water supply well, the Town Park well, is over 0.8 miles to the north and upgradient of the Woburn site. Three other Wilmington municipal wells are within approximately 1.0 mile of the site.

The site is located in the upper portion of the Mystic River drainage basin. The only surface water on the site is a tributary of Halls Brook which is classified as a Class B waterway. Waters under Class B are freshwaters designated for the uses of protection and propagation of aquatic life and wildlife and for primary and secondary contact recreation. There

are no surface water supplies downstream of the site. No water quality data exist for this brook, but as with groundwater, the on-site landfill may have the potential to influence water quality.

## AQUATIC RESOURCES

No aquatic resources occur within the proposed footprint of the Woburn site. A stream tributary to Hall's Brook flows through the southwestern portion of the site. At the time of the site visit, the stream flowed very slowly in an easterly direction and was approximately 6-10 feet wide and 1 foot deep. A red brown floc coated many of the stream's bottom features, including the vegetation. No culvert was visible where the access road crossed the stream, although a slight current was apparent. It is assumed that the hydraulic crossing is that of a "farm drain" which allows flow through rock placed at the base of the road and permits flow through their interstices.

## VEGETATION

The major portion of the site is a disturbed early-successional field and shrubland. Several small stands of hardwoods remain on the northern portion of the site, and along the small stream. Scattered shrubs, representative of disturbed-site species and most of Eurasian origin, have become established throughout the site.

On the northern parcel, dominant species on the closed landfill include mugwort (*Artemisia vulgaris*), alfalfa (*Medicago lupulina*), grasses (Two *Poa* spp. and *Bromus tectorum*), clovers (*Trifolium repens* and *T. pratense*), and goldenrods (*Solidago* spp.). Scattered small individuals of black locust (*Robinia pseudoacacia*), honeysuckle (*Lonicera tatarica*), and tree of heaven (*Ailanthus altissima*) have become established across the cap. On the steep slopes of the landfill, stands of trees approximately 30-40 feet in height occurred on the east and north sides. Common species included trembling aspen (*P. tremuloides*), gray birch (*B. populifolia*), and staghorn sumac (*R. typhina*).

The disturbed old field portions of the southwestern and eastern parcels support species similar to the plant community on the landfill cap in the northern parcel.

## WETLAND RESOURCES

Several areas of freshwater wetlands which will fall within the purview of Section 404 of the Federal Clean Water Act were observed on the Woburn site. Wetland resources as protected by the Massachusetts Wetlands Protection Act and Regulations (MGL c.131, s.40, and 310 CMR 10.00) include Bordering Vegetated Wetlands, Isolated Land Subject to Flooding, Land Under Water Bodies and Waterways, and Banks. The following describes the various wetland resources from general observation. No jurisdictional wetland boundary delineations were performed since site access was limited.

Adjacent vegetation was primarily woody. On the eastern side of the access road, shrubs overhung most of the stream's length; species included common and European buckthorn (*Rhamnus cathartica* and *R. frangula*), red maple (*Acer rubrum*), willow (*Salix* sp.) and honeysuckle (*L. tatarica*). On the western side of the access road, small trees (20-30 feet in height) of red maple, mulberry (*Morus alba*), black willow (*Salix nigra*), and gray birch dominated the stream corridor.

Small isolated wetlands occur in depressions elsewhere on the site. Under the powerline, several herbaceous wetlands less than 0.1 acre in size were observed; along with considerable trash, common plant species included cattail (*T. angustifolia*), bluejoint grass (*Calamagrostis canadensis*), soft rush (*J. effusus*), and jewelweed (*Impatiens capensis*). Northwest of the on-site landfill, a small apparently isolated

forested wetland occurred at the base of the landfill slope. Standing water in the middle open portion of the wetland was estimated to be 2.0± feet deep at the time of the site visit, and stagnant in appearance (heavy pollen accumulation, dark brown in color). Last year's herbaceous stems were visible well into the flooded zone, which suggests that water levels will drop significantly as the growing season progresses.

The canopy was quite open, and dominated by red maple, black willow and big-tooth aspen (*Populus grandidentata*), with willow and European buckthorn in the shrub layer. The herb layer contained limited species; a composite thicket condition formed a dense homogenous herbaceous cover in the flooded portion of the wetland. Along the edges, jewelweed and water horehound (*Lycopus* sp.) occurred, along with common reed (*P. australis*) and Japanese knotweed (*Polygonum cuspidatum*) which crept down the slope of the landfill and encroached on the wetland.

A review of aerial photography revealed a small pond further to the north, occurring very close to the Woburn town line, and a more extensive forested wetland system in Wilmington in close proximity to the northern edge of the site. Neither area was visited during field work, but would not be impacted by the project design.

## WILDLIFE

Mammal species typical of sites such as the closed landfill, with sparse herbaceous vegetation, include woodchucks and eastern cottontails. The scattered shrubs and adjacent forest also provided perches or nest sites for species such as indigo buntings, song sparrows and common grackles, all of which use open land or forest edge. Eastern kingbird, tree swallow, and hoary bat are examples of wildlife species that forage over open land and also use adjacent trees for perching, nesting or roosting (DeGraaf and Rudis 1986). The many rocks and other debris on the landfill top also provided good cover for species such as brown snakes and common garter snakes (Hunter et al. 1992).

The hardwood forest on the side slopes of the landfill area was young, with an open canopy (about 40-50% cover), and well-developed shrub and herbaceous layers. Species observed in the forest/shrub habitat included gray catbird, common yellowthroat, song sparrow, and yellow warbler. All of these species typically are associated with brushy habitats.

Several forested wetlands occurred in the area north of the landfill. Wildlife species most likely to occur in these wetlands would include those also able to use the adjacent landfill (e.g., common yellowthroat, song sparrow), adjacent developed sites (e.g., skunk), or the adjacent fragmented forest (e.g., coyote, raccoon). Some species typical of forested wetlands would be unlikely to use the smaller site (e.g., northern waterthrush and veery: DeGraaf and Rudis 1986, Robbins et al. 1989).

Wildlife species observed on the site on either May 12 or 27, 1993, include the following:

Common garter snake (*Thamnophis sirtalis*)
Red-tailed hawk (*Buteo jamaicensis*)
American kestrel (*Falco sparverius*)
Ring-necked pheasant (*Phasianus colchicus*)
Killdeer (*Charadrius vociferus*)
Northern flicker (*Colaptes auratus*)
Blue jay (*Cyanocitta cristata*)
American crow (*Corvus brachyrhynchos*)
American robin (*Turdus migratorius*)
Gray catbird (*Dumetella carolinensis*)
Northern mockingbird (*Mimus polyglottos*)
European starling (*Sturnus vulgaris*)
Yellow warbler (*Dendroica petechia*)
Common yellowthroat (*Geothlypis trichas*)
Rose-breasted grosbeak (*Pheucticus ludovicianus*)
Indigo bunting (*Passerina cyanea*)
Field sparrow (*Spizella pusilla*)
Song sparrow (*Melospiza melodia*)



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Red-winged blackbird (*Agelaius phoeniceus*)
Common grackle (*Quiscalus quiscula*)
House finch (*Carpodacus mexicanus*)
American goldfinch (*Carduelis tristis*)
Rabbit (Leporidae family)
Woodchuck (*Marmota monax*)

## THREATENED AND ENDANGERED SPECIES

The Mystic Valley Amphipod (*Crangonyx aberrans*) is a crustacean that occurs in cool, shallow, slow-moving or stagnant fresh water with leaf litter; and is only known to occur in New England (MANHESP 1991). It is a Species of Special Concern in Massachusetts. *C. aberrans* has been recorded south of the site in Hall's Brook (Lincoln 1993; MANHESP, letter dated March 1, 1993). The on-site tributary has several of the habitat characteristics required by the Mystic Valley Amphipod: shallow depth, sluggish velocity and leaf litter.

No search for *C. aberrans* was undertaken on the study area, but a 1991 survey sampled the tributary to Hall's Brook downstream of the study area (NAI 1991b). One immature *Crangonyx*, which could not be identified to species, and 17 *Crangonyx pseudogracilis* were collected at this sample point, but no adult *C. aberrans* were recorded at any sample point during the 1991 study. Since *C. pseudogracilis* typically occupy the same habitat as *C. aberrans* (Smith 1983 cited by NAI 1991), this survey reported no *C. aberrans* even in suitable habitat.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources identified on or within 1000 feet of the Woburn site.

## SOCIO-ECONOMIC/LAND USE

Woburn (11) is an 59± acre site containing a city landfill and vacant land. Boston Edison power transmission lines cross the site, dividing it into three pieces. People use the site for dirt-biking. The Boston and Maine Railroad tracks run in a north/south direction east of the site. Adjacent to this site is an office park to the east; another office park to the south, along with an industrial park and some residential use; general industrial and residential to the west; and general industrial to the north with some limited residential use.

Woburn, originally known as Charlestown Village, was settled in 1636 by people seeking relief from crowded conditions in Charlestown. Once a farming community, Woburn housed leather tanning and shoe manufacturing operations in the 19th century after the Middlesex Canal was built. These industries have been superseded by metal fabrication and the manufacture of electrical equipment. The predominant land use remains low-density housing. The population of Woburn declined 2% to 35,943 from 1980 to 1990 . The median family income in Woburn is $50,428.

### 2.2.1.2 Environmental Consequences

## GEOLOGY/SOILS

On-site udorthents represent an unnatural and altered soil condition. Given the sandy gravelly deposits, placement of silty dredge spoils could change the surficial character of on-site soils not associated with the landfill. The dredge spoils could provide quality material for capping of the landfill area.



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## HYDROLOGY/WATER QUALITY

Because the quality of groundwater resources at the Woburn site is unknown, potential impacts cannot be fully addressed. However, a liner would be required by MADEP and should minimize leakage of contaminants from the dredged material into the groundwater. A potential benefit of using this site is that an unsecured landfill would be capped by the dredging project. This action may result in improvement of the groundwater quality by eliminating the present infiltration and leaching of that portion of the waste deposited above the water table. Any waste in contact with groundwater would continue to leach.

To avoid impacts from high chloride levels, the dredged material would be dewatered at Boston Harbor prior to transport to the Woburn site. Dewatering facilities are described in the dredge management plan (Section 3.0 of the EIR/S); monitoring requirements of MADEP would be in place to keep impacts from the dewatering process to an acceptable level in the surface waters of Boston Harbor.

No impacts to surface waters surrounding the disposal site are anticipated during the dredge disposal phase. The leachate collection system and the liner would be used to collect any excess water or contaminants. Leachate treatment will be controlled to prevent impacts to the surrounding environment. At the end of the dredge disposal phase (2± years), the site would be capped with an impermeable cover to prevent further infiltration or surface water runoff from the dredged material.

After the site has been capped and revegetated, runoff quality should resemble that of adjacent undeveloped land. Runoff quality should also improve because the currently sparse vegetation, steep slopes, exposed soils and trash are all likely to degrade existing runoff quality.

## AQUATIC RESOURCES

Runoff into wetlands adjacent to the site will be controlled to keep sediments from entering the wetland during the dredge disposal phase. After site closure, runoff will be redirected to best approximate the pre-project water budget of these wetlands.

## VEGETATION

The placement of dredge spoils and the proposed containment facility would eliminate all existing vegetation within the construction footprint.

Upon completion of all on-site activities, early-stage succession of tolerant and opportunistic species should occur. A vegetation plan may be required for the landfill cap, since shallow-rooted species are generally preferable in maintaining cap integrity.

## WETLAND RESOURCES

The preliminary design incorporates avoidance and minimization of all wetland resource impacts in its design criteria. As a result, most of the wetlands on the Woburn site and their buffer zones would not be impacted. The exception is a small 1.0± acre forested wetland on the northwest side of the site, in which fill may be placed to ensure adequate sideslope stability during closure of the existing landfill. More detailed site information would be necessary to further quantify surface area impacts to wetland from any fill. The functions and values of this wetland have not yet been evaluated but due to its small size, isolation, and disturbed conditions, the wetland is expected to be of relatively low value for biological support, flood control, wetland wildlife habitat and water quality functions. Aesthetic, recreational, and educational values are also expected to be low because of its disturbed setting and lack of public access. Therefore, impacts to this area of wetland are expected to be minor. Proposed compensation for



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these impacts is discussed in Section 2.3 of the EIR/S.

## WILDLIFE

Construction of the containment facility would result in the loss of all upland wildlife habitat within the disposal footprint until the capping and closure of the site were completed. Wildlife in the immediate vicinity would be disturbed for the duration of site activity because of noise, and human presence. Upon closure of the project, there would be an opportunity for natural recruitment and restoration and improved habitat quality by eliminating exposed trash and future dumping. As described above, a limited permanent wetland wildlife habitat loss would also occur, but is expected to be of minimal significance.

## THREATENED AND ENDANGERED SPECIES

No known threatened and endangered species use the Woburn site; therefore, no impacts are anticipated.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources on or near the Woburn site; therefore, no impacts are anticipated.

## SOCIO-ECONOMIC/LAND USE

The site is an abandoned landfill, intersected by powerlines and a sewage pipe. The site is primarily owned by the City of Woburn, with a parcel owned by the Boston Edison Co. Use of this site for the project would not result in any loss of tax revenue to the City of Woburn, since no work would be done near the powerline. The powerlines and pipeline on the site would not be impacted by the project. Also, capping the site after the project is completed would save the City of Woburn the expense of capping the existing landfill.

The site is primarily industrial, with some nearby residences. Noise and odors from the site could affect some of these residences. Odors may need to be controlled daily by covering the dredged material. Daily cover requirements would reduce the available site capacity. Noise and odor also would be lessened by prevailing winds. The direction of prevailing winds is from the west, and no residences occur immediately east of the site.

Travel to the site would be along secondary and local roads and would pass by residences. Truck traffic to the site could increase noise and odor levels and could create safety problems, particularly along Merrimac Street and New Boston Road. A new exit from Route I-93 or development of a new rail siding east of the site could markedly reduce transport impacts.

### 2.2.2 Wrentham (WREN-495)

This site is depicted on Figure A1-5.

#### 2.2.2.1 Existing Conditions

**GEOLOGY/SOILS**

The topography of the Wrentham site ranges from an upland area in the northeast portion of the property to several water filled depressions in the central and southern portions of the property. The upland areas are underlain by dense, poorly sorted glacial till and bedrock. The lowland areas in the central and southern portions of the property are underlain by stratified drift. Portions of the stratified drift deposits in the southern portion of the property have been mined for sand and gravel.

Outcrops of bedrock are found in the upland portions of the property. Based upon the Bedrock Geological Map of Massachusetts (Zen 1983), the bedrock underlying the site consists of the Precambrian Age Dedham Granite. Dedham Granite is part of a structural block which trends northeast to southwest. In the vicinity of the property the Dedham Granite is traversed by a north to south trending normal fault.

Soils on the site are predominantly well drained and somewhat excessively drained outwash and till soils (SCS 1989a). Except for the level idorthents in the quarry areas, slopes range from 3-8% to 15-35%. The Charlton-Hollis-Rock Outcrop complex includes a dominant sandy till, but also included are till areas of Canton fine sandy loam, and outwash deposits of Hinckley fine sandy loam and Merrimac fine sandy loam. A linear unit of ponded Freetown muck, a very deep organic deposit, is associated with a small stream on the western edge.

**HYDROLOGY/WATER QUALITY**

The site is underlain by medium yield aquifer (MADEP Groundwater Overlay Maps). There are no municipal drinking water wells located on the site as the area is primarily serviced by a municipal piped system. No groundwater quality data were available for the site. There is a proposed municipal well approximately 0.15 miles west of the site. This proposed well location is in the Blackstone River basin, out of the watersheds of the project study site; however, actual groundwater divides may not coincide with surface watershed boundaries.

The north and west portions of the site are located in the Charles River basin while the south portion is in the Ten Mile River basin. There are several small ponds and a stream located on the site, but no water quality data were available. Surface waters on the site in both watersheds are classified as Class B waterbodies. Waters under Class B are fresh and designated for the uses of primary and secondary contact recreation and for the protection and propagation of aquatic life and wildlife. Several private wells are near the site for residences on portions of Green Street and Route 1A.

**AQUATIC RESOURCES**

Several small kettlehole ponds occur within the central project area. Most appeared to be steep sided; however, the largest pond (on the eastern side of the site) was shallow, with aquatic vegetation visible throughout. On the western edge of the site lies an unnamed stream which drains to Eagle Brook after flowing north through a series of off-site ponds. In June, the stream was approximately 4.0 feet wide and 6 to 8 inches deep, with a sand and detritus bottom and sluggish flow.



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## VEGETATION

Vegetation cover types and wetland identification were ascertained from stereo aerial photographs (black and white, 1:6000, dated December 1991), and ground truthed only peripherally from the old railroad grade, Green Street, and an improved gravel road bisecting the site. Should this site be selected, a more thorough site investigation would be required to determine jurisdictional wetland boundaries and more detailed vegetation descriptions.

The scrubland northwest of the active quarry area was on a low rolling dry plain bordered by several prominent rock outcrops. Based on vegetation composition and structure, the soil appeared to be well-drained poor sands with an average litter layer. The vegetation was dominated by a mixture of oaks, approximately 15 feet tall and many with multiple stems. Oak species included red oaks (probably *Quercus coccinea* and *Q. rubra*), scrub oak (*Q. illicifolia*) and white oak (*Q. alba*). Minor representatives of other tree species such as red maple (*Acer rubrum*), cherries (*Prunus* spp.) and gray birch (*B. populifolia*) were also observed. Tall snags of white pine (*Pinus strobus*) were scattered across the site. The understory was dominated by a lowbush blueberry (*Vaccinium* sp.), with sweet fern (*Comptonia peregrina*), meadowsweet (*Spirea latifolia*) and blackberry (*Rubus* sp.) also common. The herbaceous layer was sparse and indicative of dry site conditions: bracken (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pensylvanica*) and haircap moss (*Polytrichum* sp.) were dominant species. Even a small swale running the length of the site appeared to be dominated by upland species, again supporting the SCS classification of well-drained soils on the site.

Shrublands elsewhere on the site were similar in structure and general species composition. Other common species included multiflora rose (*Rosa multiflora*), willows (*Salix* spp.), poison ivy (*T. radicans*), and tree-of-heaven (*A. altissima*). The forested portions of the site were hardwood-dominated with red oaks and white ash (*Fraxinus americana*) as the principal species. Other observed species include sassafras (*Sassafras albidum*), sugar maple (*Acer saccharum*), big-tooth aspen (*P. grandidentata*) and white pine. Understory species included white oak, gray birch, black cherry (*P. serotina*), poison ivy, and lowbush blueberry as well as canopy species. Structure was typical of second-growth forests of the area; canopy height was approximately 70 feet, with a maximum stem diameter at breast-height of about 18 inches, and an estimated 70% canopy closure.

Several small open areas of old field occurred. Soils were obviously poor and well drained, with many surface rocks and cobble. The vegetation was typically early-successional, dominated by forbs such as asters, goldenrods, yarrow (*Achillea* sp.), ragweed (*Ambrosia artemisiifolia*), wild carrot (*Daucus* sp.), grasses (*Poa compressa* and others), and sedges (*Carex brevior*). Scattered shrubs (willows, meadowsweet and sweet fern) were established.

## WETLAND RESOURCES

Several areas of freshwater wetland occur across the Wrentham site will be subject to review under Section 404 of the Federal Clean Water Act. Jurisdictional resources under Massachusetts Wetlands Protection Act and Regulations (MGL c.131, s.40, and 310 CMR 10.00) on the Wrentham site include Bordering Vegetated Wetlands, Land Under Water Bodies and Waterways, Isolated Land Subject to Flooding, and possibly Banks.

In the northern and western portions, forested wetlands occurred either in isolated depressions on the landscape or associated with small ponds. On the far western edge lies an unnamed stream system which drains into Eagle Brook. The stream is bordered by a wide swath of wooded wetlands, except where it traverses a residential landscaped lot. The wooded wetland is primarily red maple (*A. rubrum*) with a minor element of white ash and other

species. The understory was relatively dense with woody species such as red maple, swamp azalea (*R. viscosum*) and spice bush (*L. benzoin*). Herbaceous species included sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), skunk cabbage (*Symplocarpus foetidus*) and sedges (*Carex* sp.). Immediately bordering the stream, the overstory opened up to a dense shrub swamp.

On the southern and eastern portions of the site, where the vegetation is predominantly low secondary growth, scattered shrub wetlands in isolated basins and in small drainages occur. Under the powerlines, vegetation is maintained by mowing or herbicides, and emergent/shrub wetlands were evident on the aerial photographs. Several small kettlehole ponds dot the central portion of the site. These ponds generally appear to be steep sided with few bordering wetlands. The largest pond was observed from the railroad tracks to have a narrow band of shrub swamp bordering its shores. The pond was shallow throughout, with pond lilies and emergent species dominating most open water areas. A narrow shrub swamp separated this pond from an adjacent smaller pond, but a surface hydrologic connection almost surely occurs at high water levels.

## WILDLIFE

The scrublands could be expected to support many of the species typical of dry, brushy habitat (e.g., American redstart, gray catbird, New England cottontail: DeGraaf and Rudis 1986; redbelly snake: Hunter et al. 1992). The rufous-sided towhee, is typical of brushy habitat, forages in leaf litter (DeGraaf and Rudis 1986), which was abundant at this site.

The hardwood forest had a good vertical structure, with well-developed shrub and herbaceous layers. Wood thrush and woodland jumping mouse are typical of this forest type (DeGraaf and Rudis 1986). A well-developed layer of duff, a stonewall, and abundant logs would favor small animals requiring cover: for example, chipmunks, masked shrews, and redback salamanders (DeGraaf and Rudis 1986).

A small early successional field in the southern corner of the site contained sparse herbaceous vegetation, with some scattered shrubs and an occasional tree. Common yellowthroat, song sparrow and mourning dove would be expected in this habitat type. This habitat may be suitable for the northern hairstreak, a butterfly which is described in the "Threatened and Endangered Species" section.

The ponds appear to have poor interspersion of vegetation types and vegetation and water. Therefore, it is likely not to be important for waterfowl brood rearing. Canada goose scat was observed on the pond edge. These geese probably were feeding there.

The stream, moist soil and dense shrub layer in the red maple swamp would attract species such as veery, short-tailed shrew and yellow warbler (DeGraaf and Rudis 1986) as well as two-lined salamanders (Hunter et al. 1992), all of which would not occur in the other, drier cover types.

Some wildlife species may use a combination of habitats. For example, American kestrels may perch in the snags jutting above the scrubland and forage above the scrubland and in the adjacent early successional field (DeGraaf and Rudis 1986). White-tailed deer from the forest may browse on saplings and shrubs in the scrubland. Eastern kingbirds or eastern phoebes may hawk insects above the shrubs from perches at the forest edge or in the supercanopy snags.

The Wrentham site and its vicinity are intersected by a powerline, an interstate highway, several secondary roads, a dirt road, and a gravel mining operation. It is too fragmented to be used by species that breed in large tracts of unbroken forest (e.g., black-throated blue warbler: Robbins et al. 1989). However,

wildlife species that use a variety of habitats and that have home ranges of a half-mile or more in diameter may use the site as part of their domain. Examples include red fox, striped skunk and raccoon (DeGraaf and Rudis 1986).

The following species of wildlife were observed on the project site on May 12 and June 21, 1993:

Bullfrog (*Rana catesbeiana*)
Canada goose (*Branta canadensis*)
Red-tailed hawk (*Buteo jamaicensis*)
Killdeer (*Charadrius vociferus*)
Rock dove (*Columba livia*)
Mourning dove (*Zenaida macroura*)
Eastern phoebe (*Sayornis phoebe*)
Eastern kingbird (*Tyrannus tyrannus*)
Blue jay (*Cyanocitta cristata*)
Tufted titmouse (*Parus bicolor*)
American robin (*Turdus migratorius*)
Gray catbird (*Dumetella carolinensis*)
Northern mockingbird (*Mimus polyglottos*)
European starling (*Sturnus vulgaris*)
Blue-winged warbler (*Vermivora pinus*)
Prairie warbler (*Dendroica discolor*)
Indigo bunting (*Passerina cyanea*)
Rufous-sided towhee (*Pipilo erythrophthalmus*)
Song sparrow (*Melospiza melodia*)
Common grackle (*Quiscalus quiscula*)
House finch (*Carpodacus mexicanus*)

## THREATENED AND ENDANGERED SPECIES

Two species identified by the State of Massachusetts as of Special Concern occur adjacent to the site (MANHESP, letter dated March 1, 1993): and include the northern hairstreak butterfly (*Fixsenia ontario*), and Philadelphia panic grass (*Panicum philadelphicum*). Both species are typical of open ground.

The northern hairstreak occurs at disturbed sites that are dry, open and sparsely vegetated, such as power lines, railroad rights-of-way, and abandoned gravel pits (Hildreth, undated). The old fields and parts of the powerline right-of-way and abandoned railroad bed may provide appropriate habitat for this species. These areas would need more intensive investigation to determine whether they provide suitable conditions.

The Philadelphia panic-grass occurs in open areas or thin woods (Fernald 1950). In Massachusetts, it has been found in open wetlands, along the shores of water bodies, and in depressions (MANHESP 1992). The most likely place for it to occur on the study area would be in the wetlands within the powerline corridor and along the banks of open water throughout the study area.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources on or within 1000 feet of the Wrentham site.

## SOCIO-ECONOMIC/LAND USE

This 181-acre site is predominantly open land, with an active quarry and asphalt plant at its southern tip. It is located immediately southwest of the Route 1A Interchange on Route I-495 and near the Wrentham State Forest. The vast majority of the site is undeveloped shrub and forestland containing some ponds and wetlands. There are some residences abutting the property.

Wrentham was first settled in 1669 and was considered part of Dedham. Industries that developed in the town during the 19th century included the production of straw hats and jewelry. The major employer in the town today is the State, reflecting the presence of a state school for the retarded. The

population of Wrentham is 98% white. The median family income is $51,184.

Access to the site is via I-93 south to Route I-95 south, and northwest on Route I-495 to Route 1A to High Street to Green Street and onto the site.

2.2.2.2 Environmental Consequences

GEOLOGY/SOILS

The site would require regrading prior to construction of the lined containment facility and deposition of the dredge spoil (silts). These activities may require extensive earthmoving of sandy/gravelly till and filling with silt, thus potentially changing general surface soil characteristics. Blasting or drilling may be required to remove all or a portion of the existing bedrock outcrops.

The site is presently worked, and represents an altered condition; therefore, the placement of the containment facility and dredge spoils should not adversely impact existing geologic and/or soil conditions.

HYDROLOGY/WATER QUALITY

Because little is known about the quality of groundwater resources at this site, potential impacts cannot be fully addressed. However, a liner would be required by MADEP and should prevent leakage of contaminants into the groundwater.

As with the Woburn site, impacts to surface water would be minimized during the dredge disposal phase by a combination of dewatering the dredged material prior to transport to the site, and by maintenance of the leachate collection system.

These actions would prevent chloride, sediment and any sediment-related contaminants from entering surface waters. Dewatering facilities are described in the dredge management plan in Section 3.0 of the EIR/S; MADEP discharge and monitoring requirements would keep dewatering impacts to surface water quality within an acceptable range in Boston Harbor.

Runoff from capped portions of the disposal site would be controlled so as to minimize erosion risks prior to entering any surface water system.

AQUATIC RESOURCES

As described in the Water Quality section, the on-site stream and small ponds would be protected from contamination during the dredge disposal phase by dewatering prior to on-site disposal, and by the liner-leachate collection system. Surface runoff from the project would be treated using appropriate erosion control methods and controlled to avoid directly entering aquatic habitats. After site closure, runoff from the project area would be redirected to best approximate the pre-project water budgets of surrounding aquatic habitats.

VEGETATION

The placement of dredge spoils and construction of the proposed containment facility will eliminate all existing vegetation within the footprint. Being a disturbed site, the existing vegetative composition and structure is of a shrubland, scrubland, and forb dominated old field. Following capping and closure of the site, this type of vegetative character should return.

WETLAND RESOURCES

The preliminary design incorporates avoidance and minimization of impacts to wetland resources in its design criteria. As a result, most of the larger wetlands and wetland complexes would be avoided



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altogether (based on the restricted in-field wetland assessment and findings to date). Several smaller isolated wooded wetlands in the interior portions of the two parcels would be filled. Under the proposed preliminary design, approximately 4.0 acres of identified wetland resources protected under the Federal Clean Water Act would be impacted. Under Massachusetts regulations, this acreage includes both Bordering Vegetated Wetlands and Isolated Land Subject to Flooding. Additional field survey would be necessary to determine the extent and proportion in each resource category. Impacts to the functions and values of these shrub swamps and forested wetlands cannot be addressed until site-specific wetland evaluations have been performed. Should the Wrentham site be selected as suitable for dredge disposal, more detailed studies would likely be necessary to ascertain more fully the proposed impacts to wetland resources.

## WILDLIFE

Construction of the containment facility would result in the loss of all wildlife habitat within the project footprint until capping and closure of the site was completed, and revegetation commenced. Additionally, a relatively large tract of undeveloped land would be fragmented, which may discourage use by those species which require large areas. This impact is expected to be moderate because the forest and shrub communities are common in the region, and the study area presently contains an active gravel and asphalt operation. Upon completion of the project, the site would be restored to open land, and should regain much of its value as wildlife habitat.

## THREATENED AND ENDANGERED SPECIES

The on-site potential for use by the Philadelphia panic grass and Northern hairstreak should be verified, because both species have been recorded at nearby locations. The scrub-shrub wetlands and old-field areas are the most likely habitats in which to find these two species, respectively. These habitats occur throughout the southern portion of the site. Upon detailed field investigation by experts of these two species, impacts to areas identified as potential habitat could be avoided.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

Since there are no listed historical or archeological resources on or near the Wrentham site, no impacts are anticipated.

## SOCIO-ECONOMIC/LAND USE

The project site is owned by Simeone Corporation, which has proposed to extract sand and gravel from the portion of the site that abuts Route I-495 in preparation for an industrial subdivision (Landmark Engineering of New England, Inc. 1993). Use of the northern part of the site by the project would deprive the Town of Wrentham of existing tax revenue as well as the potential tax revenue from the subdivision. Use of the southwestern parcel would result in loss of existing tax revenues, as well as any potential for future development.

Green Road already is used heavily by quarry trucks. The project would increase truck traffic. Odors from dredged material along the truck route could be a concern.

Odor and noise from the site should not be a concern near the quarry and asphalt plant because they may not be distinguishable from existing noise and odor levels there. However, in the northern part of the project, which is farther away from the plant and closer to the residences, these could become a concern. Daily cover of dredged material may be required to control odors; this would reduce overall capacity for actual dredge material disposal.

### 2.2.3 Landfill Sites - An Overview

Three private solid waste landfills within reasonable haul distance have been identified that could accept portions of the dredged silt material. These three sites include Laidlow Waste Systems Sanitary Landfill at Plainville, BFI-Northern Disposal, Inc. in East Bridgewater and Fitchburg/Westminister Sanitary Landfill in Fitchburg. All are lined facilities with leachate collection systems. None have special waste permits but all are willing, within their MADEP Solid Waste Site Assignment restrictions, to accept dredged material pending MADEP and local board of health approval. Table A1-1 summarizes the features and constraints of each site for comparative purposes.

Use of a portion of the dredged material as daily and intermediate cover is also a possibility at all three sites. To be considered suitable for intermediate cover the material must meet the physical and chemical standards described under 310 CMR 19.00 and expanded on by MADEP. Use as final cover should also be considered, provided the material meets the 310 CMR 19.00 standards, including criteria for Toxic Characteristic Leaching Procedures, Ph, solids, and reactivity.

As required by 310 CMR 19.00, the introduction of a special waste to any of the candidate sites should not impact the public health, safety and the environment by comprehensively regulating the storage transfer process, treatment, disposal, use and reuse of solid waste. Protection of these issues generally requires a comprehensive site evaluation and/or assessment which evaluates on-site and offsite conditions and receptors relative to public health and environmental risk. Since these candidate landfill sites are lined and presumed suitable to receive "special wastes," all issues of public health and environmental risk have been addressed previously. Therefore, both existing and proposed condition narratives, as contained herein, are brief and as follows. Potential impacts for each candidate landfill site are summarized in Table 2.3.2-7 of the EIR/S.

#### 2.2.3.1 Existing Conditions

#### PLAINVILLE SANITARY LANDFILL

Laidlaw Waste Systems' Landfill of Plainville is a double-lined RCRA facility, operated by Laidlaw Waste Systems, Inc. in Plainville, MA (Figure A1-6). Access is via Route I-495 to Route 1 N and Madison Street, with an approximate travel time of 1.0 hour from Boston Harbor (35± miles).

Although no dredged material has been landfilled at the Plainville site, they have accepted grit and screenings from MWRA sewage treatment projects. Plainville was considered for the disposal of dredged material from the Moran terminal on Boston Harbor but a different site was selected. The landfill can accept materials containing up to 1000 ppm total petroleum hydrocarbons. Materials must contain at least 40% solids. Laidlaw engineers must review bulk sediment test results, and materials for disposal must contain no free-standing water. Any further need for testing will be determined by the MADEP. Coordination with the Plainville Board of Health consists of submitting an information package about the proposed disposal to the Board for review.

The landfill is very concerned about odor control, because of a campground near the site. Deodorizing agents will be required after disposal should odor problems develop.

Plainville expects to exceed its permitted capacity in 1995, but has several expansion proposals in various stages of preparation. One of the proposals, currently undergoing MADEP review, would extend the site's capacity for approximately one year, if approved. Three other expansions could potentially provide disposal capacity until the year 2000.

## FITCHBURG/WESTMINSTER SANITARY LANDFILL

Fitchburg/Westminster is a lined solid waste facility operated by Resource Control, Inc. in Fitchburg, MA (Figure A1-7). Access is gained via Princeton Road off Route 2, with an approximate travel time of 1¼ hours from Boston Harbor (45± miles).

The landfill has not received dredged material for disposal but has accepted petroleum-contaminated soil and wastewater treatment plant sludge. In addition to meeting 310 CMR 19.00 standards, waste disposal material must be at least 25% solids and contain no free-standing water upon arrival at the site. No nuisance materials can be accepted at the landfill, so disposal material must be odor-free. Local coordination with both the Westminister and Fitchburg Boards of Health is required.

Fitchburg/Westminster expects to exceed its permitted capacity in 1997. No expansions are currently proposed.

## BFI-NORTHERN DISPOSAL, INC.

Northern Disposal, Inc. is a lined facility operated by Browning Ferris Industries in East Bridgewater (Figure A1-8). Access requires taking Route 24 to Route 27 onto Thatcher Street. Time of travel is estimated to be 45 minutes from Boston Harbor (25± miles).

This landfill has accepted dredged material from another project in the last three years, as well as small volumes of sewage sludge and petroleum contaminated soils. This landfill was selected for the disposal of dredged material from the Moran Terminal on Boston Harbor. The landfill can accept materials with no free-standing water and a minimum of 20% solids. Approval for disposal is required from both DEP and the Town of East Bridgewater Board of Health. Odor is a particularly sensitive problem as several residences are located very close to the landfill. Deodorizing agents will be required after disposal in the event that odor problems develop.

Northern Disposal, Inc. expects to exceed its current permitted storage capacity in 1996, although it may pursue a vertical expansion.

### 2.2.3.2 Environmental Consequences

The three landfills under consideration for disposal of the silt sediments are all constructed to handle the material so as to avoid impacts on the environment. They are all lined facilities and strictly regulated for waste-stream handling and disposal. Because of their similarities, they will be addressed together in terms of project impacts using landfills as disposal options.

## GEOLOGY/SOILS

Geological and soil conditions at landfills are generally accepted to be severely altered from pre-landfill dumping activities. Landfills designated for waste or special waste disposal can readily accept several forms of waste which meet their specific designation. Therefore, specific impacts on geology/soil will not be an issue.

## HYDROLOGY/WATER QUALITY

The dredged material would be dewatered at Boston Harbor prior to being trucked to a landfill site. Dewatering is required to eliminate standing water and to achieve the criteria for percentage of solids specified by each landfill. Dewatering at Boston Harbor would reduce the volume of dredged material and therefore the Project truck traffic, and would minimize the problem of chloride handling in a freshwater environment. The dewatering facility described under the Dredge Management Plan

(Section 4.0 of the EIR/S) would also be utilized for the landfill disposal option. As with the upland inland sites, no adverse water quality impacts to Boston Harbor are anticipated due to the MADEP permit requirements.

## AQUATIC RESOURCES

No impacts to aquatic resources would occur at the landfill sites or Boston Harbor as a result of dewatering.

## WETLAND RESOURCES

No impacts to wetland resources would occur at the landfill sites or Boston Harbor as a result of dewatering.

## WILDLIFE

No impacts to wildlife would occur at the landfill sites or Boston Harbor as a result of dewatering.

## THREATENED AND ENDANGERED SPECIES

No threatened or endangered species are known to occur at any of the landfill sites, or at the Boston Harbor dewatering facility, so no impacts would occur.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

No historical or archeological resources are known to occur at any of the landfill sites, or at the Boston Harbor dewatering facility, so no impacts would occur.

## SOCIO-ECONOMIC/LAND USE

Each are existing and active landfills so that their individual or collective use should not pose any additional socio-economic/land use impacts on their respective communities.



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## 2.3 SITE EVALUATIONS: NEARSHORE AQUATIC SITES

### 2.3.1 Mystic Piers (Massport Piers 49 & 50)

The site is depicted on Figure A1-9.

#### 2.3.1.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

Like all of Boston Inner Harbor, the Mystic Piers site is a depositional environment (EG&G 1984), accumulating fine grained sediments (silts and clays). Sediment sampling along the harbor-face of Massport's Mystic Piers 1 (Station 1), 49 and 50 (Stations 1 and 2), adjacent to the proposed disposal site, revealed that the silt-clay component was 41-78%, averaging 60% (see EIR/S Section 2.2). Benthic grabs collected within the proposed disposal area contained predominantly silty sediments, although gravel was present in one sample.

No within-berth data were available for assessing sediment quality. However, all stations sampled to characterize berth-area dredged materials were within approximately 400 feet of the mouth of the proposed Mystic Pier disposal site and may be indicative of sediment quality. Assuming these data reflect conditions within the Mystic Pier site, the sediments are likely to contain moderate to high levels of metals and organics. Arsenic, chromium, copper and mercury likely occur in Category II levels; lead and zinc likely occur in Category III levels. Total PAHs concentrations are likely to be high ( > 10 ppm), with fluoranthene and benzo(g,h,i)perylene contributing the highest concentrations. Total organic carbon is likely to be 2-3% of dry weight, indicating a relatively high potential for bioaccummulation of contaminants.

#### WATER QUALITY AND CIRCULATION

The area of Boston Harbor adjacent to the Mystic Pier site has been classified as Class SC waters by the MADEP. This designates these saline waters for the protection and propagation of marine life and secondary contact recreation. Water quality of Boston Inner Harbor is strongly influenced by the numerous discharges into the harbor, including CSOs, NPDES discharges and non-point source urban runoff. There is no site-specific water quality data for the Mystic Pier Site; however, water quality can be characterized by Boston Inner Harbor data which are described in Section 4.1.1 of the EIR/S. At the Mystic Pier site there is an outfall pipe, which is a minor discharge consisting of either stormwater, sanitary waste water or from a minor industrial discharge such as non-contact cooling of equipment (Menzie-Cura and Assoc. 1991).

The opening of the Mystic Piers site indicates that water exchange between Boston Harbor and the site is not restricted. Thus, water movement at the Mystic Pier site can be characterized by Boston Inner Harbor currents (described in Section 4.1 of the EIR/S) which are tidally diverse.

In general, water quality and circulation are driven by tidal cycles, and influenced by seasonal weather patterns. High summer temperatures have been reported to depress dissolved oxygen concentrations, often resulting in defaunation in the benthos in Boston Harbor (Hubbard and Bellmer 1989). This condition is commonly referred to as the "August Effect," and will be also referred to throughout this document.

#### AQUATIC RESOURCES

The site was visited during low tide on April 28, 1993, to evaluate habitat conditions. The intertidal zone is restricted to the tidal excursion vertically along the walls and pilings surrounding the Mystic

Piers site, except in the southwest corner where rubble has accumulated in sufficient quantity to be exposed at low tide. Intertidal portions of the western and northern walls are covered extensively with algae (primarily *Fucus* sp. with some *Spongomorpha* sp.). The pilings along the southern perimeter were heavily covered with barnacles, blue mussels (*Mytilus edulis*) and green algae (*Spongomorpha* sp.) with algal cover increasing with distance from the mouth. Diatoms were present on the algae and rubble. Mussels and macroalgae both provide habitat for other organisms. These communities may be exploited for food or shelter by crustaceans and finfish.

## Benthic Infauna

Two areas were sampled (in April 1993) for benthic infauna. Results (extrapolated to number/$m^2$) are reported on Table A1-2. Station MP-1, adjacent to the pilings, was nearly azoic (two taxa totalling 86 individuals/$m^2$) while Station MP-2, near the head of the site, contained 17,759 individuals/$m^2$ (11 taxa) of which 11,954/$m^2$ were nematodes. The total abundance at MP-2 was in the range observed by the Corps in the Chelsea Creek and Confluence Area in 1986. However, the channel stations were dominated by polychaetes (> 70%) while the Mystic Pier station was dominated by nematodes (67%). *Capitella capitata* and oligochaetes comprised 85% of the remaining organisms. These predominant taxa are classified as pioneer taxa. Nematodes are early settlers in organically enriched sediments whose presence stimulates microbial degradation of organics (Tietjen 1982). Oligochaetes and *C. capitata* are typically associated with organically enriched, stressed environments. Its reproductive strategy enables *C. capitata* to colonize disturbed sediments rapidly. No amphipods or live mollusks were collected. The moderate abundance of infauna (17,759/$m^2$) in at least a portion of the site contributes to the productivity of Boston Harbor and these near-surface dwelling organisms are available as prey items for crabs and demersally feeding fish. Winter flounder (*Pleuronectes americanus*) have been documented as feeding on *C. capitata* in Boston Harbor (Haedrich and Haedrich 1974; NAI 1985), although their preferred prey includes amphipods and large worms.

## Finfish

Finfish were not sampled in this site. It is likely that most species that reside in or migrate through Boston Inner Harbor could enter this area. The pilings and wharf, shading the area below, offer shelter from predators. The orientation of the site perpendicular to the main channel provides shelter from currents. Both subtidal and intertidal benthic resources provide prey items. Soft substrate could support feeding by demersal species (e.g., winter flounder). Fish such as cunner (*Tautogolabrus adspersus*), tomcod (*Microgadus tomcod*) and sculpins (*Myoxocephalus* spp.) could feed on the fouling community on the walls and pilings (Edwards et al. 1982; Menge 1982; Ojeda and Dearborn 1990). Two species of particular concern are alewife (*Alosa psuedoharengus*) and winter flounder. The anadromous alewife spawns above the head of tide of the Mystic River so reproductive adults migrate upriver past the Mystic Piers site between April and May (Whitlatch 1982). Adults descend the river during the summer, juveniles swim downriver past the site from late summer-fall (Loesch 1987). Another anadromous species, rainbow smelt, may also use this portion of the Harbor. Winter flounder is one of the most abundant species in Boston Harbor where it is considered to be a resident. It prefers to spawn on sand common in the outer harbor (Bigelow and Schroeder 1953). Site-specific data for winter flounder were not available.

## WETLAND RESOURCES

Under the jurisdiction of the Massachusetts Wetlands Protection Act (MGL c.131, s.40 and 310 CMR 10.00) the Mystic Piers site is a Designated Port Area (DPA). DPAs are almost completely developed areas where few or no natural land forms or vegetation remain. They tend to be paved, bulkheaded, and used for heavy industry so that they have virtually no significance to the interests of the Act, except for Land Under the Ocean. Land Under the Ocean in DPAs are significant to flood control, storm damage prevention, and the protection of marine fisheries, as is Land Under the Ocean outside of DPAs. The major addition is that Land Under the Ocean in designated port areas also provides support for coastal engineering structures, such as bulkheads, seawalls, revetments, and solid fill piers. The site is primarily Land Under the Ocean, potentially important to marine fisheries, storm damage prevention and flood control. Land Under the Ocean within the Mystic Pier provides food resources and shelter; however, the silty substrate is not preferred spawning habitat for winter flounder, nor are the saline conditions conducive to spawning of the anadromous alewife. Storm damage protection and flood control are provided by the vertical granite wall surrounding the perimeter of the site.

Under federal wetlands guidelines, the entire Mystic Piers site is defined as tidal water. The fine-grained character of sediments at the site, as well as proximity to identified contaminants, suggest that the potential for retention of sediments, toxicants and nutrients exists. Abundance and diversity of the benthic fauna varied substantially in the site. Compared to other locations in the harbor, Mystic Piers exhibited moderate potential for supporting higher trophic levels. Construction activities could be more sensitive at this site due to its proximity to an anadromous fish run (in the Mystic River).

## WILDLIFE

The aquatic area of Mystic Piers may be used by waterfowl that dive for food (e.g., bufflehead and common goldeneye), birds that hunt fish in the water (e.g., red-breasted merganser and double-crested cormorant), or those that hunt fish from the air (e.g., common tern and belted king fisher). Coastal areas are particularly important to waterfowl during the winter. Inland feeding areas usually freeze, so water-dependent birds such as American black ducks move to unfrozen waters on the coast.

Abandoned piers provide roosting sites for gulls and common terns. Norway rats are also commonly associated with waterfronts (DeGraaf and Rudis 1986). Harbor seals may occasionally occur since they generally feed in shallow water inshore (FAO Adv. Comm. 1976, cited by Chapman and Feldhamer 1982).

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or anticipated to occur within the boundaries of the Mystic Piers site (Lincoln 1993). Although common terns have been observed nesting within Boston Harbor, no evidence of nesting was present at the Mystic Piers site on April 28, 1993.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources at the Mystic Piers site.

## SOCIO-ECONOMIC/LAND USE

The inlet between the Mystic Pier No. 1 and Pier 49 is no longer used for cargo handling at Massport's

Moran Terminal in Charlestown. Charlestown is a neighborhood within the City of Boston. Recreational vessels docking here in the late 1970s were removed to accommodate shipping activity. The recreational docking has not been reinstated even though the port-related shipping activity ceased to operate in the inlet. There are no residential areas abutting this property. The closest residential neighbors are across the Little Mystic Channel in the Charles Newtowne complex and in the former Navy Yard.

Charlestown, with a population of 14,731, is a dense residential community surrounded by industrial land use on the north and south edges. To the southeast, the former Boston Naval Shipyard has been redeveloped into a mixed use complex including residences, institutions, shops, offices and recreational facilities. The population of Charlestown is 95% white. From 1980 to 1990 the population shifted with a reduction in the percentage of children and an increase in the 25-44 year age group. This reflects the new condominiums and apartments constructed in the Navy Yard and along Main Street. The median family income is $41,638.

2.3.1.2 Environmental Consequences

SEDIMENT CHARACTERISTICS

This site would be filled with the dredged material, capped and converted into an upland area. The silt sediments placed at the disposal site would be stabilized by a retaining wall and 3 foot cap of clean sediment. The elevation after filling would be equal to the adjacent land. Sediment samples collected in close proximity to this site indicated that the sediments within the pier are likely to have moderate to high levels of metals and organics (see Section 4.1 of the EIR/S). The existing poor sediment quality would be covered by capping, eliminating the potential for further dissemination of existing contaminants into the water column and for further bioaccumulation.

WATER QUALITY AND CIRCULATION

The average current velocity at this site is less than 0.5 knots. In general, water circulation at the Mystic Pier site is driven by tidal cycles and influenced by seasonal weather patterns. This should not be affected by filling of a relatively limited area of existing tideland. During disposal operations, suspended solids would be released into the Boston Harbor waters. As a result, there would be localized and temporary increases in suspended solids concentrations in the water column as discussed below. The use of a dragline at this site would also contribute to a higher amount of suspended sediment at this site; however, the use of a silt curtain would trap most of the suspended sediment. Disposal activity would occur for a 6- to 9-month period and if controlled there would be only temporary impacts of the suspended solids concentrations on the water quality in the vicinity of the site. A sedimentation basin or a settling pond could be used as a means to mitigate water quality impacts.

The effects of disposal on the Boston Harbor water column chemistry are likely to be minor; mitigative measures (silt curtains, etc.) would minimize release of sediment contaminants into the water column. There should be no degradation of the Class SC waters.

AQUATIC RESOURCES

In the intertidal zone there would be a permanent loss in macroalgae, barnacles, and blue mussel production on the hard substrate (vertical seawalls and pilings) present at the site. The construction of a retaining wall across the pier opening would replace some of that habitat.



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**Benthic Infauna**

Benthic invertebrates at the Mystic Piers site would be buried during disposal operations. The overall high abundance of infauna in at least a portion of the site contributes to the productivity of Boston Harbor and these near-surface dwelling organisms are available as prey items for crab and demersally feeding fish. The dredged material placed at the site would fill the site to the adjacent land elevation. Therefore, 2.71± acres of soft substrate would be lost.

**Finfish**

Disposal operations would have some impact on fish at the disposal site. Some displacement and/or mortality of fish eggs, larvae, and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Finfish are likely to use the site for shelter from currents and predators and for feeding. The anadromous alewife spawns at the head of tide in the Mystic River, so reproductive adults migrate upriver past the Mystic Piers site between April and May. Adults descend the river during summer. Winter flounder could spawn in the close proximity to this site from March to September (Section 4.1 of the EIR/S). Thus, seasonal disposal restrictions would be enforced at this site (See Section 3.0 of the EIR/S). Most fish species would avoid the area during disposal and thus be displaced; there would be permanent loss of finfish refuge and foraging habitat.

## WETLAND RESOURCES

There would be a permanent loss of 2.71± acres of Land Under the Ocean in a DPA and Tidal Waters at this site. The impacts for the biological resources protected are discussed above.

## WILDLIFE

Disposal of dredged material at the Mystic Piers site is not expected to have substantial adverse impact on wildlife populations (e.g., birds) occurring near the disposal site because it is not a high quality environment for their use.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Mystic Piers site.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 100 barge trips to the Mystic Piers site. This would result in some minor delays to commercial and recreational boat traffic using the harbor; the Coast Guard would regulate these activities. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels.

Filling at this location would not displace any marine cargo loading or unloading operation. The active berths with cargo handling equipment at Moran Terminal are located on the north side of the site abutting the Mystic River as well as the east side of the site abutting the Inner Harbor. Since placement of material would occur from the water, there will be no impact on adjacent streets caused by truck traffic delivering material to the site.



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### 2.3.2 Revere Sugar

The site is depicted on Figure A1-10.

#### 2.3.2.1 Existing Conditions

**SEDIMENT CHARACTERISTICS**

Benthic samples from the interior portions of the site revealed the sediments to be anoxic silts with an oily sheen. At the mouth of the site there was a thin oxygenated layer overlaying anoxic black silts. No samples were collected within the site boundaries for sediment characterization, but Stations 1 and 2 sampled along the Mystic River berth at Revere Sugar (Appendix C of the EIR/S) represent probable sediment conditions. Contaminant loads in these sediments were generally high: Category II levels of chromium and copper; Category III levels of arsenic, lead, zinc and PCBs; high levels of total PAHs (18-44 ppm) and total petroleum hydrocarbons. Individual PAHs exhibiting particularly high values (> 5 ppm) were pyrene, phenanthrene, fluoranthene and chrysene. TOC values (3-3.6%) indicate that the potential for bioaccumulation is high.

**WATER QUALITY AND CIRCULATION**

Tidal flow and land-based discharges to the Mystic River influence the water quality of the Revere Sugar site, which is classified as Class SC waters. Dissolved oxygen experiences August Effect fluctuations at this site.

Circulation within the Revere Sugar site is governed by tidal flow and physical structures. The northeast corner of the site is likely to experience reduced flows or eddies during flood tide since the eastern boundary of the site is perpendicular to the primary flow. Similarly, the northwest corner would experience reduced flows or eddies during ebb tides. The pilings across the mouth of the site interrupt linear flow and can reduce current speed, enhancing the likelihood of sediment deposition. The even more numerous pilings along the western and southern edges of the site create the same effect in these areas.

**AQUATIC RESOURCES**

Habitat conditions were examined at the Revere Sugar site on April 28, 1993. The intertidal zone is restricted primarily to vertical excursion on pilings and walls. The wooden retaining wall along the eastern boundary and the abandoned pier on the southern side supported small quantities of macroalgae (predominantly *Fucus* sp. with some green algae). Barnacles and littorinid snails were present but not numerous. The barnacle cover increased along the western pilings towards the mouth. The granite wall behind the pilings supported some algae cover (*Fucus* sp. and green algae). Barnacle cover was heaviest on the metal pilings at the mouth of the site. Mussels were observed only at the northwest corner of the site.

Breaching of the retaining wall along the southeast portion of the site has allowed erosion into the aquatic zone, creating a small intertidal zone of rubble and fine-grained sediments.

**Benthic Infauna**

Benthic infauna was sampled in three locations (Table A1-2). Nematodes accounted for > 80% of the abundance at Stations RS-1 and RS-2 (98% RS-1 84% RS2); *C. capitata* and oligochaetes were also numerically important components of the fauna. Abundances at RS-3 were low, made up primarily of the cirratulid polychaete *Caullariella* sp. and nematodes. Species richness at RS-1, near the mouth of the site, indicates that, at least seasonally, benthic infauna can be relatively diverse in this site. The polychaetes present are primarily surface deposit

feeders, indicative of the stressed sediment conditions. The tube dwelling amphipod *Microdeutopus gryllotalpa*, is commonly found associated with docks, algae and mussels (Bousfield 1973). Its presence in the infauna suggests it is present among the fouling organisms on the pilings and bulkheads. The paucity of suspension feeders (e.g., bivalves) indicate that suspended particulates or siltation rates are higher than suitable.

### Finfish

As with Mystic Piers, finfish are likely to utilize the Revere Sugar site for shelter from currents and predators, and for feeding. Species feeding indiscriminantly on the bottom would encounter prey. Species that prefer to browse on hard substrates would find little food. while winter flounder could spawn in this area, their preferred spawning habitat (sand) may not occur at this site. Revere Sugar is located well below the head-of-tide, so does not provide suitable conditions for anadromous species to spawn.

## WETLAND RESOURCES

The Revere Sugar site is located within the Mystic River DPA (310 CMR 10.00). Under Massachusetts wetlands regulations, most of the site would be designated as Land Under the Ocean and have the potential to be significant to marine fisheries, storm damage prevention and flood control. This site could provide both refuge (from currents and predators) and feeding opportunities (primarily for demersal feeders). It is unlikely to provide spawning habitat for either winter flounder, as it appeared to lack sandy sediments, or anadromous species (e.g., alewife), as it is located well below the head-of-tide. Storm damage prevention and flood control are enhanced at this site by the man made boundaries, although the seawall at the southern end of the site is in disrepair and offers limited protection against exceptionally high tides. The greatest potential for storm damage prevention and flood control occurs during low tides.

Intertidal resources include a debris strewn beach in the southeastern corner and the granite walls and pilings surrounding the site. The beach could be categorized as Coastal Beach but is not significant in the DPA. No natural intertidal features exist at this site.

Under federal regulations, the entire site is categorized as Tidal Waters. This resource provides two functions not specifically identified by Massachusetts for DPAs. The fine-grained character of the sediments indicates the potential for sediment/toxicant retention and for nutrient retention/transformation exists. Aquatic diversity/abundance is moderate at this site as it appears to vary spatially, being highest at the mouth. Potential construction at this site may be more sensitive because of its location on a river that has an anadromous fish run.

## WILDLIFE

Wildlife use of the Revere Sugar site is expected to be similar to that described for Mystic Piers (Section 2.3.1.1 of this evaluation).

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or anticipated to occur within the boundaries of the Revere Sugar site (Lincoln 1993). Although the state-listed common tern has been observed in Boston Harbor, no evidence of nesting activities of this species were seen during a site visit on April 28, 1993.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources on or within 1000 feet of the Revere Sugar site.

## SOCIO-ECONOMIC/LAND USE

Revere Sugar, a site containing 6.5± acres in Charlestown, is currently under lease from Massport by the MWRA which has constructed a water transportation facility for the ferrying of construction personnel to Deer Island. Construction personnel can park vehicles on the Revere Sugar property before boarding the ferry to Deer Island. The lease for the ferry operation runs to 1998. The dock is located on the west side of the property. The property is between two industrial sites and between the Mystic River and Medford Street. Across Medford Street are residences and a cemetery. Land side access to the site from Moran Terminal is via Terminal Street to Medford Street. These streets have mixed uses.

The neighborhood closest to Revere Sugar has a very low percentage of people below the poverty line and a high median family income compared to other locations in Charlestown.

### 2.3.2.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

This site would be filled with the dredged material, capped and would be converted into an upland area. The silt sediments placed at the disposal site would be stabilized by a retaining wall and 3 foot cap of clean sediment. The elevation after filling would be equal to the adjacent land. Sediment samples collected in close proximity to this site indicated that the sediments are likely to contain high concentrations of metals and organics (see Section 2.2 of the EIR/S). The existing poor sediment quality would be isolated by capping and bulkheading, eliminating the potential for further exposure of contaminants to the water column and for bioaccumulation.

## WATER QUALITY

The average current velocity at this site is less than 0.5 knots. Circulation within the Revere Sugar site is governed by tidal flow and physical structures. Disposal activities would occur for a 6- to 9-month period with some potential for temporary impacts from the suspended solids in the vicinity of the site. As with other pier sites, silt curtains and other mitigative measures (settling basin, etc.) would be necessary to prevent unacceptable levels of suspended sediments from entering the river and harbor. Partial bulkheading during site construction and disposal would help restrict openings to the river and provide better opportunities for point-source controls.

The effects of disposal on the Mystic River water column chemistry are likely to be minor. Release of sediment-borne contaminants into the water column are expected to be controlled so that there would be no degradation of the Class SC waters.

## AQUATIC RESOURCES

There will be a permanent loss of intertidal substrate and secondary production of macroalgae, barnacles, and littorinid snails on the hard substrate (pilings and vertical seawalls). The construction of a retaining wall across the pier opening would replace some of that habitat on its outside wall.

### Benthic Infauna

Benthic invertebrates at the Revere Sugar site will be permanently buried and displaced during disposal operations. Nematodes accounted for > 80% of the abundance, also, *C. capitata* and oligochaetes were numerically important components of the fauna. The dredged material placed at the site would fill the site to the adjacent land elevation. Therefore, 3.67± acres of soft substrate would be loss.

### Finfish

Since finfish are likely to use the site for shelter from currents and predators and for feeding, some displacement and/or mortality of adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Most fish species should avoid the area once construction is initiated. There would be permanent loss of finfish refuge, foraging, and possibly spawning habitat once construction is complete.

## WETLAND RESOURCES

There would be a permanent loss of 3.67± acres of Land Under the Ocean in a DPA and Tidal Waters at this site. The impacts on the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Disposal of dredged material at the Revere Sugar site would not adversely impact wildlife populations (e.g., birds) occurring near the disposal site; loss of aquatic habitat would occur.

## THREATENED AND ENDANGERED SPECIES

Since no federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Revere Sugar site, there should be no related impacts.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project should have no effect upon any structure or site of historical, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 100 barge trips to Revere Sugar. This would result in some minor delays to commercial and recreational boat traffic using the harbor which would have to be controlled by the U.S. Coast Guard. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels.

Any fill on the westerly portion of this site would eliminate the docking facility recently constructed by the MWRA. The current lease which runs to 1998 would need to be bought out. Filling out to the pierhead/bulkhead line on the portion of the site abutting Somerville Lumber is unlikely to affect the utility of this site for port shipping in the future provided that the fill is contained. Since placement of material would occur from the water, there will be no construction-related impact on adjacent streets caused by truck traffic delivering material to the site.

### 2.3.3 Amstar

The site is depicted on Figure A1-11.

#### 2.3.3.1 Existing Conditions

**SEDIMENT CHARACTERISTICS**

Benthic samples collected at Amstar contained odorless, grey silty sediments. No chemical analyses were performed on sediments from the Amstar site, but Station 3 from the Revere Sugar berth was located approximately 300 feet from the mouth of the site and is assumed to be representative to on-site conditions (see EIR/S Section 2.2). That station had a 73% silt-clay component (Category III). Chromium, copper and nickel all occurred at Category II levels; arsenic, lead, zinc and PCBs were Category III concentrations. Total PAHs were among the highest (46.41 ppm) observed during the 1992 berth area sampling. Benzo (b)fluoranthene, benzo(k)fluoranthene, fluoranthene and pyrene each contributed more than 5 ppm to the total concentration. Total petroleum hydrocarbons were 3540 ppm. Total organic carbon was 6.6%, among the higher values observed during the berth sampling, suggesting that potential for bioaccumulation of contaminants is lower at Amstar than other sites in Boston Harbor. Zinc and PAH uptake may be exceptions to this generalization, as these constituents were found at higher levels at Revere Sugar Station 3 than at other berths.

**WATER QUALITY AND CIRCULATION**

In general water, quality at this site is expected to be similar to conditions in the Mystic River since there are no obstructions to flow. Again, the water quality classification is Class SC. The character of the sediments observed within this site suggest that it may experience the late summer hypoxia (August Effect). Water quality on the site may also be influenced by two discharges on the southern and western banks which are most likely minor discharges consisting of stormwater. There is also a NPDES discharge from Cambridge Electric in the vicinity of the Amstar site (Menzie-Cura and Assoc. 1991).

Amstar opens directly on the Mystic River with no obstructions. Like Revere Sugar, the northeast corner of the site may experience reduced flows or eddies during flood tides as currents are diverted around the end of the wharf. This phenomenon would occur during ebb tides at the northwest corner. The pilings supporting the eastern wharf and the floating dock slow currents and contribute to sedimentation under the wharf.

**AQUATIC RESOURCES**

There are three types of intertidal habitat occur at the Amstar site. Pilings and vertical seawalls along the eastern side provide hard substrate that has been colonized by barnacles, mussels and green algae. Beneath the ramp to the floating dock is a small, gently sloping gravel-cobble beach. The cobble support green algae. The rest of the south boundary is a rip-rap slope comprised of boulders that are heavily covered with *Fucus* sp. There is little *Fucus* sp. on the western rip-rap slope except at the mouth of the site. Along the western boundary barnacles and periwinkles (*Littorina* sp.) were numerous; green algae was present above and below the barnacle zone.

**Benthic Infauna**

Most of the site is submerged continuously. Differences in species composition at the two sampling locations (Table A1-2) may reflect differences in circulation, exposure and adjacent substrate conditions. Species present at Station AM-1 (dominants: nematodes, *Polydora cornuta*, oligochaetes) are typically abundant harbor-wide. Total abundance



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(18,287/$m^2$) at AM-1 was moderate relative to other areas sampled. Station AM-2 supported low abundances of several species, two of which (*Crangon septemspinosa* and harpacticoid copepods) are motile. Sediment at this station was gelatinous, with an oily sheen.

### Finfish

Finfish could utilize this area for refuge from predators, particularly among the pilings at any tide and among the *Fucus* sp. of the southern boundary during high tides. The entire site could provide refuge from peak currents due to its orientation perpendicular to the channel. Anadromous fish could use the site for this purpose. Subtidal regions could provide food resources for demersal browsers. Intertidal food resources are limited except for fish that browse green algae.

The Amstar site does not provide spawning habitat for anadromous species as freshwater input is limited to three drainage pipes. Winter flounder spawning opportunities are limited since the site's sediments are not sandy.

## WETLAND RESOURCES

Amstar is located within the Mystic River DPA (310 CMR 10.00). The site is primarily Land Under the Ocean, under Massachusetts regulations, and is considered to be significant to marine fisheries, storm damage prevention and flood control. As described under Aquatic Resources, the Amstar site could provide both refuge (from predators and currents) to many fish species and feeding opportunities (primarily demersal species). It is unlikely to provide important spawning habitat.

Man-made features at Amstar were designed to contribute to storm damage prevention and flood control. Surrounding land elevations are several feet above mean high water. The rip-rap slopes along the southern and western boundaries are effective in dissipating currents and waves.

The intertidal area under the floating dock ramp could be categorized as Coastal Beach, but is not significant in the DPA.

The entire site is classified as Tidal Waters, under federal regulations. The fine-grained sediments found at this site, in conjunction with nearby sediment sampling, suggest that this site has the potential for sediment/toxicant retention and for nutrient retention/transformation. Benthic fauna were moderate in abundance and diversity compared to other sites examined. As anadromous fish species are known to transverse the Mystic River, it is possible that Amstar could be used by them as well.

## WILDLIFE

Wildlife use of the Amstar site is expected to be similar to that described for Mystic Piers site.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or anticipated to occur within the boundaries of the Amstar site. The state-listed common tern has been observed to nest in Boston Harbor. No nesting activities were observed during field investigations on this site on April 28, 1993.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical and archeological resources on or within 1000 feet of the Amstar site.

## SOCIO-ECONOMIC/LAND USE

Amstar is an industrial site containing approximately 20 acres in Charlestown. It is currently available for sale, although there are several industrial tenants. One tenant runs a sand and gravel operation and uses the dock for material transfer. The site is in the City's Maritime Economy Reserve Zone which is geared to water dependent activities. It is surrounded by industrial uses to the east and west. Across Medford Street from the site are residences and a park. Access to Amstar is the same as that to Revere Sugar. Demographic characteristics are similar to those described for Revere Sugar.

### 2.3.3.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

This site would be filled with the dredged material, capped and converted into an upland area. The silt sediments placed at the disposal site would be stabilized by a retaining wall and 3 foot cap of clean sediment. The elevation after filling would be equal to the adjacent land. Sediment samples collected in close proximity to this site indicated that the sediments within the site are likely to be moderately to highly contaminated (see Section 4.1 of the EIR/S). The existing poor sediment quality will be isolated by capping and bulkheading, reducing the potential of disseminating contaminants into the water column and of bioaccumulation.

## WATER QUALITY AND CIRCULATION

The average current velocity at this site is less than 0.5 knots. During disposal operations suspended solids could be released into the Mystic River waters resulting in localized and temporary increases in suspended solids concentrations in the water column. Therefore, the use of a silt curtain at this site would be appropriate to trap most of the suspended sediment. Disposal activity will occur for a 6- to 9-month period; if properly controlled effects from the suspended solids concentrations on the water quality in the vicinity of the site should be minimized. A sedimentation basin or a settling pond may be necessary to mitigate water quality impacts. There would be no degradation of the Class SC waters.

## AQUATIC RESOURCES

In the intertidal zone, there would be a permanent loss in production from barnacles, mussels and green algae on the hard substrate (pilings, vertical seawalls and rip-rap) present at the site. The construction of a retaining wall across the pier opening would replace some of that habitat. The small gravel-cobble beach beneath the ramp would also be lost.

### Benthic Infauna

Benthic invertebrates at the Amstar site will be permanently buried and displaced from disposal operations. Nematodes, the polychaete *P. cornuta* and oligochaetes were typically abundant harbor-wide and were the abundant species at this site. The dredged material placed at the site would fill the site to the adjacent land elevation. Therefore, 3.51± acres of soft substrate would be lost.

### Finfish

Disposal operations would impact fish utilization of this site. Some displacement and/or mortality of adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Anadromous river herring could no longer use this area for refuge. Subtidal regions would not be available to provide food resources for demersal browsers. Most fish species could avoid the area of disposal, but there would be permanent loss of finfish refuge and foraging habitat (i.e., 3.51± acres).



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## WETLAND RESOURCES

There would be a permanent loss of 3.51± acres of Land Under the Ocean in a DPA and Tidal Waters at this site. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Disposal of dredged material at the Amstar site would have no substantial impact on wildlife populations (e.g., birds) occurring near the disposal site, although there would be permanent loss of foraging habitat for shorebirds and waterfowl.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Amstar site; therefore, no impacts are anticipated.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 130 barge trips to Amstar. The Coast Guard would have to coordinate any minor delays to commercial and recreational boat traffic using the harbor. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels.

Adjacent to the Amstar site is Revere Sugar which has an active water transportation facility. Any filling at the Amstar property would require a bulkhead to contain material so as to prevent any effect on the dock at Revere Sugar. Partial filling of the property would restrict ship to shore transfer of people or freight including the current sand and gravel operation. However, it would not restrict marine-related storage of material. Since placement of material would occur from the water, there will be no impact on adjacent streets caused by truck traffic delivering material to the site.

### 2.3.4 Cabot Paint

The site is depicted on Figure A1-12.

#### 2.3.4.1 Existing Conditions

**SEDIMENT CHARACTERISTICS**

Benthic samples collected at Cabot Paint contained odorless, gray silty sediments. No chemical analyses were performed on sediments from Cabot Paint site, but Station 1 of Eastern Minerals was located approximately 2000 feet from the Cabot Paint site (see Section 2.2 of the EIR/S). This station had a 66.5% silt-clay component with arsenic, chromium, lead, mercury, zinc and PCB concentrations all occurred at Category II levels. Total PAHs occurred at levels (11.38 ppm), and benzo(b)fluoranthene contributed 3.67 ppm to the total concentration. Total organic carbon was 3.6%, suggesting some bioaccumulation of contaminants may likely occur.

The ACOE conducted chemical sampling in 1986 at eight (8) stations (A through H) in Chelsea Creek. Station G was located in the vicinity of the Cabot Paint site. It is assumed for this level of site evaluation that the chemical constituents at Station G should be similar to that of the Cabot Paint site. Station G had a sandy organic clay composed of 68% fine grained material with a moderate chemical oxygen demand (102,000 ppm). The only contaminant detected in high concentrations was lead at 283 ppm (Category III). Levels of mercury (1.14 ppm), zinc (276 ppm) and chromium (185 ppm) were present at Category II.

**WATER QUALITY AND CIRCULATION**

The Chelsea Creek is classified as SC waters by the MADEP. Such waters are saline and classified as suitable for aesthetic enjoyment, recreational boating, industrial cooling and process use, and as habitat for indigenous wildlife and forage for game fish. Cabot Paint opens directly into the Chelsea Creek, but the wooden pilings on the north of this site slow currents and contribute to some sedimentation in the vicinity of the pilings.

Dissolved oxygen readings collected in April 1993, ranged from 8.6 - 9.0 mg/L at water temperatures ranging from 6.6-8.2°C. Salinity data collected on that date ranged from 22.6-28.4 ppt at low tide, indicating the influence of freshwater inputs.

**AQUATIC RESOURCES**

The intertidal habitats within the Cabot Paint site vary and comprise 1) a sloping rip-rap embankment on the north side, 2) gravel beaches on the northeast and northwest sides, 3) the wooden pilings on the north side, 4) a wooden bulkhead and concrete slab on the northwest side, 5) an abandoned boat ramp on the northwest end, and 6) abandoned barges and boat on the northwest end. Microalgae cover (*Fucus* sp. and green algae) varied throughout the site's intertidal areas. Limited cover was observed on the rip-rap, while approximately 40% of the gravel beach was covered. The abandoned boat ramp was also covered with *Fucus* sp. The wooden pilings were completely covered with barnacles and *Fucus* sp. and the wooden bulkhead had some of these species.

**Benthic Infauna**

The composition of the benthic infauna is shown in Table A1-2. The two sampling locations may reflect the differences in substrate conditions, circulation, and exposure. Station CP-1 was located in the vicinity of the submerged pilings, where the most abundant species were Oligochaeta, *S. benedicti*, and Nematoda. The total percentage composition of these three species was 59% at Station CP-1. Total abundance at this station (of 9,202 individuals/$m^2$) was moderate when compared with the other areas

sampled. At station CP-2 (located in an open area between the pilings) the most abundant species were *S. benedicti* and Nematoda. This station had a total abundance of 3,354/$m^2$, low when compared with the other stations. The total percentage composition of these three species was 96% at Station CP-2. Species richness at both stations was low (5-9).

### Finfish

The ACOE NED collected finfish samples by gillnet in July and November, 1986 during a 48-hour effort on two different sampling days in the Chelsea Creek. The dominant finfish species found in the July sampling effort were rainbow smelt (*Osmerus mordax*) and alewife (*A. pseudoharengus*). In the November sampling effort, no fish were caught. Given the limited amount of data for comparison, no real conclusions can be drawn at this time. Finfish could use the wooden pilings and *Fucus* sp. for shelter from predators during high tide. The sandy substrate in the Chelsea Creek may provide spawning habitat for winter flounder (*P. americanus*) (ACOE 1988).

## WETLAND RESOURCES

Cabot Paint is located within the Chelsea River DPA and primarily contains Land Under the Ocean, as defined under Massachusetts Wetlands Protection regulations (310 CMR 10.00). Land Under the Ocean is considered to be significant to marine fisheries, storm damage prevention and flood control. The sloping rip-rap embayment on the north side of the site was designed for storm damage prevention and control. The gravel beaches could be categorized as Coastal Beach, but this designation is not significant in the DPA.

Many species of marine fishes, including anadromous fish, may inhabit DPAs. Anadromous fish such as rainbow smelt (*O. mordax*) and alewife (*A. pseudoharengus*) are known to traverse the Chelsea Creek. As described in the Aquatic Resources section, the Cabot Paint site could provide both shelter from predators and feeding opportunities for these fish species. This site may also provide spawning habitat for winter flounder.

The entire site is classified as Tidal Waters under federal regulations. The fined-grained sediment grain size and the results of the samples analyzed, indicate that this site has the potential for sediment/toxicant affinity and nutrient retention. Benthic infauna species diversity was low-moderate and species richness was low at this site.

## WILDLIFE

On-site wildlife resources appear limited, and very similar to the Mystic Piers site.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Cabot Paint site.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no sites or structures of historical, architectural or archeological significance as defined by MHC or the National Historical Preservation Act, as amended.

## SOCIO-ECONOMIC/LAND USE

This site, containing 6.5± acres off Marginal Street in Chelsea is a mixed use parcel, fully occupied by industrial tenants and a major car rental storage

facility. The current owner has demolished some of the industrial buildings on site and adapted the remaining buildings to support several industrial uses. The wooden bulkhead along Chelsea Creek has deteriorated and currently poses navigation problems for vessels traversing Chelsea Creek. A commuter ferry service to Boston operated briefly out of this location during 1990 in an effort to reinstate ferry service from this site. The service was discontinued.

The City of Chelsea evolved from a summer resort community to a residential suburb of Boston. A major fire in 1908, in which over 17,000 residents were left homeless, changed the landscape permanently. The Chelsea which emerged from the fire was primarily commercial with manufacturing and shipping facilities. Several of the industries have closed in recent years succeeded by service and distribution operations. The population of Chelsea is 28,710 and is 70% white with a high percentage also reporting Hispanic origin. The median family income is $29,039. High end residential use has been developed on property surplused by the military, contrasting with more modest housing in densely populated sections of Chelsea.

Access to this site over land is via I-93 to the Tobin Bridge to Chestnut Street, and from Chestnut south to Williams Street, then east on Williams to Marginal Street.

### 2.3.4.2 Environmental Consequences

#### SEDIMENT CHARACTERISTICS

This site would be filled with the dredged material, capped and converted into an upland area. The contaminated dredged sediments placed at the disposal site would be stabilized by a retaining wall and 3 foot cap of clean sediment. The elevation after filling would be equal to the adjacent land. Sediment samples collected in close proximity to this site indicated that the sediments likely have moderate to high levels of some chemicals (Section 2.2 of the EIR/S). The existing poor sediment quality would be isolated by capping and bulkheading, eliminating the potential of disseminating contaminants into the water column and of bioaccumulation.

#### WATER QUALITY AND CIRCULATION

The average current velocity at this site is less than 0.5 knots. During disposal operations, suspended solids could be released into the Chelsea River waters resulting in localized and temporary increases in suspended solids concentrations in the water column. The use of silt curtains in combination with appropriate bulkheading at this site would be appropriate to trap most of the suspended sediment. Disposal activity would occur for a 6- to 9-month period; if properly controlled effects from the suspended solids concentrations on the water quality in the vicinity of the site should be minimized. At this site a sedimentation basin or a settling pond may be necessary to mitigate water quality impacts. There would be no permanent degradation of the Class SC waters.

#### AQUATIC RESOURCES

In the intertidal zone there would be a permanent loss in *Fucus* sp. and barnacle production on the hard substrate (rip-rap and bulkhead). The construction of a retaining wall across the pier opening would replace some of that habitat. The small gravel beaches on the northeast and northwest side of the site would be lost.

##### Benthic Infauna

Benthic invertebrates at the Cabot Paint site would be buried during disposal operations. At this site, the most abundant species were Oligochaeta, *S. benedicti* and Nematoda. The dredged material placed at the



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site would fill the site to the adjacent land elevation. Therefore, 5.59± acres of soft substrate would be lost.

### Finfish

Disposal operations would impact fish utilization of this site. Some displacement and/or mortality of adult fish could occur during disposal events due to burial or exposure to high suspended sediment levels. The dominant finfish species in the Chelsea Creek are rainbow smelt (*O. mordax*) and alewife (*A. pseudoharengus*). Most fish species would avoid the area of disposal, but there would be permanent loss of finfish refuge and foraging habitat.

## WETLAND RESOURCES

There would be a permanent loss of 5.59± acres of Land Under the Ocean within a DPA and Tidal Waters at this site. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Disposal of dredged material at the Cabot Paint site would have no significant impact on wildlife populations (e.g., birds) occurring near the disposal site, although there would be permanent loss of foraging habitat for shorebirds and waterfowl.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Cabot Paint site; therefore, no impacts are anticipated.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 70 barge trips to the Cabot Paint site. The Coast Guard would have to coordinate any minor delays to commercial and recreational boat traffic using the harbor. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels.

Partial filling at this mixed use property would isolate sediments already on the site from biological resources. However, more extensive filling may be required to accommodate the volume of material. The additional filling might necessitate adjustments to current operations on site during the placement operation. The restoration of the premises to its previous use after placement of the material may require special foundation preparation. Thus, there could be a reduction in land value resulting from the material being placed on the premises.

Operations on the adjacent parcels should not be disturbed by the dredge spoil and disposal at Cabot Paint. However, perception about the containment of material will be important if the adjacent sites are to be competitive in the current sluggish market for industrial land. The seaward bulkhead currently impedes navigation in Chelsea Creek. Boston Harbor Pilots would prefer to see the existing bulkhead pulled landward so as to better facilitate movement through this constricted area. Barges involved in filling or repairing this bulkhead could interfere temporarily with navigation on Chelsea Creek.

Access to this site by land entails traveling through a densely developed urban area comprising residences interspersed with industrial buildings. Truck traffic is already heavy in Chelsea because of the convenient highway access and the resulting siting of distribution facilities.



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## 2.3.5 Little Mystic Channel

The site is depicted on Figure A1-13.

### 2.3.5.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

No samples were collected within the site boundaries for sediment characterization, but Stations 2 and 3 at the Mystic Pier sites are in close proximity to the Little Mystic Channel and should represent probable sediment conditions. The sediment texture was predominately fine grained with a range of 76.3% - 78.4% silt-clay (Category II). Bulk sediment metals test results showed that at Station 2, arsenic, chromium, copper, lead, mercury, and zinc all occurred at Category II levels (Appendix C). At Station 3, arsenic, lead and zinc were found to be Category III, and cadmium, chromium, copper, and mercury were found to be Category II concentrations. Total PAHs ranged from 5.23 and 29.75 ppm at Stations 2 and 3 in Mystic Pier 1. Station 3 contained the highest levels of metals of the three stations at this site. At Station 3, benzo(a)anthracene and benzo(a)pyrene, chrysene, fluoranthene and pyrene were present in concentrations above 4 ppm. But at Station 2, only fluoranthene was above 5 ppm. At Mystic Pier 1, total petroleum hydrocarbon concentrations were among the highest observed during the 1993 berth area sampling. At Mystic Pier 1, there have been approximately twelve minor oil spills (U.S. Coast Guard, Marine Safety Office, letter dated May 13, 1992). This may have influenced the concentration of PAHs and TPHs at this site. PCBs were present at Category III concentrations at Stations 2 and 3. Total organic carbon ranged from 2.1-4.9% at both stations. This is an average value, indicating that there are moderate levels of food resources for benthic deposit feeders, suggesting that some bioaccumulation of contaminants may be occurring.

#### WATER QUALITY AND CIRCULATION

The water quality of the Little Mystic Channel is influenced by tidal exchange, the six discharge pipes that were observed on the north side of the site, and a Combined Sewerage Overflow (CSO). These storm drainage pipes add urban runoff pollutants (e.g., oil and grease, detergents etc.) into the Channel. There is one CSO, the Chelsea Street Extension outfall, which discharges directly to the Little Mystic Channel on the south shore. The currents in Little Mystic Channel are primarily tidally driven. The Little Mystic Channel is classified as SC water by the MADEP. Such waters are saline and suitable for aesthetic enjoyment, recreational boating, industrial cooling, and as habitat for indigenous wildlife and forage for game fish. Dissolved oxygen readings collected in April 1993 ranged from 9.0-9.4 ppm. As temperatures peak in August, available dissolved oxygen levels diminish within Boston Harbor and cause a corresponding depression in biological activity at the sediment water interface (August Effect). This oxygen depletion contributes to a significant faunal depletion on a cyclic basis (Hubbard and Bellmer 1989). Salinity data collected in April 1993 ranged from 16.8-28.9 % at low tide, indicating the influence of freshwater inputs to the Harbor. Little Mystic Channel flows directly into the Main Ship Channel, but the Mystic-Tobin bridge pilings slow currents and contribute to some sedimentation in the vicinity of the pilings.

#### AQUATIC RESOURCES

The intertidal habitats within the Mystic Channel vary and include, 1) vertical granite walls on the north and south side which contain approximately 80% *Fucus* sp. and a one-inch layer of barnacles; 2) sloping rip-rap embankment on the west side which is covered with *Fucus* sp. and green algae; 3) wooden bridge pilings on the eastern side which were covered with periwinkles (*Littorina* sp.), barnacles and green algae; 4) submerged logs and boat on the north side;

5) a metal bulkhead which was covered with *Fucus* sp., heavy barnacle settlement, and some mussels approximately 50 feet from the bridge; 6) a sandy/gravel beach on the south side which was sparsely covered with green algae; and 7) a rock ledge beach on the north side which was covered with *Fucus* sp.

## BENTHIC INFAUNA

Composition of the benthic infauna at the site is shown in Table A1-2. The four sampling locations may reflect the differences in substrate conditions, circulation and exposure. Station LMC-2, located in the vicinity of the sloping rip-rap embayment, was most diverse in terms of species composition. The total abundance of organisms was 27,907 individuals/$m^2$ at this station, a moderate level relative to other harbor areas sampled. Oligochaeta was the dominant taxon and had an abundance of 13,717/$m^2$. Station LMC-1 supported low abundance of two taxa, *Caulleriella* sp. (86/$m^2$) and *S. benedicti* (43/$m^2$) at extremely low levels compared to all the other sites for these taxa. Station LMC-3 supported a low abundance of 10 taxa, the most abundant being Nematoda and *S. benedicti*. Station LMC-4 had a low abundance of six taxa, the most abundant being Nematoda. The sediment samples collected at this site for benthic infauna observations were fine and grayish-black in color with a mild sulfur odor.

### Finfish

The dominant finfish species recorded in the Main Ship Channel include winter flounder (*P. americanus*), rainbow smelt (*O. mordax*), and alewife (*A. pseudoharengus*) (ACOE, NED 1988). There probably is movement of at least some of these species in and out of the Little Mystic Channel. Finfish could use the wooden bridge pilings, submerged logs and boat and *Fucus* sp. for shelter from predators during high tide. The predominant sandy/silt sediment present at this site provides suitable habitat for winter flounder. There is also a fair supply of *C. capitata* in part of the channel (1892/$m^2$ at Station LMC-2); these are consumed by winter flounder according to Haedrich and Haedrich (1974).

## WETLAND RESOURCES

Little Mystic Channel is located within the Mystic River DPA (310 CMR 10.00). The site is primarily Land Under the Ocean, under the State regulations, and is considered to be significant to marine fisheries, storm damage prevention and flood control. The vertical granite wall on the north and south side, together with the sloping rip-rap embayment on the west of the site, were all structures designed for storm damage prevention and flood control. Significance to marine fisheries is discussed above.

Anadromous fish are known to traverse the Main Ship Channel and there may be movement into the Little Mystic Channel. As described in the Aquatic Resources section, the Little Mystic Channel could provide both shelter from predators and feeding opportunities for several fish species. This site might also provide spawning habitat for anadromous species.

The entire site is classified as Tidal Waters under federal regulations. The fined-grained sediments results of the samples analyzed at Mystic Pier, which is in close proximity to Little Mystic Channel, indicate that this site has the potential for sediment/toxicant affinity and nutrient retention. Benthic infauna were moderately diverse in species composition at one station and showed low abundance at the other three stations sampled at this site.



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## WILDLIFE

Wildlife use in the Little Mystic Channel is expected to be similar to that described at the Mystic Pier site.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Little Mystic Channel.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources at the Little Mystic Channel site.

## SOCIO-ECONOMIC/LAND USE

This little-used channel in Charlestown is surrounded by a mixture of land uses including residential, recreational and maritime-industrial. The channel provides a visual buffer between the residences to the south and the marine terminal to the north. A public boat ramp is located on the north side of the channel. However, this ramp has not received the use anticipated when it was installed in the early 1970s. Demographic characteristics of this area are similar to those described at the Mystic Pier site.

Marine access to this site is constrained by the 12 foot vertical clearance under the Little Mystic Channel Crossing at the mouth of the channel. Landside access to this site is via Terminal Street from Moran Terminal.

### 2.3.5.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

Sediments in the Little Mystic Channel contain moderate to high levels of metal and organic compounds. PCBs, arsenic,lead and zinc were found at Category III. The dredged sediments placed at the disposal site would be stabilized by a retaining wall and a 3 foot cap of clean sediment. Final elevations would result in clean, shallow subtidal habitat. Given its present condition, partially filling it with silt material would not adversely affect the existing sediment quality. The degraded sediment quality, would be stabilized and improved by capping, reducing the likelihood of disseminating contaminants into the water column and of bioaccumulation.

## WATER QUALITY AND CIRCULATION

The Little Mystic Channel can be characterized as a low energy environment, thus making it more suitable for dredged material disposal and containment. The average current velocity at this site is approximately 0.5 knots. During disposal operations, suspended solids would be released into the Little Mystic Channel waters. Because of these potential impacts, use of a silt curtain or other mitigative methods at this site to contain most of the suspended sediment would likely be necessary to maintain water quality standards during construction.

Movement through the water column would expose and mix the sediment during its descent. About 5% of released material has been estimated to remain suspended in the water and transported outside the disposal site (Truitt 1988). The ADDAM's model (Appendix F) has been utilized to evaluate and predict suspended solid impacts at several of the candidate sites. Reference will be throughout this evaluation to specific site results as are relevant. The results for this project site indicated that those levels may be 3% or less (Appendix F).

Although most of the chemical constituents are tied up with the sediment, there would be some release of contaminants into the water column. Disposal activity will occur for approximately a 6- to 9-month period. Therefore, there would be localized impacts from the suspended solids and chemical concentrations on the water quality within the site. As mentioned above, silt curtains would be appropriate to contain these materials within the channel until construction is complete.

## AQUATIC RESOURCES

In the intertidal zone, there would be temporary reduction in *Fucus* sp., green algae, and barnacle production on the hard substrate (granite wall, riprap and bulkhead) present at the site. The small gravel/sandy beach on the south side of the site would be temporarily impacted.

### Benthic Infauna

Benthic invertebrates in the Little Mystic Channel would be buried during disposal operations. There would be a temporary loss of 15.0± acres of soft substrate. Dredged material placed at the site would quickly be re-colonized by *S. benedicti*, oligochaetes, and other common species occurring in the harbor sediments. In the Little Mystic Channel, *S. benedicti* and oligochaetes were found to range from 0-13717/$m^2$ and 43-2709/$m^2$ respectively in the 1993 benthic analysis. Recolonization should result in a benthic community similar to that presently existing in the Little Mystic Channel subtidal areas. However, since the cap material would be clean, a more diverse population could occur.

Siltation caused by disposal operations would probably have some short-term adverse impacts on invertebrates occurring in the immediate adjacent areas. However because of the recruitment potential, no long-term adverse impacts on invertebrate communities in the shallow subtidal area of the Little Mystic Channel are expected; in fact some improvement could occur.

### Finfish

Some mortality of juvenile and adult fish could occur during disposal events due to burial or exposure to high suspended sediment levels. The dominant finfish species in the Main Ship Channel are winter flounder (*P. americanus*), rainbow smelt (*O. mordax*), and alewife (*A. pseudoharengus*). There probably is some movement of these species into the Little Mystic Channel. Impacts will be limited to the immediate vicinity of the disposal site. Disposal of dredged material would temporarily reduce prey available to species that feed primarily on benthic invertebrates, such as winter flounder. Since the predominant sandy/silt sediment present in the Little Mystic Channel may provide suitable habitat for winter flounder, restriction of work and disposal activities to between June and February could help minimize impacts to spring migratory and/or spawning activities. There would be a temporary loss of finfish refuge until the construction is complete; foraging habitat should return when recolonization of benthic fauna occurs (within a year or so).

## WETLAND RESOURCES

There would be a short-term impact on 15.0± acres of Land Under the Ocean also classified as Tidal Waters at this site. The site would be restored after construction and maintained as a shallow subtidal area. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.



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## WILDLIFE

Disposal of dredged material in Little Mystic Channel should have no adverse long-term impacts on wildlife populations (e.g., birds) occurring near the disposal site. However, there would be a temporary loss of foraging habitat for some species (e.g., diving ducks).

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of Little Mystic Channel.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would have no effect upon any structure or site of historical, architectural or archeological significance as defined by MHC the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 170 to 224 barge trips to the Mystic Pier. This would result in some minor delays to commercial and recreational boat traffic using the harbor which would be controlled by the Coast Guard. Approximately 11,700 to 15,200 truck trips (assuming 20 cy per truck) would be involved in transporting the dredged material from the Mystic Pier to the Little Mystic Channel. There would be some impact of noise and traffic from these truck trips. Construction activities would have some aesthetic impact, and result in slightly elevated noise levels. Given the industrial nature of this site, however, these impacts should not be notably adverse.

While the most direct effect of partial filling of the channel would seem to be compromising the boat dock facility, this is not the case because the dock has not been used for its intended purpose. Partial filling of the channel would not permanently change the water view which residents of the Charles Newtowne housing complex currently enjoy. The residences and the recreational facility would be sensitive receptors with the greatest potential for effects from the disposal activity; but, such activities would only be temporary.

## 2.3.6 Reserved Channel

The site is depicted on Figure A1-14. Two areas in the Reserved Channel are being evaluated as candidate sites for disposal, Areas A and B, respectively.

Area A—This area is located at the mouth of the inlet on the inner side of the bridge (away from open water). It is approximately 8.9 acres in size with water depths ranging from 6 to 12 feet. A floating dock and the yacht club are located in this portion of the site. The passage under the Summer Street Bridge is 40 feet in width. Northwest of the bridge is a vertical granite wall approximately 50 feet in length. Continuing west-northwest, the granite wall is replaced by a metal bulkhead. On the far northwestern end of the bulkhead are some abandoned wood pilings and an old floating dock. On the southwestern side of the site from the bridge is a sloping rip-rap embankment for approximately 50 feet. From this rip-rap toward the neck are discarded concrete slabs and trash material. West of the trash material are wooden pilings and behind the pilings is a vertical granite wall.

Area B—This portion of the site extends from the neck on the northwest toward the tip of the peninsula. It is approximately 7.7 acres in size with water depths ranging from 0 to 16 feet. A steel bulkhead extends for approximately 75 feet. Continuing along the western tip and along the southwestern side of the inlet is a sloping rip-rap embankment. Between the bulkhead and the rip-rap is a pile of rubble. On the southwestern side toward the neck the rip-rap is replaced by a granite wall, which is fronted by a rocky beach. In front of the rocky beach are one or two sunken boats and some abandoned pilings. In the middle of the tidal area is a floating lobster pot dock.

### 2.3.6.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

Benthic samples collected at the Reserved Channel contained odorless, gray-black clay/silt sediment. No chemical analyses were per formed on these sediments, but Station 3 of the Boston Edison Intake was located approximately 1000 feet from the Reserved Channel Area B (see Section 2.2 of the EIS). This station had a 66.2% silt-clay component (Category II) and indicated PCB and PAH levels at Category III. Fluoranthene, ideno(1,2,3-cd)pyrene, and pyrene contributed more than 50% to the total PAHs concentrations. Cadmium, Lead, and Nickel were found at Category II at this station. Total organic carbon was 13%, the second-highest value of all the sites analyzed for TOC. This indicates that the potential for bioaccumulation at the Reserved Channel Area B is lower than other sites in the Boston Harbor. The total petroleum hydrocarbon at this station was 4270 ppm.

The ACOE conducted chemical sampling during 1986 at four stations (A, B, C, and D) in the Reserved Channel. Station A was located in the western end of the Reserved Channel close to Area B. At Station A a 18-23 cm core section was analyzed. It had a 18.2 cm layer of black organic clay. This upper organic clay consisted of 93% fine grain material with a moderate chemical oxygen demand (79,000 ppm). Lead was the only chemical constituent present at Category III concentrations (221 ppm). Mercury (1.48 ppm), zinc (264 ppm), chromium (186 ppm), and nickel (58 ppm) were detected at Category II.

PCB samples were collected at 8 stations by Boston Survey Consultants in November 1982, from the Reserved Channel west of Summer Street Bridge within Area A (MADEP-Boston Files, 1983). PCB concentrations at all eight stations occurred at Category III and ranged from 1.0-34.5 ppm.

## WATER QUALITY AND CIRCULATION

The water quality of the Reserved Channel is influenced by the three combined sewerage overflows (CSO) observed approximately 700 feet northwest of Pappas Street, at Summer Street, and at I street. These CSOs can add urban runoff pollutants (e.g., PAHs, nutrients, detergents, bacteria, etc.) into the Channel. Boston Edison has a NPDES discharge pipe in the vicinity of Summer Street; the NPDES permit limits the thermal influence on surface waters in the Reserved Channel.

The Reserved Channel flows directly into the Main Ship Channel. The Summer Street bridge pilings slow and deflect currents and contribute to some sedimentation in the vicinity of the pilings.

The Reserved Channel is classified as SC Water by the MADEP. Such waters are saline and suitable for aesthetic enjoyment, recreational boating, industrial cooling, as habitat for indigenous wildlife, and forage for game fish. In both Areas A and B, dissolved oxygen readings collected in April ranged from 8.4-8.7 ppm and 6.8-8.9 ppm respectively. As temperatures peak in August in Boston Harbor, available dissolved oxygen levels can diminish and cause a corresponding depression in biological activity at the sediment water interface (August Effect). This oxygen depletion contributes to a significant faunal depletion on a cyclic basis (Hubbard and Bellmer 1989). Salinity data collected in April 1993, ranged from 27.0-31.2 ppt at Area A and 23.4-33.4 ppt at Area B during low tide, indicating the influence of freshwater inputs to the Harbor.

## AQUATIC RESOURCES

The intertidal habitats within the Reserved Channel include:

Area A:- Wooden bridge pilings and a floating yacht club dock which were sparsely covered with green algae. A vertical granite wall on the northwest side of Summer Street which was covered with approximately 20% of algae. A metal bulkhead on the northwest side which was covered with green algae and barnacles. Sloping rip-rap embankment on the southwest side which was covered with *Fucus* sp., barnacles, *Littornia* sp., and green algae. Some concrete slab and trash material was present which had no visible growth; there were some abandoned wooden pilings and an old floating dock on the far northwestern side.

Area B:- A steel bulkhead on the northwest side which was approximately 90% covered with barnacles. A sloping rip-rap embankment on the western tip and southwestern side which was moderately covered with *Fucus* sp., *Enteromorpha* (tubular green algae), and other green algae. A granite wall on southwestern side towards the narrow neck which had moderate growth of *Fucus* sp., *Ulva* sp., and barnacles. A rocky beach in front of the granite wall was sparsely covered with *Littornia* sp., *Fucus* sp., and green algae. There were also sunken boats, abandoned pilings and a floating lobster dock present.

### Benthic Infauna

The composition of the benthic infauna is shown in Table A1-2. The four sampling locations may reflect the differences in substrate conditions, circulation and exposure. Stations RC-1 and RC-2 were located in Area A and RC-3 and RC-4 located in Area B.

Area A:- Station RC-2 was located in the vicinity of the Granite wall on the southwestern side of Area A, had the most diversified species composition. Oligochacta and *S. benedicti* was the two most abundant taxa (15,480/$m^2$ and 1548/$m^2$, respectively) of all the sites sampled. The total abundance was 21,156/$m^2$ at Station RC-2 which was moderate relative to other areas sampled.

Station RC-1 supported low abundance of seven species, the most abundant being Oligochaeta (2451/$m^2$). Oligochaetes were was moderately abundant at this site compared with all the other sites. The total abundance was 3,096/$m^2$ at Station RC-2, and was low relative to other areas sampled.

Area B:- Station RC-3, located in the vicinity of the lobster dock, supported very low abundance of four taxa, the most abundant being *S. benedicti* (215/$m^2$). At Station RC-4 Oligochaeta (26,574/$m^2$), *Corophium insidiosum* (2580/$m^2$), and Nematoda (16,641/$m^2$) were the most abundant taxa. The first two taxa reached their maximum abundance at this site of all the sites sampled. The total abundance at Station RC-4 was 49,837/$m^2$, fairly high relative to the other areas sampled.

The sediment samples collected at this site for benthic infauna observations were odorless, clay/silt, and grayish black in color.

Finfish

The dominant finfish species in the Main Ship Channel are flounder (*P. americanus*), rainbow smelt (*O. mordax*), and alewife (*A. pseudoharengus*). There may be movement of these species into the Reserved Channel. Finfish may use the wooden bridge pilings, floating dock, and *Fucus* sp. for shelter from predators during high tide. The Reserved Channel may provide spawning habitat for winter flounder, although it lacks the preferred substrate.

## WETLAND RESOURCES

Areas A and B of the Reserved Channel are not located within a Designated Port Area (310 CMR 10.00). The site is primarily Land Under the Ocean under Massachusetts Wetlands Protection regulations (310 CMR 10.00); this classification is considered to be significant to the protection of marine fisheries, which are discussed above. Nearshore areas of Land Under the Ocean such as Areas A and B are likely to be significant to storm damage prevention and flood control. The vertical granite wall and bulkhead, together with the sloping rip-rap embankment at the site, were all structures designed for storm damage prevention and flood control. Nearshore areas of Land Under the Ocean also provide important food for birds; for example, waterfowl can feed on the algae. The sloping rip-rap embankment and the rocky beach (Coastal Beach) at this site were covered with algae.

The entire site is classified as Tidal Waters under federal regulations. The fined-grained sediment and chemical levels in the samples analyzed show that this site has had an affinity for toxicant and nutrient retention. Benthic infauna were moderately diverse in species composition at two stations and showed low abundances and species richness at the other two stations sampled at this site.

## WILDLIFE

Wildlife use at the Reserved Channel is expected to be similar to that described for Mystic Piers (Section 2.3.1.1 of this evaluation).

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of the Reserved Channel.



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## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources at the Reserved Channel site.

## SOCIO-ECONOMIC/LAND USE

This channel is generally surrounded by industrial and office uses in South Boston. There is a sewer outfall at the southerly end of the Channel which would require relocation if this area were to be filled. There is a yacht club immediately adjacent to the Summer Street Bridge, and a passive water viewing area has been created for the general public to use on the west side of the channel. This viewing area is not 6(f) land because it was not purchased or improved with funds from the Land and Water Conservation Act (16 USC 460). As noted earlier there is a floating lobster pot dock in the middle of Area B; the extent of its use is not known.

While the South Boston peninsula was settled early in Boston's history, much of the land area between the subject site and Boston Harbor was created by filling the tidal flats. The filled land supported maritime shipping and railroad terminal uses. The area to the south of the channel has traditionally been a densely populated, predominantly residential neighborhood. The population of South Boston is 29,464 of which 96% is white. The median family income in the subject area is $34,200.

Marine access to this site is restricted by the vertical clearance on the Summer Street Bridge over the Channel. That clearance is only 6 feet at high tide. The most direct landside access would be I-93 south to Summer Street and then east to the Reserved Channel.

### 2.3.6.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

Samples collected in close proximity to Area B (the only samples for this area) indicated that lead was the only chemical present at Category III concentrations; mercury, zinc, chromium and nickel were detected at Category II levels by ACOE in 1986. The silt sediments placed at the disposal sites would be sealed with a 3-foot cap of clean sediment; final elevations would create shallow subtidal habitat at Areas A and B. Thus, the existing poor sediment quality would be isolated and improved by capping, preventing the dissemination of contaminants into the water column and of bioaccumulation. Benefits from this alternative include holding the silt material within the channel, and reducing the amount of silt exposed to biological resources within the harbor.

## WATER QUALITY AND CIRCULATION

Areas A and B of the Reserved Channel can be characterized as low energy environments suitable for dredged material disposal and containment. During disposal operations, suspended solids would be released into the Reserved Channel waters. As a result, there would be localized and temporary increases in suspended solids concentrations in the water column in this area. The use of a silt curtain and other mitigative measures would be necessary to contain most of these suspended sediments until construction is complete. Because of the open end of the channel at the outer perimeter of Area A, more extensive engineering controls may be necessary to keep water quality levels at acceptable levels in the outer Reserved Channel and the Main Ship Channel during construction. Temporary isolation of the disposal area may be necessary, if feasible.

## AQUATIC RESOURCES

Area A - There would be a temporary reduction in green algae, barnacles, *Fucus* sp., barnacles and *Littorina* sp. production on the hard substrate (wooden bridge pilings, vertical granite wall, metal bulkhead, sloping rip-rap, and concrete slab) in the intertidal zone.

Area B - In the intertidal zone there would be temporary reduction in *Fucus* sp., green algae, and barnacle production on the hard substrate (steel bulkhead, rip-rap, and granite wall) present at the site. The small rocky beach in front of the granite wall on the southwestern side of the site would be temporarily impacted.

### Benthic Infauna

Area A - Benthic invertebrates in Area A of the Reserved Channel would be buried during disposal operations. There would be a temporary loss of 8.94± acres of soft substrate. Dredged material placed at the site should quickly be colonized by *S. benedicti*, oligochaetes, and other common species occurring in the adjacent harbor sediments. Area A had the most diverse species composition of all the sites sampled, with oligochaetes found to be the most abundant taxon (15,480/$m^2$).

Area B - Benthic invertebrates in Area B of the Reserved Channel would be buried during disposal operations. This area supported low to moderate abundances of taxa including *S. benedicti*, Oligochaeta, and Nematoda. There would be a permanent loss of 7.66 acres of subtidal substrate. However, with tidal flushing, intertidal benthos would become established.

Siltation caused by disposal operations would probably have some short-term adverse impacts on invertebrates occurring in adjacent subtidal and intertidal areas. However, no long-term adverse impacts on invertebrate communities in the shallow subtidal area of Area A in the Reserved Channel are expected; the area should recolonize to a similar or better habitat. Subtidal habitat in Area B will be lost and replaced with saltmarsh. Thus, a resource with different species composition and different functions and values would result; this habitat would be of high value in Boston Harbor.

### Finfish

Some displacement and/or mortality of juvenile and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. The dominant finfish species in the Main Ship Channel are flounder (*P. americanus*), rainbow smelt (*O. mordax*), and alewife (*A. pseudoharengus*). There probably is movement of at least winter flounder into the Reserved Channel. Impacts should be limited to the immediate vicinity of the disposal site. Disposal of dredged material in Area A, which would remain subtidal would reduce prey available to species which feed primarily on benthic invertebrates, such as winter flounder, at least until recolonization occurs (estimated at a year or so). In Area B, which would be replaced with salt marsh, there would be permanent loss of finfish refuge and foraging habitat. Salt marsh habitat may provide temporary refuge and forage habitat during high tides.

## WETLAND RESOURCES

Area A - There would be a short-term impact on 8.94± acres of Land Under the Ocean (and Tidal Waters) at this site. The site would be maintained as a shallow subtidal area after construction.

Area B - There would be a permanent loss of 7.66± acres of Land Under the Ocean and Tidal Waters. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above. Converting Area B



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into a salt marsh would provide 7.66± acres of valuable out-of-kind wetland resource replacement.

## WILDLIFE

Disposal of dredged material in Areas A and B should have no long-term adverse impact on wildlife populations (e.g., birds) occurring near the disposal site. Temporary displacement impacts would occur during construction while the site is disturbed. Converting Area B into a salt marsh would provide new habitat for various wildlife species.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of Areas A and B.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 25 barge trips to the North Jetty for Area A and 110 for Area B. This would result in some minor delays to commercial and recreational boat traffic using the harbor. A total of 1,800 truck trips would be involved in transporting the dredged material from the North Jetty to Area A, and 8,000 to Area B. There would be some impact of noise and traffic from these truck trips. Construction activities would have some aesthetic impact, and result in elevated noise levels.

The impacts of disposal at this location should be limited to water dependent uses in the Channel. The value of surrounding industrial land is already affected by high PCB levels in the Channel, and the engineered placement of sediments should have a positive benefit by isolating these sediment from biological resources. The sewer outfall would require relocation. Depending on the extent of fill material placed in this portion of the channel, the yacht club operation may be affected. Construction may have to be timed to avoid the period of maximum dock usage (summer). The yacht club boats could have a draft problem if fill material is not carefully placed and avoided in certain areas. If any fill is placed in the yacht club area, it would prohibit future dredging of that area and/or any future expansion of the dock areas.

The Summer Street Bridge poses a major constraint to access to the site by water. Because of the 6-ft vertical clearance, access must be timed to accommodate the tide. Access over land using Summer Street will send truckers through the congested Dewey Square area of Downtown Boston. Further, South Boston residents object to the use of Summer Street as a regular truck route. A more circuitous route might be required to reach this destination over land.

## 2.4 SITE EVALUATIONS: IN-CHANNEL AREAS AND BORROW PITS

### 2.4.1 In-Channel Areas

#### 2.4.1.1 Existing Conditions

The In-Channel disposal scenario is simply the placement and capping of dredged material within the channel/tributary from which it had been dredged.

Silt and sedimentation would be dredged from each channel, placed on a barge, a deeper trench would then be dug in the channel, and the silt and sediment placed within the trench and capped. The proposed use and methods are described in more detail in Section 3.0 of the EIR/S. Each channel/tributary would contain its own silt material and be capped therein. As the environmental resources and consequences for this disposal alternative are the same as for the dredging site, the existing conditions of the water and sediment quality, biological and socio-economic environment in each site are described in the Section 3.0 of the EIR/S.

#### 2.4.1.2 Environmental Consequences

General site conditions would be the same as described for each channel/tributary; the end result is still each channel dredged to the proposed full project depth. However, the channel bottom would consist of a cap under which would lie the silt material.

The proposed disposal sites occur in tributaries currently used by ship traffic. Coordination (by the Coast Guard) between ships needing to use the tributary and disposal activities (including dredging and barge storage of the silt) would need to occur to minimize interference with shipping traffic. The cap would be of sufficient thickness to sustain disturbance from ships and storms.

The sediment characteristics of parent material with the channels have been described in Section 2.2; bulk sediment analysis indicated that no parameter exceeded Category I limits. The remaining parent material (after capping) would be disposed at the MBDS or other suitable site. Since the channels are already filled with the silt material, returning it to its place of origin and capping it would provide an environmental benefit by isolating the material more or less in-place. The substrate surface would change from a silty material to a clay and/or gravel material. The benthic community may change slightly but should be healthier as the chemicals of concern would no longer be available to the biological community. No federally or state-listed threatened or endangered species have been identified to occur in the channel and tributaries, so adverse impacts are not expected.

This disposal alternative would have no effect upon any structure of historic or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.



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### 2.4.2 Spectacle Island Confined Aquatic Disposal (CAD)

The site is depicted on Figure A1-15 herein.

#### 2.4.2.1 Existing Conditions

## SEDIMENT CHARACTERISTICS

The CA/T project examined sediments in and near this area with ponar grabs and borings to characterize the surficial material and underlying sediments (Cortell 1990b) (Table A1-3). Surface sediments tended to form broad areas of uniform grain size. Fine sand (with some silt) predominated in a 500-foot band following the northeastern shoreline to about mid-island, 300 feet beyond MLW and recurred beyond the mussel bed several hundred feet further south. From mid-island and beyond the southern sand band, sediments were primarily silty, with some clay. Seaward of these areas, surface sediments were clay with some silt (Cortell 1990b).

Bulk sediment analysis of borings indicated that surface and near surface sediments offshore of the eastern shoreline of Spectacle Island were generally free of contaminants (Cortell 1990b). Three of the five borings (ST1-7, ST1-9, ST1-11; Table A1-3) in the area proposed were classified as Category I under the Massachusetts criteria for the classification of dredged materials, although volatile solids at ST1-11 were within the Category II range (7-9 ppm) (Table A1-3). Elevated levels of arsenic, a naturally occurring metal in New England soils, caused surface sediments at ST1-8 and ST1-12 to be classified as Category II (12-20 ppm); subsurface concentration of arsenic resulted in Category III ( > 20 ppm) classification of sediments below one foot at ST1-8 (Appendix C-1; Table 2 of the Sampling Plan). Because of these findings, the proposed disposal location has been designed to involve only those areas where Category I sediments were recorded (see Figure A1-15).

## WATER QUALITY AND CIRCULATION

The hydrodynamics around Spectacle Island were examined for the CA/T (Cortell 1990b). Circulation is dominated by tidal currents, affected by the distribution of islands and channels in the Outer Harbor. Ebb tide currents passing the east side of Spectacle Island can reach 0.6 knots on spring tides, while spring flood tides reach 0.4 knots. The broad shallow subtidal area off the eastern shore diverts currents toward the channels (President Roads to the north; Sculpin Ledge to the southeast). The area proposed for the CAD is subjected to lower tidal currents created by eddies. Waves in the vicinity of Spectacle Island are primarily storm driven. The maximum fetch for Spectacle Island is 7.1± nautical miles. Wave energy for the area was calculated for the Massport Logan Inclined Safety Area (ISA) EIR for storms with wind velocities from 10 to 50 knots. The wave breaker height near Spectacle Island ranged from 0.09 to 2.60 feet with wave powers of 0.1 to 412.9 ft-lb/sec.

The waters in the vicinity of Spectacle Island have been classified as Class SB waters. This classification protects saline waters for the propagation of marine life, primary and secondary contact recreation and shellfish harvesting with depuration. Water quality in the outer harbor area historically has been influenced by raw sewage discharges, CSO's, various industrial discharges, urban runoff and the pollutants flowing from the inner harbor system. However, as upgrades to treatment processes are completed, water quality in the harbor has, and will continue to improve.

## AQUATIC RESOURCES

### Benthic Infauna

Benthic resources east of Spectacle Island were examined for the CA/T project (Stations 6, 7, 9, 10; Cortell 1990b). Comparison of stations (through

cluster analysis) indicates that these stations were similar in terms of species structure (Battelle 1988). The faunal community was dominated by the tube dwelling amphipod *Ampelisca abdita* (37%) and the gastropod *Nassarius trivittatus* (20%), reflecting relatively clean, sandy sediments. Nephtyid polychaetes (*Nephtys caeca* and *N. ciliata*) were also numerically important at these stations. Total abundance (ranging from 653-3107/$m^2$) was low compared to other sandy areas (Massachusetts Bay) and silty areas of the Inner Harbor (up to 241,230/$m^2$). Station 10, off the northeast shoreline of Spectacle Island, had the highest abundance and number of taxa of the 11 stations sampled around the island. Larger fauna were evaluated qualitatively along transects swum for lobster investigations (Transects 3 and 4 reached the shoreward portions of the proposed CAD site; Cortell 1990). In addition to *Nassarius* sp. and *Ampelisca* sp. the offshore portions of these transects supported nereid worms (sand worms), *Pagurus* sp. (hermit crabs), *Panopeus* sp. (mud crabs) and *Cancer irroratus* (rock crabs).

The purpose of the lobster transects was to quantify lobster use of the area and evaluate the substrate for use or potential use by early benthic phase lobsters, considered to be a vulnerable stage for this species because of limited habitat availability (Wahle and Steneck 1991). CA/T transects 1 (southernmost), 2, 3, 4 and 5 (northernmost) were located along the east side of Spectacle Island (Cortell 1990); transects 3 and 4 were within the area proposed for the CAD. Free-living lobsters were most abundant off the north shore of Spectacle Island (Transect 5 yielded 0.0027/$ft^2$; Transect 6 yielded 0.0035/$ft^2$); Transect 3 yielded the third highest abundance (0.0022/$ft^2$). Abundances along Transects 1, 2 and 4 were low (0.0003-0.0004/$ft^2$). These average abundances, however, do not account for the fact that lobsters were concentrated towards the deeper end of all transects except Transect 3. Lobster pot markers were present in the proposed site during all three surveys in 1990. Pot markers tended to be most heavily concentrated off the northern shoreline of the island and farther east of the island in Sculpin Ledge Channel (Cortell 1990a).

During a lobster monitoring program run from early May to early July, 1992 in the Harbor, Cortell (1992) reported that an average of five lobsters (average catch per 3-day haul, all size classes) per trap were collected at a station just to the north of Spectacle Island, the southern side of the ship channel. This catch was typical of several other stations in this study. Other trawl sampling indicated that abundances were generally lower at a site (closest to Spectacle Island) just north of the Ship Channel in President Roads, compared with four other stations in the channel area. Lobstermen do fish this area along the edge of the channel between Spectacle and Long Island.

No early benthic phase (EBP) lobsters were found in samples collected along lobster transects. The preferred cobble substrate (Wahle and Steneck 1991) was common only along the nearshore portions of Transects 1 and 5. Mussel beds may also enhance substrate suitability (Wahle and Steneck 1991). Mussel beds occurred along the nearshore portions of Transects 2, 4 and 5. It was speculated that the anoxic sediments underlying these mussels would preclude use by EBP lobsters (Cortell 1990b). The borings collected offshore of these transects indicated that sediments were fine-grained, unsuitable for EBP lobsters (Cortell 1990b).

**Finfish**

Based on the on-going development of the artificial reef design, as required by the Individual Permit—Landfill Closure and Maintenance at Spectacle Island for CA/T (ACOE no. 199202207; 2/16/93), target fish species in the Spectacle Island area include forage species such as Atlantic menhaden, Atlantic herring and rainbow smelt, and predator species such as winter flounder, striped bass, bluefish, pollock, Atlantic cod, tautog and cunner. The northeastern



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half of Sculpin Ledge Channel is the recommended location for the proposed terrace reef (NAI 1993).

## WETLAND RESOURCES

The Spectacle Island CAD location is considered Land Under the Ocean under the Massachusetts Wetland Protection Act (310 CMR 10.00) and Tidal Waters under the Federal Clean Water Act (40 CFR 230). As Land Under the Ocean, the site is considered to be significant to the protection of marine fisheries, protection of land containing shellfish, storm damage prevention, flood control and protection of wildlife habitat. This area has been demonstrated to provide habitat for free-living, but not early benthic phase, lobsters and juvenile rock crabs (Cortell 1990b). Active use of the area by finfish has not been examined but is likely to occur to some degree for feeding (although benthic fauna is sparse) and passage. Waterfowl may feed in this area. Portions of the nearshore area of Spectacle Island are classified as Land Containing Shellfish (mussels). The proposed subtidal location of Spectacle Island CAD, intercepts the tidal currents from the channels, reducing their intensity. This increases deposition offshore from the shellfish beds, protecting them from excess siltation. Shoreline erosion is reduced by the reduction in currents. Storm energy is dissipated by the shallow subtidal expanse east of the island. Because this is an open water area, however, the shore east of Spectacle Island provides little flood control.

Classified as Tidal Waters under federal regulations, Spectacle Island CAD was evaluated for its ability to provide the functions of sediment/toxicant retention, nutrient retention/transformation, recreation and uniqueness/heritage. Sediment sampling at this site revealed only low levels of chemicals and low-to-moderate levels of fine-grained sediments. However, reduced currents provide Spectacle Island CAD with greater potential for performing the functions of sediment/toxicant retention and nutrient retention/transformation than the adjacent channel areas. It is likely that recreational boaters with shallow-draft vessels cross this area. Human use of the island will increase once park development is underway.

## WILDLIFE

Waterfowl, including great cormorant (*Phalacrocorax carbo*), herring gull (*Larus argentatus*), white winged scoter (*Melanitta deglandi*), common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), mallard (*Anas platyrhynchos*), black duck (*Anas rubripes*), merganser (*Mergus* spp.) and scaup (*Aythya* spp.) have been observed in the vicinity of Spectacle Island (Cortell 1990a). Each of these species feed on fish and invertebrates (Martin et al. 1951; Whitlatch 1982; DeGraaf and Rudis 1986) that occur in the area proposed for Spectacle Island CAD.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the immediate vicinity of Spectacle Island CAD. Common terns have nested on a dilapidated pier on the northwestern end of Long Island, approximately 0.6 miles away, across Sculpin Ledge Channel. All marine mammals are protected under the Federal Marine Mammals Protection Act. Harbor seals (*Phoca vitulina*), harbor porpoises (*Phocena phocena*) and grampuses (*Grampus griseus*) occur occasionally in the harbor. None of these species are listed as threatened or endangered. There are no natural occurrences of exposed ledge that would be suitable as seal haul-outs in the vicinity of Spectacle Island CAD.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources at the Spectacle Island CAD site.

## SOCIO-ECONOMIC/LAND USE

Activities at the subtidal area east of Spectacle Island would be visible from Spectacle Island, Long Island, and Deer Island as well as from vessels using Sculpin Ledge Channel and President Roads. Currently public access to Spectacle Island and Long Island is limited although park development on Spectacle Island is expected to begin in 1995. Vessels using President Roads are predominated by commercial ships, whereas Sculpin Ledge Channel is actively used by fishing vessels and pleasure boats.

This location is currently used only by fishermen and recreational boaters. The site is less than 1000 ft. from the proposed dike which the Massachusetts Highway Department intends to construct as part of its closure of the abandoned landfill at Spectacle Island.

### 2.4.2.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

Bulk sediment analysis of borings at Spectacle Island indicates that surface and near surface sediments offshore of the eastern shoreline of Spectacle Island were generally low in contaminant levels (Cortell 1990a). The dredged sediments placed at the disposal site would be stabilized by a 3-foot cap of clean sediment which would render surface sediment quality in the disposal site cleaner than existing conditions. The cap eventually will be buried by fine sediments deposited by natural processes. Contaminated dredged material placed in open-water disposal sites may be chemically and/or biologically isolated by capping with clean dredged material (Truitt 1985).

The cap and the dredged sediments would be confined within the walls of the pit below the level of the harbor floor. Therefore in the long term, a deposit in a capped pit would be less likely to release contaminants because it is not in direct contact with the water column. Even more important, because of this site's location in an area of active deposition, it is less likely that its contaminant-laden sediments could be lost through natural erosion (current action) or extraordinary storm events. Therefore, the site vulnerability to storms should be negligible because of the added protection of greater depth of the pit and the pit walls (Bokuniewicz et al. 1981).

There should be no significant impact on the sediment quality in the vicinity of Spectacle CAD site as a result of the disposal of the dredged material at the borrow pit.

## WATER QUALITY AND CIRCULATION

In the vicinity of the Spectacle Island, circulation is dominated by tidal currents. The ebb tide currents flowing on the east side of the island range from 0.4-0.6 knots. During the course of the new pit construction, it is anticipated that turbidity levels in and around the immediate construction area would be increased by the dredging. The turbidity plume so generated would be restricted to a very limited area in the vicinity of the dredge, with 95-99% of the suspension material settling within a few yards (Schubel et al. 1978). It is unlikely that the construction process would increase sedimentation in the vicinity as the material would be mostly sand, and the new hole itself would serve as a sink for suspended materials. In addition, an environmental bucket may be used during this process.

During the disposal operations in open water, suspended solids would be released into the sur-

rounding waters. The dredged material would be released from a barge above the borrow pit. It would descend through the water column as a dense mass. During this descent anywhere from 1 to 5% of the dredged material may be lost to the water column (WES 1986). Movement through the water column would expose and mix the sediment during its descent. As a result, there would be localized and temporary increases in suspended solid concentrations in the water column.

The ADDAM'S model (Johnson 1990; see Appendix F) was used to examine the spatial extent of potential water quality impacts from disposal at this CAD site. Since currents in the adjacent Sculpin Ledge Channel appear to run 0.4 and 0.6 kn during maximum flood and ebb tides (Cortell, 1990a), respectively, these were used in the model; however, since the CAD site is in an eddy area, a lower current regime was run as well (Table A1-4). An important point to remember, however, is that the model simulation is for level bottom; in reality, the disposal would be into a borrow pit approximately twice as deep as the overlying water depth at MLW. This physical restriction will help contain settling sediments and associated silt plumes. With this in mind, the result in Table A1-4 may be worst case. These results estimate that the silt cloud (at a depth of 6 ft and approximately 1990 ft in diameter) from a single disposal event would be below the water quality criteria at a distance of approximately 9,000 ft (during maximum flood tide) and 13,000 ft (during maximum ebb tide) from the disposal site. At half this velocity, which is more typical of the CAD area, these distances would be half as far. Given the current directions within this area, silt clouds during ebb tide would flow into the Main Ship Channel and toward the mouth of the Harbor. During flood tides, they would flow southwest through Sculpin Ledge Channel toward the area east of Thompson Island. However, given the expected depth of the pit (20 feet) compared to the depth of the overlying water (9-11 ft at MLW) much of the silt should settle to within the confines of the hole before it is spread to the distances predicted by the ADDAM'S model.

Generally, the common methods of open water disposal do not alter the chemical properties of the dredged material, and therefore do not break the bonds that hold contaminants to sediment particles (Burns and Schubel 1983; Bokuniewicz et al. 1986). The binding of pollutants to sediment particles (particularly the fine-grained organic and/or clay components) tend to immobilize the contaminants and prevent their release to the water column (O'Connor and O'Connor 1983). As a result, any sediment that may remain suspended after the main deposit reaches the bottom would not likely release its bond contaminants to the water column. This is consistent with field studies at disposal sites in New York Harbor conducted by the Army Corps of Engineers-New York District; none have ever detected a significant increase in contaminant or nutrient level in the water at disposal sites (ACOE 1984; Bokuniewicz et al. 1986).

Even though the material is to be disposed within a constructed depression, the shallow nature of this site means that specific construction techniques (i.e., barge access channels, berms, etc.) may need to be applied to this site. It is also expected that mitigation techniques (specialized silt curtains, etc.) may need be applied to this construction site in order to control and contain silt and potential containment plumes during disposal.

## AQUATIC RESOURCES

### Benthic Infauna

The CA/T project found that the benthic faunal community in the area east of Spectacle Island was dominated by the tube-dwelling *Ampelisca abdita* (reflecting relatively clean, sandy sediments), and the gastropod *N. trivittatus* (Cortell 1990a). In digging the pit, the benthic community within the construc-

tion site would be completely lost. The digging would be a continual process for several months, and the subsequent disposal operations would occur for an additional period of 6-9 months. During this period, the site would be under a constant state of disturbance, precluding reestablishment of any benthic populations for that period. Upon completion, the site would be capped with parent material and sediment similar to that from the area, returning it to its former bathymetry. In this case it is reasonable to expect a quick recolonization to the previous benthic type as would occur after filling an existing hole. As construction and final capping should take approximately 1-2 years, the recolonization, of the complete community may not occur for 1 year following disturbance (McCall 1977). Recolonization of a Long Island dredged material disposal site following dredging occurred within 3 months (100 days) for *A. abdita* and *N. triviltatus* (Rhoads 1978).

The nature of the final benthic community will depend on the make-up of the cap. For this Project it is proposed that Boston blue clay be used as the cap, with existing substrate placed over the clay cap. Sediments will continue to be deposited by natural processes; therefore, it is reasonable to expect rapid recolonization of *S. benedicti* (one of the most opportunistic species), from the undisturbed areal populations a relatively short time frame (Cerrato and Scheir 1983). The new community would then be similar to the existing harbor benthos.

A portion of the blue mussel beds which extend into the southern and northern portions of the CAD would be affected. The mussel bed substrate could potentially provides a favorable bottom for habitation by early benthic phase (EBP) lobsters. However, a recent survey did not find any evidence of EBP lobsters in the CAD area or elsewhere around Spectacle Island (Cortell 1990a). Although free-living lobsters were observed during a diver transect study around Spectacle Island (Cortell Associates 1990a), neither nearshore nor offshore substrates provide ideal structural habitat for lobster (i.e., rock, boulder, cobble, kelp). During the construction of the CAD and disposal operations, lobsters in the immediate vicinity would be displaced until suitable food resources returned. These impacts would be restricted to the construction period (mining and disposal/capping operations).

Siltation caused by the pit construction and disposal operations would probably have some short-term adverse impacts on invertebrates occurring in adjacent subtidal and intertidal areas. Siltation should have no long-term or wide spread adverse impact on harbor invertebrate communities.

**Fish and Shellfish**

Disposal operations should have only minor, short-term effects on fisheries resources around Spectacle Island in the vicinity of the disposal site. Some mortality of juvenile and adult fish should occur during construction of the pit and disposal events due to burial or exposure to high suspended sediment levels and noise. Impacts would be limited to the immediate vicinity of the site. Pit construction and disposal of dredged material would temporarily reduce prey available to species which feed primarily on benthic invertebrates, such as winter flounder.

As mentioned earlier, lobstermen fish the area along the channel between Spectacle Island and Long Island. In addition, as part of the mitigation plan for the Spectacle Island Landfill closure, an artificial fish reef, covering approximately one acre, is being planned for Sculpin Ledge Channel between the proposed CAD site and Long Island, with construction currently to take place in 1995 (Paul Geoghegan, NAI, 1993, pers. comm.). Because of these adjacent resources, special mitigation measures may be necessary to minimize the size and extent of silt plumes during construction and disposal activities at this site. Because of prevailing tidal current directions in the area in relation to the above resources, the greatest caution may be necessary during ebb tides.



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## WETLAND RESOURCES

There would be a short-term impact of 20-70 acres of Land Under the Ocean and Tidal Waters. The site would be restored after construction. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Construction of the borrow pit and disposal of dredged material in the borrow pit would not have long-term adverse impacts on wildlife populations occurring near the disposal site.

## THREATENED AND ENDANGERED SPECIES

The proposed project would not impact species considered threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) or MANHESP.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological sites at or near the Spectacle Island CAD site.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 660 barge trips. This would require Coast Guard coordination of barges with the commercial and recreational boat traffic using the harbor. Construction activities would have a minor adverse aesthetic impact, and result in slightly elevated noise levels.

If the filling is restricted to the depth of the surrounding area, there will be no permanent impact on recreational boating. However, the placement of the material may necessitate temporary restrictions on recreational boating. Because this is a shallow subtidal area, dredging would be required. This will necessitate testing and a determination of the appropriate disposal location for the sediments removed from this site.

The Massachusetts Highway Department (MHD) is currently constructing a dike adjacent to this proposed disposal site for the purpose of containing and closing the landfill at Spectacle Island. Lack of impacts from dredging the CAD on the integrity of the dike structure will need to be demonstrated to the MHD as well as to the owners of Spectacle Island, the City of Boston and the Massachusetts Department of Environmental Management.

Part of the Spectacle Island Landfill Closure Plan also includes the installation of an artificial reef in the northeastern half of Sculpin Ledge Channel. Depending on the timing of the Project, the fill placement at the Spectacle Island CAD location may need to be coordinated with the construction and/or location of the fish reef to minimize interference and impacts. As mentioned above, if the fish reef is in place during the CAD construction/use, special mitigation measures may be necessary to prevent silt plume exposure to this facility.

### 2.4.3 Meisburger Sites 2 and 7

These sites are depicted on Figures A1-16 and A1-17.

#### 2.4.3.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

The sand and gravel deposits that characterize these sites were first described by Meisburger (1976) from sub-bottom data. The sites are in approximately 100 ft of water (80-110 range). Sand and gravel form much of these irregularly shaped deposits and a layer of medium sand (up to three feet thick) may cover some of these areas locally. Because these sites are within the nearfield study area of the proposed MWRA outfall, they have received recent detailed inspection (Shea et al. 1991, Butman et al. 1992 and Blake et al. 1993). A 4 x 5 nautical mile area around the proposed outfall was characterized in detail by Butman et al., (1992) and the most common sediment type in the area surveyed was coarse sand and gravel (42%). These deposits lay between gravel and boulder covered drumlins which comprised 23% of the study area. Fine-grain sediments (6%) and highly variable or patchy distribution of mud, sand and gravel (29%) made up the remainder of the cover. The areas described by Meisburger (1976) are predominately covered with sand and gravel although the boulder areas border some of the deposits in these areas. Results of other studies in this area (Blake et al. 1993; Shea et al. 1991) are generally consistent with the above findings although most of their data were collected from REMOTS images from representative data. Studies from this area point out that bottom sediments indicate higher energy areas in some locations while other areas appear to be depositional (silt, clay sediments), with sand underneath.

#### WATER QUALITY AND CIRCULATION

Again, because of the proximity of these site locations relative to the MWRA offshore outfall site, recent studies have focussed on this area and long-term monitoring of water quality and hydrography is planned (MWRA 1991). Although a 3-D hydrodynamic model of Massachusetts/Cape Cod Bays is still in development, intensive physical oceanographic surveys were conducted between April 1990 and June 1991 (Butman et al 1992). Some of this long-term monitoring is located immediately adjacent to the MWRA outfall at Buoy "B". While the report should be referenced for the details of initial findings, some relevant findings to this assessment include:

- There is an absence of well-defined current in this area, but water and particle transport takes place by a variety of actions, including tides, winds and river flow;
- Maximum tidal currents 1.0 m off bottom are in the range of 6-8 cm/s in this area (the mean is in the 2-4 cm/s range), compared with much faster currents (18-20+ cm/s) at the mouth of Boston Harbor and somewhat slower currents (4-6 cm/s) at the MBDS. Mean water currents at 5.0 m at this site are typically in the 4-7 cm/s range;
- Maximum re-suspension of fine-grain materials coincides with storm events that show a 2-4 fold increase in suspended material in the water column compared to background (i.e. non-storm periods) in the winter.

The waters in this area have been classified as Class SA. This classification protects the saline waters for the propagation of marine life, primary and secondary contact recreation and shellfish harvesting without depuration in approved areas.

## AQUATIC RESOURCES

### Benthic Infauna

Recent studies (Blake et al. 1993) have involved benthic sampling adjacent to Meisburger 2 in areas shown by Butman et al. (1992) to have a patchy distribution of mud, sand and gravel or a mud or fine sand cover. Although the five stations nearest the outfall in Blake's study had ≥90% sand and gravel, their sediments appear to be not quite characteristic of the coarse sand and gravel representative of the Meisburger 2 and 7 sites. Nevertheless, at these five stations infaunal benthic densities ranged from 15,600 to 100,100 per $m^2$ with the number of species running from 49 to 81 (samples were collected through a 0.3 mm sieve). The dominant species for these stations were typically an amphipod/polychaete combination (i.e, *Corophium crassicorne/Exogene hebes*) or a polychaete assemblage dominated by *Spio limicola, Polydora socialis*, and *Mediomastius californiensis*. The former species group was characteristic of the transitional area (composed of these five stations) between the soft bottom area and the hard substrate and thus may be more characteristic of the Meisburger sites; total densities of this station group (5 stations) averaged 20,492 individuals/$m^2$.

### Finfish

Trawl data provided by the MADMF (1991-92 Resource Assessment/Surveys, unpublished data) for a station two nautical miles west of the MWRA outfall indicated that three commercial finfish species (winter flounder, Atlantic cod and yellowtail) made up 40-60% (collectively) of the total catch (Table A1-5). The total catch (all fish) from two spring (May '91 and '92) collections were 655 (20 min. tow) and 685 (13 min. tow); a total of 17 and 60 lobsters were also collected from these same tows. Rock and Jonah crabs were found in small numbers. Total abundances of fish and lobster at this site were average to above average compared with 10 sampling events (in May and August 1991-92) distributed offshore from Nantasket Beach to the MBDS.

From a commercial fisheries perspective, these sites are within the area of greatest territorial harvest for coastal lobster fishery (unpublished data, MADMF 1991). For example, Area #4 (which extends from Lynn to Cohasset) accounted for 41.1% of the 11,000,500 pounds caught (on Coastal licenses) in Massachusetts territorial waters. Site-specific catch data for these disposal sites were not available.

## WETLAND RESOURCES

The Meisburger sites exist beyond the geographical and depth jurisdiction of the Massachusetts Wetlands Protection Act and Regulations (MGL c.131, s.40, and 310 CMR 10.00). These sites fall within the federal designation of tidal waters since they fall within the territorial sea of Boston Harbor, and the associated 3 mile limit of jurisdiction required for the discharge of dredged or fill material under Section 404 of the Clean Water Act.

## WILDLIFE

Approximately 35 species of marine mammals, 5 species of marine turtles and 40 species of seabirds occur within the Gulf of Maine. Aerial surveys were conducted for the ACOE to assess the use of the Massachusetts Bay Disposal Site (MBDS) by marine mammals, reptiles and seabirds (MBO 1987). The dominant species observed within the MBDS locale are typical of the offshore waters of Massachusetts (Meisburger and Boston Lightship sites).

Seabirds observed include northern fulmar (*Fulmanus glacialis*), shearwater (*Puffinus* sp.), storm petrels (Hydrobatrae), northern gaument (*Sila bacsaus*), Pomarine jaeger (*Steriovarius pomarinum*), gulls (Larinae) and Alcids (Alcidae). Dominant nonendangered mammals include minke whale

(*Belasnoptera acutorostrata*), white-sided dolphin (*Lagenorhynchus acutus*), and harbor porpoise (*Phocena phocena*). Although five species of turtles potentially could occur on Massachusetts Bay, only the leatherback turtle (*Dermochelys coriacea*) is typical in the area.

## THREATENED AND ENDANGERED SPECIES

The following threatened and endangered aquatic species can occur in the Western North Atlantic including parts of Massachusetts Bay (U.S. Department of the Interior 1991):

Cetaceans

right whale (*Eubalaena gracilis*) (Endangered)
humpback whale (*Megaptera novaeangliae*) (Endangered)
finback whale (*Balaenoptera physalus*) (Endangered)
sei whale (*B. borealis*) (Endangered)
sperm whale (*Physeter macrocephalus*) (Endangered)
blue whale (*B. musculus*) (Endangered)

Turtles

Kemp's ridley (*Lepidochelys kempi*) (Endangered)
leatherback (*Dermochaelys coreacea*) (Endangered)
hawksbill (*Eretmochelys imbricata*) (Endangered)
loggerhead (*Caretta coretta*) (Threatened)
green (*Chelonia mydas*) (Threatened)

Fish

shortnose sturgeon (*Acipenser brevirostrum*) (Endangered)

Studies have shown that the majority of local threatened and endangered whale sightings have been concentrated near the tip of Cape Cod in the northern and central areas of the Great South channel and north of Cape Cod along Stellwagen Bank and Jeffrey's Ledge (ADL 1992). The sightings offshore from Boston Harbor are typically concentrated eastward of the MBDS, within the newly designated Stellwagen Bank National Marine Sanctuary. The Meisburger sites are approximately half way between Boston Harbor and the MBDS and are not a reported area of concentration for these species. Whale watch cruises out of Boston Harbor do not attend these areas.

Of the five threatened or endangered turtles that could occur in this area, the leatherback, Kemp's ridley and the Loggerhead are the most regularly observed in Massachusetts and Cape Cod Bays. Of these species, the leatherback is the most frequently encountered, with the western North Atlantic estimated to support 16,000 individuals (Lazell 1980); however, it is primarily an oceanic species. The loggerhead may show the most common inshore occurrence, with 7,700 individuals estimated to be in north and middle Atlantic coastal water (CETAP 1982). The Kemp's ridley turtle would be the most rare, with the Atlantic population estimated to be less than 500 individuals (Carr and Mortimer 1980). There is nothing unique about the Meisburger 2 and 7 sites that would attract these species nor are we aware of any specific sightings for this area.

The shortnose sturgeon inhabits estuarine and freshwater areas along the eastern coast of the U.S. and Canada and would not be an inhabitant of these open water alternative disposal sites.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources on the Meisburger 2 and 7 sites.



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## SOCIO-ECONOMIC/LAND USE

The Meisburger 2 and 7 sites are located in an area used for recreational boating and for commercial fishing. The sites are easily reached by barge during fair weather conditions. The sites are within one mile of the Massachusetts Water Resources Authority's Ocean Outfall, currently scheduled for completion in 1995.

### 2.4.3.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

The proposed action at this site includes mining the existing sand and gravel at the preferred site and depositing the silt material in the resulting borrow pit.

The dredged sediments placed at the disposal site would then be stabilized by a 3-foot cap of parent sediment. Contaminated dredged material placed in open-water disposal sites may be chemically and/or biologically isolated by capping with clean dredged material (Truitt 1986). The cap eventually will be buried by sediments deposited by natural processes. The area available can fall within a 140±-acre area of seabed for Meisburger 2, and 106 to 403± for Meisburger 7.

The cap and the dredged sediments would be confined within the walls of the pit below the level of the harbor floor. Therefore in the long term, a deposit in a borrow pit would be less likely to release contaminants because it is not in direct contact with the water column. Even more important, because of its location under the seafloor, the borrow pit would be less likely to lose its chemical-laden sediments through natural erosion (current action) or extraordinary storm events. Therefore, the site's vulnerability to storms should be negligible because of the added protection because of greater depth and the pit walls (Bokuniewicz et al. 1981).

During development of the borrow pit some of the excavated material will be stored and replaced as a final cap layer, restoring the area to its original condition.

## WATER QUALITY AND CIRCULATION

During the course of the new pit construction (i.e., removal of the sand and gravel), it is anticipated that turbidity levels in and around the immediate construction areas would be increased by both the dredging and barge overflow. However, use of a mechanical dredge would greatly reduce potential water quality impacts from this operation. The turbidity plume generated would be restricted to a very limited area in the vicinity of the dredge, with 95-99% of the suspension material settling within a few yards (Schubel et al. 1978). Because of the coarseness of the sand removed, resuspension would be minimal. The construction process would increase turbidity locally for a very short time period as the material is mostly sand, and the new hole itself would serve as a sink for suspended materials; no other water quality impacts are expected.

As a result of the disposal operations there would be localized and temporary increases in suspended solids concentrations (and turbidity). The dredged material would be released from a barge above the pit. It would descend through the water column as a dense mass. During this descent any where from 3% to 5% of the dredged material may be lost to the water column (WES 1986). Movement through the water column would expose and mix the sediment during its descent.

Sediment disposal simulations for the Meisburger sites conducted with ACOE's ADDAM's model showed that four hours after a 2,000 cy dump that water quality criteria for copper (assumed to be the conservative parameter) would not be exceeded outside the site's boundary at any depth (Appendix F). Table A1-6 depicts the predicted maximum

concentration of copper and silt/clay in the water column under stratified conditions at the Meisburger 7 site. This was true for the summer (stratified) conditions; therefore, it is safe to assume it would hold for winter (unstratified) conditions as well. Within the disposal site copper concentrations in the water column were also estimated not to exceed water quality criteria after four hours. Temporary (<4 hours) exceedences within the disposal site are allowable within the Section 103 regulations and not unexpected with silty material of this quality. After a four hour period the silt/clay cloud was estimated to have a diameter of 2581 feet; however, 97% of the sediment volume would have settled out by this time. Results indicated that risks to marine organisms outside the disposal site should be minimal, since water quality criteria are met within the four hour period allowed.

The above model results notwithstanding, there may be concerns about chemicals associated with the sediments elutriating excessively into the water column during their descent to the bottom. However, common methods of open water disposal do not alter the chemical properties of the dredged material, and do not break the bonds that hold contaminants to sediment particles (Burns and Schubel 1983; Bokuniewicz et al. 1986). The binding of pollutants to sediment particles (particularly the fine-grained organic and/or clay components) tend to immobilize the contaminants and prevent their release to the water column (O'Connor and O'Connor 1983). As a result, any sediment that may remain suspended after the main deposit reaches the bottom would not likely release its bonded contaminants to the water column. This is consistent with field studies at disposal sites in New York Harbor; none have ever detected a significant increase in contaminant or nutrient level in the water at disposal sites (ACOE 1984; Bokuniewicz et al. 1986).

## AQUATIC RESOURCES

### Benthic Infauna

Recent studies (Blake et al. 1993) indicated that the dominant species in the general vicinity of Meisburger 2 and 7 were an amphipod/polychaete combination (*Corophium crassicorne/Exogene hebes*). In digging the pit, the benthic community within the construction footprint would be completely lost. The digging would be a continual process for several months, and the subsequent disposal operations would occur for an additional period of 6-9 months. During this period the site would be under a constant state of covering, thereby precluding reestablishment of any benthic populations for that period. Upon completion, the site would be capped with parent material and potentially covered with sediment similar to that from the area, and returned to its former bathymetry. In this case it is reasonable to expect a quick recolonization to the previous benthic type as would occur after filling an existing hole. As construction and final capping should take approximately 1-2 years, recolonization may not occur for at least a year following cessation of site activity (McCall 1977).

The nature of the final community will depend on the make-up of the final cap and the response of the surrounding populations to that available substrate. For this project it is proposed that Boston blue clay be used as the cap; a layer of clean sand may be placed on top of the cap. This cap would also eventually be covered by sediments deposited by natural processes. Therefore, it is reasonable to expect rapid recolonization of *C. crassicorne* and *E. hebes*, the dominant species from the undisturbed populations around the pit, perhaps in as short a time frame as 1 year (Cerrato and Scheir 1983). The new community on the site would then be similar to the existing community. In immediately adjacent subtidal and intertidal areas siltation caused by the pit construction and disposal operations could have some short-term, nearfield adverse impacts on inver-

tebrates. However, no long-term adverse impacts on the invertebrate communities in these adjacent offshore areas are expected.

Lobsters were common in collections conducted by MADMF (unpublished data from 1991-1992) at a station 2 miles west of the MWRA outfall in an area expected to be representative of the Meisburger sites. The major physical effect of construction of the pit and disposal operations on aquatic populations are turbidity, direct burial and temporary loss of habitat. There would be some localized turbidity impact on the biota. Lobsters in the immediate vicinity would be impacted to some extent as a result of impacts to potential foraging habitat; some impacts to living habitats (i.e. burrows) are anticipated. These impacts are expected to be restricted to the short-term and within the immediate area of the disposal site only.

### Finfish

Disposal operations should have only minor, short-term effects on fish in the vicinity of the borrow pit/disposal site. Some mortality of adult fish may occur during construction of the pit and disposal events due to burial or exposure to high suspended sediment levels. Three commercial finfish species (winter flounder, Atlantic cod and yellowtail flounder) made up 40-60% (collectively) of the total catch in collections conducted by MADMF (unpublished data from 1991-1992) at a station 2 miles west of the MWRA outfall in an area expected to be representative of the Meisburger sites (Table A1-5). Therefore, there may be some displacement of these species from construction activities. Impacts would be limited to the immediate vicinity of the site. Pit construction and disposal of dredged material would temporarily reduce prey available to species which feed primarily on benthic invertebrates, (such as winter and yellowtail flounders, American lobster, etc.)

## WETLAND RESOURCES

Temporary impacts to Tidal Waters are anticipated during disposal and construction activities. Upon completion of capping and closure, both sites should recolonize/re-populate through natural recruitment. Clean substrates will be restored to existing bathymetry providing better habitat conditions for benthic community redevelopment.

## WILDLIFE

Construction of the pit and disposal of dredged material in the borrow pit should not adversely impact wildlife populations occurring near the disposal site.

## THREATENED AND ENDANGERED SPECIES

Several endangered whales and turtles species can occur in the Massachusetts and Cape Cod Bays primarily, in more offshore areas near Stellwagen Bank and environs. There is nothing unique about Meisburger 2 and 7 sites that would attract these species nor are we aware of any specific sightings for this area. Therefore, the proposed project should not adversely impact species considered threatened or endangered by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, or the State of Massachusetts. This is consistent with EPA studies for cumulative impacts to these taxa from the MWRA outfall and the BHNIP disposal at MBDS (EPA 1993). Potential impacts to these species have been addressed further in a Biological Assessment prepared by ACOE, NED (Appendix A).

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources at the Meisburger sites.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 660 barge trips. This would result a level of traffic that would need to be closely coordinated by the Coast Guard with commercial and recreational boat traffic using the harbor. Construction activities would have a minor adverse aesthetic impact.

The disposal operation at the site would prevent fishing and recreational boating for the duration of the filling activity. A notice to fishermen warning them to avoid this area may be necessary as may be a Coast Guard hazards to navigation notice (due to the regular pressure of barges). Although the project activity could provide a point of nuisance to fishermen for 1½ to 2 years, adverse impacts to their fish catch are not anticipated given the relatively small area affected compared to what is available for similar fishing ground. Long-term impacts to the fishery are not expected because the dredge material would be isolated and not exposed to benthos or fish. The proximity of the sites to the MWRA's ocean outfall assures some level of monitoring (by MWRA) before and during placement of material; any construction impacts from the filling operation could be evaluated from these data.

Use of these locations will entail dredging of existing sand and gravel prior to placement of material. Some of the sand might be suitable for ACOE beach nourishment projects provided it meets grain size, availability and suitability criteria for the specific beach nourishment project. The ACOE is working with the MDC on beach nourishment projects in the Commonwealth including Nantasket Beach, among others. "Piggybacking" projects in this manner is an acceptable strategy to the ACOE. However, costs which must be factored into this option include testing, processing and transporting the material, as well as alternate use or storage costs for that portion of the material not appropriate for beach nourishment.

## 2.5 SITE EVALUATION: SUBAQUEOUS AREAS

### 2.5.1 Subaqueous Containment Site B (Subaq B)

The site is depicted on Figure A1-18.

#### 2.5.1.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

Boring sites ST1-14 and ST1-15, sampled by the CA/T program (Cortell 1990a) and presented in Table A1-7, were located off the northern side of Spectacle Island and represent the same exposure to currents, waves and storms as Subaq B. Surface sediments at ST1-14 and ST1-15 were predominantly sand (77-84%) and gravel (11-20%) with a small silt/clay component (3-5%). Bulk sediment analysis indicated that no parameters exceeded Category I limits.

#### WATER QUALITY AND CIRCULATION

Waters in the vicinity of the Subaq B site have been classified as Class SB waters by MADEP. Specific water quality data is presented in Section 3.0 for the outer harbor area. Typically the greatest impact to water quality in this area is from the numerous discharges and CSO's originating in the Inner Harbor areas. Water quality improves with increasing distance from the Inner Harbor.

The fastest tidal currents in Boston Outer Harbor occur in the deep ship channels (up to 1.4 knots) during spring tides in the southern lane of the Main Ship Channel. The mouth of Dorchester Channel attains spring tide currents of 0.8 knots on ebb tide and 0.6 knots on flood tides (Cortell 1990a). Located near the edge of the Main Ship Channel, Subaq B may experience among the fastest currents.

Subaq B is exposed and vulnerable to northeasterly storms. The nearest sheltering landfall is Deer Island (2.0± miles across the harbor). Nearby sediment conditions indicate the area is occasionally scoured.

#### AQUATIC RESOURCES

##### Benthic Infauna

Subtidal benthic macrofauna in the vicinity of the northwest portion of Spectacle Island were examined during benthic infauna and lobster surveys (Cortell 1990a). As with other sampling locations around Spectacle Island, abundances of benthic infauna (retained on a 0.5 mm-mesh sieve) north of the island were low (1113 individuals/$m^2$). Nematodes, the gastropod *N. trivittatus* and the polychaete *N. caeca* predominated.

Sediment samples collected during the lobster survey were sieved through a 2.5 mm-mesh sieve and analyzed qualitatively. The polychaetes Nereidae and *Glycera* sp., *Nassarius* sp. and post-larval crabs were the most frequently collected organisms. Soft-shell clam (*M. arenaria*) spat and razor clams (*E. directus*) were also encountered.

Lobster fishing activity in the vicinity of Subaq B was examined during the summer of 1990 for the CA/T project (Cortell 1990a). Pot markers were observed at Subaq B on each of the three dates examined. Despite being in a navigational channel, pot markers were as numerous at Subaq B as at other areas around Spectacle Island. Transects were swum by divers to document use of the substrate around Spectacle Island by lobsters, including EBP lobster. The greatest density of lobsters was observed off the northeast portion of Spectacle Island (0.0027-0.0035/$ft^2$). Lobsters occurred at about half that density (about 0.0012/$ft^2$) off the northwest portion of the island (near Subaq B); abundances elsewhere around the island were generally much lower. Most

lobsters were observed at the deeper portions of the transects. No EBP lobsters were observed around Spectacle Island; little suitable habitat was encountered for this lifestage.

### Finfish

Based on the on-going development of the artificial reef design, as required by the Individual Permit—Landfill Closure and Maintenance at Spectacle Island for CA/T (ACOE no. 199202207; 2/16/93), target fish species in the offshore coastal waters and Boston Harbor areas include forage species such as Atlantic menhaden, Atlantic herring and rainbow smelt, and predator species such as winter flounder, striped bass, bluefish, pollock, Atlantic cod, tautog and cunner.

## WETLAND RESOURCES

Subaq B is defined as Land Under the Ocean and falls under the jurisdiction of the Massachusetts Wetlands Protection Act (310 CMR 10.00). By definition, this resource is supposed to be significant to the protection of marine fisheries, protection of land containing shellfish, storm damage prevention, flood control and protection of wildlife habitat. Although food resources appear to be limited in this area (low benthic infaunal abundances), the area in the vicinity of Subaq B has been shown to support lobsters and is likely to support winter flounder. The sandy substrate may provide spawning habitat for winter flounder.

The closest significant shellfish resource to Subaq B is in the vicinity of Governors Island Flats across the Main Ship Channel to the north of Subaq B where soft-shell clams are harvested by Master Diggers. The Main Ship Channel influences currents substantially so that Dorchester Channel has little effect north to Governors Island Flats. The tidal flat on the southeastern side of Thompson Island also supports a substantial soft-shell clam resource (Cortell 1990b). Shallow bathymetric conditions between the islands and the configuration and orientation of Spectacle and Thompson Islands result in relatively slow currents passing from Subaq B to the Thompson Island Flats (0.2 knots, spring flood, Cortell 1990b). Spring flood currents through the deeper Dorchester Channel (passing north of Thompson Island) are about 0.5 knots.

Located at the mouth of the Dorchester Channel, Subaq B offers little storm damage protection because its depth is greater than surrounding areas. Storm waves would travel to shallower areas and crest before reaching land. Because it is in relatively open water, Subaq B also has little potential for storing flood water.

Dissipation of storm waves helps to protect shallower areas, such as the subtidal flat southeast of Pleasure Bay. Such shallows can be important feeding resources for waterfowl, including those species observed on and adjacent to Spectacle Island (see next section).

Subaq B is classified as Tidal Waters under federal regulations (33 CFR 328.4(b)). Tidal Waters may provide sediment/toxicant retention, nutrient retention/ transformation, recreation and uniqueness/heritage. Subaq B is not likely to contribute substantially to retention of sediments and toxicants, nor to retention or transformation of nutrients. Relatively swift currents prevent deposition of fine grained sediments that tend to absorb contaminants. Nearby sediments contained only low concentrations of metals and organic pollutants. Recreational vessels are among those using the channel.

## WILDLIFE

Waterfowl, including great cormorant (*P. carbo*), herring gull (*L. argentatus*), white winged scoter (*M. deglandi*), common goldeneye (*B. clangula*), buffle-

head (*B. albeola*), mallard (*A. platyrhynchos*), black duck (*A. rubripes*), merganser (*Mergus* spp.) and scaup (*Aythya* spp.) have been observed in the vicinity of Spectacle Island (Cortell 1990a). It is likely that these same species of waterfowl use the Subaqueous B site area for feeding and resting). Each of these species feed on fish and invertebrates (Martin et. al. 1951; Whitlatch 1982; and DeGraaf and Rudis 1986) that occur in the area.

## THREATENED AND ENDANGERED SPECIES

No threatened or endangered species listed by federal or state authorities are identified or anticipated to occur within the boundaries of Subaq B. Several marine mammals not listed as threatened or endangered, including harbor seals (*P. vitulina*), harbor porpoise, (*P. phocena*) and grampuses (*G. griseus*), occur occasionally in the area. These species are all protected under the Federal Marine Mammals Protection Act.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

Previous dredging and maintenance of the Main Ship Channel and the Dorchester Channel have likely disturbed any evidence of historic or archeological remains.

## SOCIO-ECONOMIC/LAND USE

Subaq B is an entirely submerged aquatic site within view of Spectacle Island, Thompson Island, Fort Independence on Castle Island, Logan Airport and Deer Island. It lies within a presently marked navigational channel (Dorchester Channel) at its convergence with Western Way and the Main Ship Channel. Lobstermen fish this area.

This open water site is in the path used by the commuter boats to Boston. The site is within 1200 feet of Spectacle Island, an abandoned landfill which is being closed and capped by the Massachusetts Highway Department, and which will be the site of a park owned by the City of Boston and the Commonwealth Department of Environmental Management. The site is more than one-half mile from at the Castle Island, an MDC Park and 0.75 miles from Thompson Island.

### 2.5.1.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

Sediments placed in the site would be stabilized by a 3 foot cap of clean material. The cap eventually will be buried by fine sediments deposited by natural processes. Truitt (1986) demonstrated that contaminated dredged material placed in open-water disposal sites may be chemically and/or biologically isolated by capping with clean dredged material. The cap and the dredged sediments would be confined within the walls of the depression below the level of the harbor floor. Therefore, in the long term, a deposit in a depression/pit would be less likely to release contaminants because it is not in direct contact with the water column. Even more important, because of its location under the seafloor, in an area of active deposition, the depression/pit would be less likely to lose its chemical-laden sediments through natural erosion (current action) or extraordinary storm events. Therefore, the site vulnerability to storms should be substantially mitigated because of the added protection of both depth and the pit walls (Bokuniewicz et al. 1981).

## WATER QUALITY AND CIRCULATION

Subaq B is located near the edge of the Main Ship Channel, where the tidal currents are the fastest in Boston Harbor (approx. 1.4 knots). Studies done by



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the ACOE (1988) showed that currents directed towards areas of depression are slowed by the depression, and then regain speed as they pass by.

During disposal operations, there will be localized and temporary increases in suspended solids concentrations in the water column. The dredged material will be released from a barge above the site. It would descend through the water column as a dense mass. During this descent any where from 3% to 5% of the dredged material may be lost to the water column (WES 1986). ADDAM's model results for this project site indicate that this should be 3% or less (see below). Movement through the water column would expose and mix the sediment during its descent.

Common methods of open water disposal do not alter the chemical properties of the dredged material, and therefore do not break the bonds that hold contaminants to sediment particles (Burns and Schubel 1983; Bokuniewicz et al. 1986). The binding of pollutants to sediment particles (particularly the fine-grained organic and/or clay components) tends to immobilize the contaminants and prevent their release to the water column (O'Connor and O'Connor 1983). As a result, any sediment that may remain suspended after the main deposit reaches the bottom would not likely release its bond to contaminants and disperse them to the water column. This is consistent with field studies at disposal sites in New York Harbor; none have ever detected a significant increase in contaminant or nutrient level in the water at disposal sites (ACOE, NYD 1984; Bokuniewicz et al. 1986).

The ACOE ADDAM's model was used to demonstrate potential water quality impacts at a representative in-harbor site (Subaqueous E: Table A1-8). Under maximum flood tide conditions, a sediment plume diameter of 2220 feet was predicted with a silt/clay concentration of 9.7 mg/L above background; background is about 4.5 mg/L (New England Aquarium 1990). It was calculated that approximately 3% of release material would remain suspended in the water four hours after disposal. Under maximum ebb tide conditions a sediment plume diameter of 2205 feet was predicted with a silt/clay concentration of 0.815 mg/L above background, it was calculated that $<2\%$ of release material would remain suspended in the water four hours after disposal under this scenario. The modeling analysis indicated that suspended solids would be transported beyond the disposal site and may extend for 4,700 feet; Governors Island flat and Deer Island flats could be reached if tidal events would move the material in that direction.

After a four hours disposal simulation, the model calculated a maximum copper concentration within the plume of 0.0058 ppm under maximum flood tide conditions, and 0.0019 ppm under maximum ebb tide conditions. Since the Massachusetts water quality criteria for copper is 0.0029 ppm. under maximum tidal flood conditions, the water criteria was predicted to be exceeded; however, under maximum ebb tide this condition was not predicted. Tidal-dependent disposal periods as well as engineering mitigation methods to control sediment plume expansion would be necessary to control water quality impacts from this disposal option.

## AQUATIC RESOURCES

### Benthic Infauna

Benthic invertebrates at the Subaq B disposal site would be buried during disposal operations. Nematodes, the gastropod *Nassarius trivittatus* and the polychaete *Nephtys caeca* were the dominant species found in a benthic infauna survey done by Cortell (1990a) in the vicinity of northwest portion of Spectacle Island. Dredged material placed at the site would quickly be colonized by the species common to the surrounding areas. The resulting community should then be similar to that presently occurring on the site. Over the long-term, invertebrate productivi-

ty and diversity should improve. Therefore, partially filling the depression at the site could improve habitat quality for invertebrates due to the cleaner sediment.

The closest significant shellfish resource to Subaq B (soft-shell clams, harvested by Master Diggers) is in the vicinity of Governors Island Flats, across the Main Ship Channel to the north of Subaq B. Lobster fishing activity in the vicinity of Subaq B was examined during the summer of 1990 for the CA/T project (Cortell 1990a). It was found that lobsters occurred at a density of $0.0012/ft^2$ off the northwest portion of Spectacle Island, near Subaq B. The disposal of dredged material at Subaq B should have no long-term impacts on the soft shell clam and lobster populations in the vicinity of the site; but some short-term construction impacts could occur. Lobsters would be displaced from the construction area; bioaccumulation of silt plume material should be no different than existing conditions since prey are already being obtained from surrounding areas with similar conditions.

The major physical effects of disposal on aquatic populations are turbidity and direct burial. Shellfish in the immediate vicinity could be impacted by both turbidity and burial to some extent. These impacts are likely to be restricted to the short-term, since the annual reseeding of clam spat would act as a natural mitigation to these impacts. Shellfish are filter feeders and the suspended sediment can interfere with their feeding mechanism; bioaccumulation of suspended silts and their associated chemicals could be a risk. Lobsters in the immediate vicinity would be impacted to some extent as a result of impacts to potential foraging habitat; impacts to living habitats (i.e. burrows) are anticipated. These impacts are expected to be restricted to the short-term.

### Finfish

Disposal operations should have only temporary effects on fish in the vicinity of the Subaq B disposal site. Some displacement and/or mortality of juvenile and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Fish could avoid any adverse conditions from turbidity. Impacts would be limited to the immediate vicinity of the disposal site. Disposal of dredged material would reduce habitat with prey available to species that feed primarily on benthic invertebrates, such as winter flounder; recovery of this habitat should occur within about a year.

## WETLAND RESOURCES

There would be a short-term impact of 50-80 acres of Land Under the Ocean and Tidal Waters. The site would be restored after construction. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Disposal of dredged material at Subaq B should not adversely impact wildlife populations, e.g. birds, occurring near the disposal site.

## THREATENED AND ENDANGERED SPECIES

The proposed project should not adversely impact species considered threatened or endangered by the USFWS, NMFS or MANHESP. Several species that are protected under the Federal Marine Mammals Protection Act (e.g. harbor seals, harbor porpoise) occasionally do occur in this area, these also should not be adversely impacted by the Project.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project should have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations of silt material would involve approximately 450 barge trips. This would result in some delays to commercial and recreational boat traffic using the harbor. Construction activities would have a minor adverse aesthetic impact, and result in slightly elevated noise levels. The proposed project would be unlikely to have long-term impact on the soft-shell clam fishery in the vicinity of the site.

If filling is to an elevation below the surrounding bathymetry, there would be no permanent impact harmful to the recreational boaters in this area or to commuter boat traffic using this route to Boston's Inner Harbor. The act of placing the material may disrupt boating activity but only to the extent of requiring vessels to travel around the barge placing the sediments.

## 2.5.2 Subaqueous Containment Site E (Subaq E)

The site is depicted on Figure A1-19.

### 2.5.2.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

No sediment data were available for the immediate vicinity of Subaq E. Samples collected off the end of Logan Runway 33L (Massport 1990) and from Stations E and F in the Main Ship Channel (ACOE 1988a) may be representative of local conditions. Composed of grey and black oily fine to medium sand, these sediments contained no constituents whose concentrations exceeded the range for Category I sediments. Surface material at Stations E and F in the Main Ship Channel, on the other hand, was ≥85% silt or clay. Bulk sediment analysis indicated that most constituents met Category I standards but lead, chromium and volatile solids occurred at Category II levels.

#### WATER QUALITY AND CIRCULATION

Water quality in the vicinity of Subaq E is classified as SB. When sampled in 1986, Class SB standards were met except for occasionally excessive bacterial concentrations (Massport 1990). As water quality conditions have been improving throughout the harbor it is likely that this area continues to meet SB criteria.

As with other sites in Boston Harbor, the hydrodynamics of Subaq E are governed primarily by tidal currents and secondarily by wind. Bounded to the north and south by shoals, and in close proximity to the Main Ship Channel, Subaq E is subject to relatively high current velocities (up to 1.0 knots flood and 1.3 knots ebb in spring tides). This area experiences a 1.0-mile northeasterly fetch, buffered only by Deer Island and is exposed to easterly winds. The adjacent shoals crest waves rapidly. Greater depth offers protection to Subaq E.

#### AQUATIC RESOURCES

##### Benthic Infauna

Benthic resources at Subaq E may be similar to those observed nearby in the Main Ship Channel (Station 6; ACOE 1988a), described in Section 4.1 of the EIR/S. Seasonal changes in community structure were apparent. The July (1986) community was dominated by *Nephtys caeca, Ampelisca abdita, E. directus* and *N. trivittatus*, generally indicative of clean, fine sandy sediments. With 32 taxa represented, the total abundance was a moderate 2775 individuals/$m^2$. In November (1986), the community was dominated by *A. abdita, Polydora ligni, N. trivittatus,* and *S. benedicti.* The 26 taxa observed totalled 5738 individuals/$m^2$. *P. ligni* and *S. benedicti* are opportunistic species with short generation times enabling rapid recruitment following environmental stresses. Common in the Inner Harbor, their presence in the Outer Harbor is an indication that this portion of the Main Ship Channel was affected by periodic stresses.

Subaq E is likely to support some soft shell clam (*M. arenaria*), although this species tends to be most abundant at and slightly above mean low water. Subaq E is located within approximately 1 nautical mile of the intertidal mud flats, along the perimeter of Logan Airport, which are harvested by commercial clammers. These mudflats also support extensive beds of blue mussels (*M. edulis*), a species also capable of subtidal existence.

##### Finfish

Fisheries resources at Subaq E are expected to be similar to those described for the Main Ship Channel, as finfish and epibenthic crustaceans are well able to traverse the small distance between these two areas.

## WETLAND RESOURCES

Like Subaq B, Subaq E is comprised of Land Under the Ocean (under state jurisdiction) and Tidal Waters (under federal jurisdiction). The Massachusetts Wetlands Protection Act (310 CMR 10.00) assumes that this resource is significant to the protection of marine fisheries, protection of land containing shellfish, storm damage prevention, flood control and protection of wildlife habitat.

Differences in bathymetry and currents between Subaq E and adjacent areas are likely to make it attractive to finfish although it would require more energy to remain in the stronger currents of this channel. Regular tidal currents are likely to prevent anoxic or hypoxic conditions from developing during the summer, enabling finfish to use this area as a refuge from summer temperatures on the adjacent shoals.

The presence of the channel partially diverts tidal energy away from the adjacent shoals. The shoals of Governor Island Flats, in particular, are likely to provide soft shell clam habitat which contributes to the productivity of the area. The abrupt change in depth between Subaq E and Governors Island Flats makes the southern edge of the Flats susceptible to damage from waves generated by easterly and southeasterly winds, however winds from these directions are relatively rare. Governors Island Flats plays a substantial role in protecting intertidal resources and the shoreline from erosional forces by dissipating waves offshore. Like Subaq B, Subaq E is located in open water and has no capacity for storage of flood waters.

Classified as Tidal Waters under federal regulations, Subaq E was evaluated for its ability to provide the functions of sediment/toxicant retention, nutrient retention/transformation, recreation and uniqueness/heritage. Because tidal currents tend to be elevated in channels and keep fine-grained sediments in suspension, it is unlikely that Subaq E contributes to sediment/toxicant retention or nutrient retention/transformation. However, its proximity to commercial anchorages exposes Subaq E to potential spills and accidental discharges. This area is used by recreational boaters for passage into Boston Harbor.

## WILDLIFE

Waterfowl, including great cormorant (*P. carbo*), herring gull (*L. argentatus*), white winged scoter (*Melanitta deglandi*), common goldeneye (*B. clangula*), bufflehead (*Bucephala albeola*), mallard (*A. platyrhynchos*), black duck (*A. rubripes*), merganser (*Mergus* spp.) and scaup (*Aytha* spp.) have been observed in the vicinity of Spectacle Island (Cortell 1990a). It is likely that these same species of waterfowl also use the Subaqueous E site for feeding and resting. Each of these species feed on fish and invertebrates (Martin et al. 1951; Whitlatch 1982; and DeGraaf and Rudis 1986) that occur in the general area.

## THREATENED AND ENDANGERED SPECIES

No federally or state-listed threatened or endangered species are identified or expected to occur within the vicinity of Subaq E. All marine mammals are protected under the Federal Marine Mammals Protection Act, whether threatened/endangered or not. Three species, harbor seals (*Phoca vitulina*), harbor porpoises (*Phocena phocena*) and grampuses (*Grampus griseus*) occur occasionally in the harbor.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no listed historical or archeological resources at the Subaq B or Subaq E sites.



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## SOCIO-ECONOMIC/LAND USE

Current use of Subaq E is for navigation between Winthrop Harbor and Boston Harbor (approximately 20 feet MLW). Although entirely submerged, disposal activities at Subaq E would be visible from Deer Island, Winthrop Harbor, Logan Airport, Fort Independence (Castle Island), Spectacle Island and Long Island during construction. Height restrictions may occur because of its proximity to Logan.

This open water site abuts General Anchorage Areas to the south and east and is in the path of the ferries carrying construction personnel to Deer Island during the Boston Harbor Clean-up Project. It is farther removed from the parks discussed with regard to the Subaq B site.

### 2.5.2.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

Dredged material placed in the site would be somewhat more coarse than existing sediments, and would be stabilized by a 3-foot cap of clean sediment. The cap eventually should be buried by fine sediments deposited by natural processes. The cap and the dredged sediments would be confined within the walls of the trough below the level of the harbor floor. Therefore in the long term, a deposit in the trough would be less likely to release contaminants because it is not in direct contact with the water column. Even more important, because of its location under the seafloor, in an area of active deposition, the trough would be less likely to lose its chemical-laden sediments through natural erosion (current action) or extraordinary storm events. Therefore, the site's vulnerability to storms should be reduced because of the added protection because of greater depth and the trough walls (Bokuniewicz et al. 1981).

## WATER QUALITY AND CIRCULATION

The hydrodynamics of Subaq E are governed primarily by tidal currents and secondarily by wind. Subaq E is located near the Main Ship Channel, the fastest tidal currents in Boston Harbor occurs in this area (approx. 1.4 knots). During disposal operations suspended solids would be released into the Harbor waters. As a result, there will be localized and temporary increases in suspended solids concentrations in the water column. The dredged material will be released from a barge above the site. It would descend through the water column as a dense mass. During this descent any where from 3% to 5% of the dredged material may be lost to the water column (WES 1986).

The common methods of open water disposal do not alter the chemical properties of the dredged material, and therefore do not break the bonds that hold contaminants to sediment particles (Burns and Schubel 1983; Bokuniewicz et al. 1986). The binding of pollutants to sediment particles (particularly the fine-grained organic and/or clay components) tend to immobilize the contaminants and prevent their release to the water column (O'Connor and O'Connor 1983). As a result, any sediment that may remain suspended after the main deposit reaches the bottom would not likely release its bonded contaminants to the water column. This is consistent with field studies at disposal sites in New York Harbor; none have ever detected a significant increase in contaminant or nutrient level in the water at disposal sites (ACOE 1984; Bokuniewicz et al. 1986).

The ACOE ADDAM's model was used to demonstrate potential water quality impacts at this site (Table 2.7). Under maximum flood tide conditions, a sediment plume diameter of 2220 feet was predicted with a silt/clay concentration of 9.7 mg/L above background; (background is about 4.5 mg/L). It was calculated that approximately 3% of release material would remain suspended in the water four hours after disposal. Under maximum ebb tide conditions a



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sediment plume diameter of 2205 feet was predicted with a silt/clay concentration of 0.815 mg/L above background, it was calculated that <2% of release material would remain suspended in the water four hours after disposal under this scenario. The modeling analysis indicated that suspended solids would be transported beyond the disposal site and may extend for 4,700 feet and could reach Governors Island flat and Deer Island flats.

After a four hours disposal simulation, the model calculated a maximum copper concentration within the plume of 0.0058 ppm under maximum flood tide conditions, and 0.0019 ppm under maximum ebb tide conditions. Since the Massachusetts water quality criteria for copper is 0.0029 ppm., the water quality criteria was predicted to be exceeded under maximum flood tide conditions; however, under maximum ebb tide this condition was not predicted.

## AQUATIC RESOURCES

### Benthic Infauna

Dredged material placed at the site would quickly be colonized by local species occurring in the harbor sediments. The resulting community should then be similar to that presently occurring at the site. Over the long-term invertebrate productivity and diversity should improve due to the Boston Harbor Clean-Up (by MWRA). Therefore, partially filling the trough at the site would improve habitat quality for invertebrates due to the cleaner sediment. Siltation caused by disposal operations could have some short-term adverse impacts on invertebrates occurring in adjacent areas. Localized siltation should not have long-term impacts on harbor-wide invertebrate population.

Subaq E is located within 1 mile of the soft shell clam mudflats in the vicinity of Logan Airport. The clams in these flats are harvested by commercial diggers; the mudflats also support blue mussel. The major impact of concern here is whether exceedences of water quality criteria during flood tide, as predicted by the ADDAM's model, would result in substantial bioaccumulation causing undue risk to those bivalves or to humans consuming them. Given the longevity of the disposal activity (several months) disposal during slack and ebb tides may be most appropriate at this site.

The major physical effect of disposal on aquatic populations are turbidity and direct burial. Such impacts would likely be restricted to the short-term, since the annual reseeding of clam spat would act as a natural mitigation to these impacts. Shellfish are filter feeders and the suspended sediment could also interfere with their feeding mechanism, during the disposal period.

### Finfish

Disposal operations could have some short-term effects on fish in the vicinity of the Subaq E disposal site. Some displacement and/or mortality juvenile and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. The outer harbor supports high densities of winter flounder, Atlantic tomcod, four-spine stickleback, and rainbow smelt. Abundance of these species tend to be highest in September and October. Any adverse impacts should be limited to the immediate vicinity of the disposal site. Disposal of dredged material would temporarily reduce prey available to species which feed primarily on benthic invertebrates, such as winter flounder.

## WETLAND RESOURCES

There would be a short-term impact of 79± acres of Land Under the Ocean and Tidal Waters. The site would be restored after construction. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Disposal of dredged material at Subaq E should not adversely impact wildlife populations, e.g. birds, occurring near the disposal site.

## THREATENED AND ENDANGERED SPECIES

The proposed project should not adversely impact any species considered threatened or endangered by the USFWS, NMFS and MANHESP. Several species that are protected under the Federal Marine Mammals Protection Act (e.g. harbor seals, harbor porpoise) occur occasionally in this area; construction activities should discourage them from frequenting the immediate project site, thus reducing potential impacts.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would have no effect upon any structure or site of historic, architectural or archeological significance as defined by MHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 423 barge trips. This would result in some delays to commercial and recreational boat traffic using the harbor. Construction activities would have a minor adverse aesthetic impact, and result in slightly elevated noise levels. Any fishing (for lobster, etc.) in the immediate disposal area would have to be curtailed during the disposal period.

If filling occurs to the depths of the surrounding area, there will be no permanent impact on marine traffic. However, during the installation of the material, any marine vessels must circumvent this area to minimize interference with the placement operation.

### 2.5.3 Winthrop Harbor

This site is depicted in Figure A1-20.

#### 2.5.3.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

Sediment grab samples were collected from 17 locations throughout Winthrop Harbor in October 1989 by the ACOE NED (1992). Winthrop Harbor sediments are predominately clayey silts with low organic contents and a mean percentage fines content of about 90%. Fines (silt + clay) content ranged from 49.3 to 93.4% (mean = 82.4%). Median particle size ranged from 0.01 to 0.07 mm, and averaged about 0.024 mm. The bulk chemical analysis results for metals are presented in Table A1-9. Generally, the sediment in Winthrop Harbor contained low levels of arsenic, cadmium, copper, nickel, and mercury. Most samples contained moderate levels of lead, but two samples (I and L) contained relatively high lead levels (Category III). Samples from north or northwest of Snake Island and near Crystal Cove (samples G through Q) generally contained elevated levels of chromium. Samples from north of Snake Island and Crystal Cove had Category II levels of zinc. PCB levels in sediments were below detection levels ( < 0.1 ppm) in all samples. Concentrations of PAHs were also generally below detection limits (ACOE 1992).

#### WATER QUALITY AND CIRCULATION

The water quality in Winthrop Harbor is designated as Class SB by the MADEP. Such saline waters are suitable for the propagation and protection of fish and other aquatic wildlife, primary and secondary contact recreation, and shellfish harvesting with depuration.

Selected water quality parameters were measured during an ebb tide on September 2, 1986, by the ACOE NED. Samples were taken at one meter depth intervals from four stations within the Harbor. Temperatures ranged from 16.3 to 15.8°C. Salinity was 31.5 ppt. Dissolved oxygen (D.O.) levels ranged from 9.0 to 10.6 and were saturated or supersaturated, presumably due to high rates of photosynthesis and mixing within the shallow harbor. The pH ranged between 7.8 and 7.9. Recent studies by Chase (1993) showed that in July and August 1993 the temperatures ranged from 17.4°C to 19.2°C and D.O. from 9.3 to 8.2 ppm. Bottom values were similar or only slightly lower than surface readings indicating good tidal mixing and water of adequate quality to support formal respiration.

Winthrop Harbor is contiguous with Boston Harbor and receives tidal flow from the outer Harbor south and east of Deer Island. Currents within the Winthrop Harbor are tidally dominated and are strongest in the channel areas (EG&G 1984). Flood waters flow northwesterly around the tip of Deer Island and are then funneled northerly into the Harbor between Snake Island and Point Shirley. Ebb flows travel in the reverse direction. Average flood velocities (10.35 cm/sec) are generally greater than average ebb velocities (8.8 cm/sec). Circulation within Winthrop Harbor does not appear to be significantly affected by wind and wave action. The harbor has a limited fetch and is fairly well protected from the predominant westerly and northeasterly winds. The most protected areas in the harbor are Crystal Cove and Winthrop Basin.

#### AQUATIC RESOURCES

##### Benthic Infauna

The subtidal sediments in Winthrop Harbor provide habitat for a variety of benthic invertebrates. Table A1-10 shows the benthic invertebrates present at Winthrop Harbor. Predominant taxa occurring in



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samples collected in the fall of 1989 by the Army Corps of Engineers were the polychaete (*S. benedicti*), aquatic oligochaetes, and gammarid amphipod crustaceans; densities in 1989 were fairly low. Common benthic invertebrates occurring in intertidal sediments include spionid polychaetes, clam worms (*Nereis virens*), soft shell clams and oligochaetes. Common epibenthic invertebrates include barnacles (*Balanus noctabis*), the common periwinkle (*Littorina littorina*), the common slipper shell (*Crepidula fornicata*), amphipods, and hermit crabs (*Pagurus* sp.) (ACOE NED 1992).

Sediments in the area of the borrow pit appear to have a depauperate invertebrate community. Five $0.04m^2$ Van-Veen grabs collected from the pit in October 1989 contained two *S. benedicti*, and no other invertebrates. Cerrata and Sceier (1983) have reviewed the literature on benthic communities in borrow pits along the east coast. Most such studies have found the populations within these habitats to be both less abundant and less diverse than surrounding areas, even when there were no noticeable degradations of water quality (lower oxygen, slower currents and greater sedimentation). Recent studies reported by Chase (1993) in July and August indicated however, that up to 55 winter flounder, 47 rainbow smelt and 32 lobsters (as well as 9 other taxa) were caught in an eight minute tow within the borrow pit, indicating this area could provide productive fisheries habitat.

Studies conducted for the ACOE NED in 1985 indicated that Winthrop Harbor sediments are not toxic to aquatic organisms. Survival of grass shrimp, clams and sandworms was not significantly ($p < .05$) less than organisms exposed to reference sediments. Bioaccumulation tests done for this study results showed that clam and worm survival was high for all sites tested in Boston Harbor (most >95%, none <90%). This is considered very good survival and does not indicate any acute toxicity to the organisms tested. The test sediments did not cause any statistically significant mortality compared to the reference sediments, which was 93% survival for worms and 97.3% for clams.

Soft shell clam (*M. arenaria*) are abundant in intertidal mudflats around Snake Island, in the Basin, and elsewhere in the Harbor. Shell harvesting in the harbor is prohibited for a greater part of the year because of fecal coliform contamination. Shellfish harvesting in Winthrop Harbor is classified as restricted, and must undergo depuration. Clam harvesting activities are discussed in more detail below. Blue mussels (*M. edulis*) and lobsters (*Homarus americanus*) also occur in the Harbor.

Soft shell clam (*M. arenaria*) are abundant in intertidal mudflats around Snake Island, in the Basin, and elsewhere in the Harbor. Shellfish are a valuable renewable resource. The maintenance of productive shellfish beds not only assures the continuance of shellfish themselves, but also plays a direct role in supporting fish stocks by providing a major food source. The young shellfish in the planktonic larval stage that are produced in large quantities during spring and summer are an important source of food for the young stage of marine fishes, many crustaceans.

## Finfish

Winter flounder is the most abundant commercially important species occurring in the harbor. Flounder are likely to be present from the fall through spring, and spawn in shallow waters with muddy or sandy bottoms between February and April. The borrow pit provides a suitable resting habitat for winter flounder. Of the 88 winter flounder captured in these 8-minute tows in the harbor in 1993 (Chase 1993), the majority were young-of-the-year. Catch rates were similar to trawls in Salem Sound in 1991 and 1992 for this species. Atlantic silverside is probably the most common forage species in the harbor. Silversides are typically abundant in nearshore Massachusetts waters during the spring, sum-

mer and fall. Spawning occurs among *Spartina* from May through early summer. Rainbow smelt were the second most abundant finfish species reported subtidally (in trawls) by Chase (1993) in August 1993.

## WETLAND RESOURCES

Emergent wetlands in Winthrop Harbor are limited mostly to Snake Island, the northern tip of Point Shirley, and the basin. Salt marsh grass (*S. alterniflora*) occurs along about 40% of the Basin shoreline. The northern tip of Point Shirley and Snake Island support dense stands of reed (*P. communis*). Sea lettuce (*U. lactuca*) and *Enteromorpha* sp. occur in the Basin. These wetland resources may supply nesting habitats, shelter, and food for some shorebirds and other wildlife.

This site is primarily Land Under the Ocean, as defined under State regulations (310 CMR 10.00), which is classified as significant to marine fisheries, storm damage prevention and flood control. Most of Winthrop Harbor shoreline is protected by seawalls. The seawalls were designed for storm damage prevention and flood control. As described in the Aquatic Resources section, the borrow pit is suitable as a resting habitat for flounder, and possibly other species (i.e. lobsters and crabs).

Land containing shellfish is under 310 CMR 10.34 (3), "significant to the protection of marine fisheries as well as to the protection of the interest of landing containing shellfish". The shellfish resource in Winthrop Harbor is discussed above. According to this regulation, projects that temporarily have an adverse effect on shellfish productivity but do not permanently destroy the habitat may be permitted if the land containing shellfish can and will be returned substantially to its former productivity in less than one (1) year.

Winthrop Harbor is also classified as Tidal Waters under federal regulations (40 CFR 230)). In addition to the values identified under the Massachusetts Wetlands Protection Act for Land Under the Ocean, Tidal Waters may provide sediment/toxicant retention,nutrient/retention/transformation,recreationand uniqueness heritage.

## WILDLIFE

Productive tidal flats in the Basin adjacent to Snake Island provide good shorebird habitat. Migratory species likely to occur include semipalmated sandpiper, dunlin, least sandpiper, sanderling, blackbellied plover, greater yellowlegs, the knot, whiterumped sandpiper, hudsonian godwit, and shortbilled dowitcher (ACOE, NED 1992).

## THREATENED AND ENDANGERED SPECIES

No federally listed or proposed threatened or endangered species are identified or known to exist in Winthrop Harbor. However, historically the federally endangered piping plover (*Charadrius melodus*) nested on Snake Island. Two state species of special concern, the least tern (*Sterna albifrons*) and the common tern (*Sterna hirundo*) also once nested on the island. In addition, the black duck, a species of special concern to the USFWS regularly winters in Winthrop Harbor (ACOE, NED 1992).

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

There are no known prehistoric sites in the vicinity of the proposed project. The Winthrop coastal area and Snake Island have the potential for containing prehistoric sites. Snake Island is included in the Boston Harbor Islands Archeological District and is listed on the National Register of Historic Places.



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There were five known shipwrecks in Winthrop. Three of these wrecks occurred near Point Shirley. Due to past dredging in the harbor, it is likely that these sites have been previously disturbed or destroyed (ACOE NED 1992).

## SOCIO-ECONOMIC/LAND USE

Winthrop is a predominantly residential, coastal community with a high population density. The 1980 US Census reported a total population of 19,294, and a median family income of $22,224. Winthrop is a popular summer resort. The service, government, and the wholesale/retail trade sectors are the largest source of employment in the town. Less than 1% of the town's workforce is directly employed in the fishing industry.

The town has two main harbors (Winthrop Harbor and Belle Island Inlet) which provide anchorage for about 800 recreational craft and 34 commercial fishing vessels. About 370 existing recreational craft are based at slips in Winthrop Harbor, and 124 at slips at the Belle Isle Inlet. Another 270 recreational craft utilize open moorings in the harbor. There are several private marinas in Winthrop which provide facilities for recreational craft. The state has provided a boat ramp and a three acre parking area along the north shore of the Basin for public access. The proposed disposal site in Winthrop Harbor is adjacent to the Winthrop Yacht Club, within 750 feet of Crystal Cove Marina and about 900 feet from a public landing. It is in a narrow channel which is heavily used by recreational boaters.

Most of the 34 commercial vessels fish full-time for lobsters in eastern Massachusetts waters. Some boats rig for dragging especially in colder months, in order to harvest scallops and groundfish from offshore waters. Virtually all landings are harvested from outside of Winthrop Harbor (ACOE, NED 1992).

Approximately 30 to 35 master diggers harvest clams from Winthrop Harbor, principally from flats around Snake Island, west of Point Shirley, and near Logan International Airport. Theses areas are classified as restricted, and all clams harvested must undergo depuration at the MADMF Newburyport Shellfish treatment Plant. The average annual harvest of clams from these flats for 1992 was 11,036 bushels (Jeffery Kennedy, (MADMF) pers. commun, June 17, 1993). The wholesale value (to diggers) of this fishery is approximately $700,000 per year. No recreational shellfishing is allowed in the harbor.

### 2.5.3.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

Sediment placed in the pit would be somewhat more coarse than existing sediments. Existing sediments in Winthrop Harbor contain low to moderate levels of contaminants. The silt sediments placed at the disposal site would be stabilized by a 3-foot cap of clean sediment. The cap eventually will be buried by fine sediments deposited by natural processes. Silt material placed in open-water disposal sites can be chemically and/or biologically isolated by capping with clean dredged material (Truitt 1986).

The cap and the dredged sediments would be confined within the walls of the pit below the level of the harbor floor. Therefore in the long term, a deposit in a borrow pit would be less likely to release contaminants because it is not in direct contact with the water column. Even more important, because of its location under the seafloor, the borrow pit would be less likely to expose the buried silt sediments through natural erosion (current action) or extraordinary storm events. Therefore, the site vulnerability to storms should be negligible because of the added protection because of greater depth and the pit walls (Bokuniewicz et al. 1981). Recent analysis of Winthrop Harbor as a subaqueous borrow pit (Bokuniewicz 1993) indicated (from ADDAM's

model results) that a 2000 cy dump would not reach the sides of the borrow pit at its widest point indicating the material would probably not escape from the pit during disposal. This would help ensure its containment until a cap is placed.

## WATER QUALITY AND CIRCULATION

Winthrop Harbor is contiguous with Boston Harbor and receives tidal flow from the Outer Harbor south and east of Deer Island. Currents within the harbor are tidally dominated and are strongest in the channel areas (EG&G 1984). Average flood velocities (10.35 cm/sec) are generally greater than average ebb velocities (8.8 cm/sec). Studies done by the ACOE, NYD (1988) showed that currents are directed toward the area of a manmade depression, slowing down over it, and speeding up again once away from its influence. Circulation within Winthrop Harbor does not appear to be significantly affected by wind and wave action.

During disposal operations some suspended solids would be released into the Winthrop Harbor waters as the dredged material goes to the bottom, even though it would descend through the water column as a dense mass. During this descent any where from 3% to 5% of the dredged material may be lost to the water column (WES 1986). As a result, there would be localized and temporary increases in suspended solids concentrations in the water column. Disposal activity at this site would occur for approximately a 6- to 9-month period. Therefore, there would be some localized increases of the suspended solids on the water quality in the vicinity of the site.

The common methods of open water disposal do not alter the chemical properties of the dredged material, and therefore do not break the bonds that hold contaminants to sediment particles (Burns and Schubel 1983; Bokuniewicz et al. 1986). The binding of pollutants to sediment particles (particularly the fine-grained organic and/or clay components) tends to immobilize the contaminants and prevent their release to the water column (O'Connor and O'Connor 1983). As a result, any sediment that may remain suspended after the main deposit reaches the bottom would not likely release its bonded contaminants to the water column. This is consistent with field studies at disposal sites in New York Harbor; none have ever detected a significant increase in contaminant or nutrient level in the water at disposal sites (ACOE, NYD 1984; Bokuniewicz et al. 1986).

The ACOE ADDAM's model was used to demonstrate potential water quality impacts at a representative in-harbor site: Subaqueous E (Table 2.7). Under maximum flood tide conditions, a sediment plume diameter of 2220 feet was predicted with a silt/clay concentration of 9.7 mg/L above background; it was calculated that approximately 3% of release material would remain suspended in the water four hours after disposal. Under maximum ebb tide conditions a sediment plume diameter of 2205 feet was predicted with a silt/clay concentration of 0.815 mg/L above background; (background is approximately 4.5 mg/L). It was calculated that $<2\%$ of release material would remain suspended in the water four hours after disposal under this scenario.

After a four hours disposal simulation, the model calculated a maximum copper concentration within the plume of 0.0058 ppm under maximum flood tide conditions, and 0.0019 ppm under maximum ebb tide conditions. The Massachusetts water quality criteria for copper is 0.0029 ppm. Therefore, under maximum flood tide conditions, the water quality criteria was predicted to be exceeded; however, under maximum ebb tide this condition was not predicted. The modeling analysis indicated that suspended solids and attendant contaminants would be transported beyond the disposal site and may extend for 4,700 feet. Assuming transport from the Winthrop site would be similar to the Subaqueous E site, then the silt plume could impinge upon Snake Island flats and the Basin and the aquatic resources therein.



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## AQUATIC RESOURCES

### Benthic Infauna

Benthic invertebrates at the Winthrop in-harbor disposal site would be buried during disposal operations. Benthic samples taken in the area of the proposed pit by the ACOE, NED in October 1989 contained two *S. benedicti*, and no other invertebrates. Low invertebrate populations suggest that the sediments in the borrow pit may be anoxic (ACOE NED 1992). Furthermore, adverse physical conditions such as poor circulation/exchange rates, low dissolved oxygen, and higher sedimentation, cause benthic species in borrow pits to suffer very high mortality rates (ACOENED, 1988). This condition was not observed in July and August, 1993 (MADMF, 1993), however, where sampling indicated that the overlying water was of sufficient quality to support faunal respirations.

The nature of the final community will depend on the make-up of the cap. For this project it is proposed that Boston blue clay be used as the cap, and possibly a layer of clean sand placed on top of the cap. This cap would also eventually be buried by fine sediments deposited by natural processes. Therefore, it is reasonable to expect rapid recolonization of *S. benedicti* from the undisturbed populations around the pit, perhaps in as short a time frame as one year (Cerrato and Scheir 1983). The new community should then be similar to the existing harbor community. Over the long-term, invertebrate productivity and diversity should be higher than currently found in depauperate borrow pit bottom sediments. Therefore, partially filling the 35-foot borrow pit could improve habitat quality for invertebrates.

Siltation caused by disposal operations could have some short-term adverse impacts on invertebrates occurring in subtidal areas immediately adjacent to the borrow pit. However, siltation should have no adverse long-term impact on harbor invertebrate communities.

Soft-shell clam are abundant in the intertidal mudflats around Snake Island, in the Basin, and elsewhere in the Harbor. Some clam mortality could occur in adjacent areas because of elevated suspended sediment levels and siltation. Small clams with minimal energy reserves would probably be most vulnerable; these can be reseeded (naturally) within a year, however, so should recover adequately.

ADDAM's model results estimated that siltation could be on the order of twice normal background levels over a plume diameter of 2200; this plume could reach Snake Island flats on a flood tide. However, storm and strong wind events can increase turbidity (total suspended solids) in shallow subtidal areas so local populations should be naturally adapted to these conditions. The potentially continuous nature of the disposed activity over several months, however, could possibly cause some cumulative impacts; however, natural reseeding should mitigate any of these impacts that do occur.

Of greater concern would be exposure to shellfish by elevated levels of metals and/or organics. ADDAM's model results indicate that on a flood tide at subaqueous E, copper levels would not be below the water quality criteria levels four hours after a dump (they may be on the order of twice as high). Since clams are filter feeders, there is the potential for bioaccumulation of contaminants during flood tide conditions from disposal in Winthrop Harbor. Mitigative measures to contain siltation and/or more detailed studies may be necessary to insure that adverse impacts to shellfish (or human consumers) do not occur form this disposal at this site.



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Finfish

Disposal operations should have only short-term effects on fish in the vicinity of the borrow pit in-harbor disposal site. Some mortality to juvenile and adult fish would occur during disposal events due to burial or exposure to high suspended sediment levels. Lobsters and crabs inhabiting the area could also suffer some mortality. Impacts should be limited to the immediate vicinity of the disposal site. The resident fish and crustaceans would be displaced from the disposal site during operations, which should last over 6-9 months (although not necessarily consecutive months). Disposal of dredged material would temporarily reduce prey available to species which feed primarily on benthic invertebrates, such as winter flounder. Partially filling the borrow pit should still leave a hole suitable as a resting habitat for flounder and other species.

## WETLAND RESOURCES

The proposed project should have no impact on the emergent wetlands in the vicinity of the site. The dense stands of reed (*P. communis*) on Snake Island and salt marsh grass (*S. alterniflorar*) on the Basin shoreline should not be impacted by the disposal of dredged material in the borrow pit. There would be a short-term impact of 8.14± acres of Land Under the Ocean and Tidal Waters. The site would be restored after construction. The impacts for the biological resources protected under Land Under the Ocean (310 CMR 10.00) are discussed above.

## WILDLIFE

Disposal of dredged material in the borrow pit should have no long-term adverse impact on wildlife populations occurring near the disposal site.

## THREATENED AND ENDANGERED SPECIES

The proposed project should have no adverse impact on any species considered threatened or endangered by the USFWS, NMFS and MANHESP.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The proposed project would not affect any structure or site of historic, architectural or archeological significance as defined by NHC or the National Historic Preservation Act of 1966, as amended.

## SOCIO-ECONOMIC/LAND USE

The disposal operations would involve approximately 160 barge trips. This would result in some delays to commercial and recreational boat traffic using the harbor. Construction activities would have a minor adverse aesthetic impact, and result in slightly elevated noise levels. Impacts to the soft-shell clam industry in Winthrop Harbor would have to be protected by appropriate mitigation and control of the silt cloud from disposal.

This site is some fifteen feet deeper than the surrounding area in the channel. Were the site to be filled to match the surrounding harbor bottom, there is not likely to be any permanent impact on the boating activity in the channel. However, the placement of the fill material will clearly affect the boat traffic unless it is carried out in the off-season. Turbidity during placement should be minimized so as not to affect marine life in the adjacent marshes.



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## 2.6 SITE EVALUATIONS: EXISTING AQUATIC DISPOSAL SITES

### 2.6.1 Massachusetts Bay Disposal Site (MBDS)

This site is depicted in Figure A1-21.

#### 2.6.1.1 Existing Conditions

**SEDIMENT CHARACTERISTICS**

The physical properties of the substrate near the disposal point is varying in composition, predominantly sandy silt, reflecting the various harbor dredging projects disposed here. The natural bottom covering the majority of MBDS (i.e. areas of the silt that have not received dredged material) is a fine silt/clay substrate (ACOENED unpublished data). The composition of this natural material indicates the basin is a depositional area capable of containing the dredged material. If sufficient currents frequented this area of the basin, the fine grained material would be suspended and transported with the currents. Areas of high current velocities would therefore have a coarse grained (heavier than silt/clay) substrate, a substrate that is not typical of this basin, but is present in the shallow (approximately 60 meter deep) northeast quadrant of MBDS. This area is a rock/cobble/sand area, at the 60 meter isopleth relief west of Stellwagen Bank.

The EPA (1989) evaluated the sediment composition of the MBDS in their draft EIS to evaluate the continued use of the MBDS. The results of the metals analysis show that metal concentrations in the MBDS are either Class I (low) or Class II (moderate) according to the Massachusetts Division of Water Pollution Control guidelines for dredged material. In general these results were similar to levels found outside the disposal site in Massachusetts Bay: EPA 1989). Petroleum hydrocarbons were detected at a higher level within the MBDS than outside. However, polyaromatic hydrocarbons, a measure of the aromatic fraction of petroleum hydrocarbons was more varied inside than outside the disposal site. Polychlorinated biphenyls (PCBs) levels on dredged material are somewhat higher than ambient levels. PCB levels detected in dredged material in the vicinity of the MBDS are comparable to levels identified in other Massachusetts Bay studies (EPA 1989).

**WATER QUALITY AND CIRCULATION**

The oceanography of MBDS is influenced, in part, by the circulation of the Gulf of Maine. (SAIC 1993). The Gulf of Maine circulation patterns in the vicinity of the MBDS are modified to a large extent by the presence of Stellwagen Bank on the eastern margin of the Massachusetts Bay. The bank interferes with the exchange of water at depth with the Gulf and the shelf beyond. Stellwagen Bank is a popular fishing and whale watching area. This area was designated as a national marine sanctuary on November 4, 1992. The MBDS is located outside the boundary of the Stellwagen Bank national marine sanctuary.

Results of MBDS oceanographic studies indicate the site to be located in a low energy, deep water environment, allowing containment of dredged material within the site. Physical oceanographic studies conducted by ACOENED under the Disposal Area Monitoring System (DAMOS) program as well as those by other investigators have shown that the bottom current velocities at the disposal site are quite low, averaging less than 7 cm/s (Butman 1977; Gilbert 1975; SAIC 1987a and SAIC 1993). This is general agreement with the current data collected for disposal of dredged material at the MBDS from the construction of the CA/T (EA Engineering, Science, and Technology 1992). Occasional higher velocities, near 20 cm/s in a westerly direction, have been observed in near bottom waters in response to easterly storm events that occurred in fall and winter. Near-bottom currents of this magnitude were not

predicted to be strong enough to resuspend sediments at MBDS (EPA 1989).

The temperature/salinity cycle of Massachusetts Bay is characterized by seasonal variability, with maximum temperatures (18°C at surface) typically occurring in a stratified water column during August and September, and minimum temperatures (5°C) typically occurring in an essentially isothermal water column in January and February (SAIC 1987a). Salinity values range from 31-33 ppt (SAIC 1987a).

## AQUATIC RESOURCES

### Benthic Infauna

Sampling of the benthos at the MBDS (SAIC 1986) described three distinct community assemblages as occurring. These assemblages reflect the various sediment regimes within the site.

The northeast section of the site has an unimpacted coarse sand and gravel composition. The benthic community, when sampled in the fall of 1985, was numerically dominated by the Syllidae polychaete *Exogone verugera profunda* (907/$m^2$); the Paraonidae polchaete *Levinsenia gracilis* (350/$m^2$); and the Spionidae polychaete *Prionospio steenstrupi* (313/$m^2$). A total of 105 species averaging 4,433 organisms per square meter were recovered.

Rock from the CA/T project was deposited in the northern section of the MBDS. The rock was placed away from the main disposal activity to allow a benthic community to develop providing prey for finfish.

The western portion of the MBDS has been impacted by continued disposal of dredged material from the greater Boston region. Approximately three million cubic yards of dredged material is disposed in this section of MBDS. This continual disturbance of the bottom maintains the community of benthic organisms in a dynamic equilibrium. The most adaptable species proliferate. Those species that reproduce rapidly and have high numbers of offspring (i.e., larvae) colonize the newly disposed dredged material (r-strategists of classical ecology) and biogenically rework the substrate. Given time, this pioneering community would alter the sediment character and allow a more mature community to develop. The frequent disposal activity maintains the resident population of the disposed material area as a pioneering sere. This assemblage at MBDS was dominated (in fall 1986) by oligochaetes (6,293/$m^2$); the Spionidae polychaete *Spio pettibonae* (4,607/$m^2$); the Cirratulidae polychaete *Chaetozone setosa* (2,160/$m^2$); and the Capitellidae polychaete *Metiomastus ambiseta* (1,757/$m^2$). A total of 78 species averaging 25,467 organisms per square meter were recovered.

The southeastern section of MBDS has an unimpacted silt/clay sediment make-up. The lack of physical disturbance (burial) by disposal of dredged material has allowed a mature benthic assemblage to become established. Interspecific competition within a mature community results in a presence of considerably lower densities of individuals (e.g. 8,390/$m^2$) than found in continually disturbed habitats (e.g. 25,467/$m^2$). The undisturbed southeastern section of MBDS was dominated by the Paraonitae polychaete *Levinsenia gracilis* (1,583/$m^2$); oligochaetes (1,050/$m^2$); and the Capitellidae polchaete *Mediomastus ambiseta* (693/$m^2$). The fall 1985 sampling in this section of MBDS recovered a total of 57 species averaging 8,390 individuals per square meter.

The August 1990 bathymetric and REMOTS sediment profile surveys conducted at MBDS confirmed that the dredged material formed a deposit one meter high at the mound center (SAIC 1993). Despite the large amount of material (over 340,000 cubic yards) deposited at the site since November 1988, the REMOTS photography indicate a steady recovery of the benthic ecosystem. This was indicated by steady increase in Stage III taxa (large burrow-

ing deposit feeders, i.e. climax community) (SAIC 1993).

## Finfish

Various finfish species have been collected within the MBDS (SAIC 1986, SAIC 1985, EPA 1989). In the spring of 1985, the spiny dogfish *Squalus acanthias* was the dominant finfish recovered. This species migrates seasonally in large schools. Those sampled at MBDS were found to be feeding on flounder, sculpin, and anemones. Fall 1985 finfish collections were dominated by the witch flounder or grey sole *Glyptocephalus cynoglossus* and the dab or American plaice *Hippoglossoides platessoides*. The former was found to be foraging on polychaetes (e.g. *Chaetozone* sp.; *Spio* sp.; *Sternapsis* sp. and *Tharyx* sp.). The latter was found to be foraging on brittle stars (Ophiuroidea). Other important species include redfish, ocean pout, cusk, and Atlantic wolffish. Silver and red hake are abundant, commercially important seasonal migrants.

## WETLAND RESOURCES

There are no protectable wetland resources subject to federal or state jurisdiction at MBDS.

## WILDLIFE

Approximately 35 species of marine mammals, 5 species of marine turtles and 40 species of seabirds occur within the Gulf of Maine. Aerial surveys were conducted for the ACOE to assess the use of the Massachusetts Bay Disposal Site (MBDS) by marine mammals, reptiles and seabirds (MBO 1987).

Seabirds observed include northern fulmar (*Fulmanus glacialis*), shearwater (*Puffinus* sp.), storm petrels (Hydrobatrae), northern gaument (*Sila bacsaus*), Pomarine jaeger (*Steriovarius pomarinum*), gulls (Larinae) and Alcids (Alcidae). Dominant nonendangered mammals include minke whale (*Belasnoptera acutorostrata*), white-sided dolphin (*Lagenorhynchus acutus*), and harbor porpoise (*Phocena phocena*). Although five species of turtles potentially could occur on Massachusetts Bay, only the leatherback turtle (*Dermochelys coriacea*) is typical in the area.

## THREATENED AND ENDANGERED SPECIES

MBDS is located in Massachusetts Bay, an area known to be utilized by various marine mammals, but outside (just west of) the boundaries of the Stellwagen Bank national marine sanctuary. Endangered whale species are known to congregate above the shallow (30 meter) Stellwagen Bank (U.R.I. 1981) when foraging for prey (e.g. sand lance *Ammontytes americanus*). These species also have been observed within the two nautical mile circular boundary of the MBDS. Endangered species identified as transients of MBDS include the finback whale *Balaenoptera physalus*; the sei whale *Balaenoptera borealis*; the humpback whale *Megaptera novaeangliae* and possibly the northern right whale *Eubalaena glacialis* (MBO 1987). The impact of the use of the MBDS on endangered species is currently being assessed by the ACOE NED. Use of the site to date has not indicated any impact to threatened or endangered species. Full coordination with the NMFS ensures compliance with the protection of endangered species and their habitats.

Cetaceans are transients of the disposal site, but are not likely to be to impacted by ocean disposal. Some threatened or endangered turtles (i.e., leatherback, Kemp's ridley and loggerhead) have been recovered in this region as well. If any transient endangered species entered the area during the project operation, they should be able to avoid the dredging or disposal activity. Disposal of dredged material at the MBDS is not expected to have an adverse impact

on endangered species, their prey, or the habitat essential for their survival. Consultation with the NMFS under Section 7 of the Endangered Species Act of 1973 (as amended, 16 U.S.C. 1531 et seq), has been initiated to ensure this activity will not jeopardize any endangered or threatened species.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

The MBDS has been used for disposal of dredged material since the 1940's. No historical or archeological resources are expected to occur at the site. Consultation by EPA during the designation of the MBDS with the Massachusetts Board of Underwater Archeology report that no known historical shipwrecks exist at or near the site.

## SOCIO-ECONOMIC/LAND USE

MBDS is an active disposal site that has been in use for several decades. Extensive shipping, fishing, recreational activities, and scientific investigations take place in Massachusetts Bay year around. There are no known interferences from disposal events on these activities (EPA ROD 1993). In addition, the availability of the MBDS for the vast majority of sediments from Boston Harbor provides an engineering, social, environmental, and economic solution for the disposal of such a large amount of material.

### 2.6.1.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

MBDS has been extensively studied by the ACOE NED. Precision bathymetry, sediment grab sampling and REMOTS image analysis (sediment profiling) have characterized this site as a low energy environment suitable for dredged material disposal and containment. Additional oceanographic sampling has been conducted to designate MBDS as an ocean dredged material disposal site.

The MBDS is the only U.S. EPA designated dredged material disposal site in the Boston Harbor/Massachusetts Bay area. This site annually receives approximately 300,000 cubic yards of dredged material with the exception of this project. However, this figure is expected to decrease for two reasons. First, more stringent biological testing for open water disposal of dredged material means more material will not be acceptable for open water disposal. In addition, the recent designation of the MBDS by EPA states that no capping of unsuitable material is allowed at the MBDS until it can be demonstrated that capping can isolate unsuitable material from the benthic community. Until this can be demonstrated to the satisfaction of the EPA and other appropriate agencies, capping would not occur. Since much of the silt material dredged from the Boston Harbor area is unsuitable, this site would be used primarily for parent material. The ACOE NED has successfully completed many capping projects in New England and believes capping is a viable option at the MBDS. Although no capping of unsuitable material will occur for the Boston Harbor navigation improvement project at the MBDS, questions raised by EPA about capping are addressed in Appendix F. Future use of the site may be considered if the efficacy of capping can be demonstrated.

Approximately 2.0 million cubic yards of dredged material (parent material) could be disposed at the MBDS. The material dredged from the proposed channels will be placed on barges and transported (approximately 1500 trips) to MBDS. The disposal will occur by bringing the barge to a complete stop at the predescribed point. This disposal point will be marked by a buoy positioned by the ACOE NED. The discharge will occur in approximately 100 meters of water.

## WATER QUALITY AND CIRCULATION

A turbidity plume will be created by the disposal of the dredged material. During descent, some of the fine-grained sediment separate from the plume and remain in suspension. The amount of material that is dispersed in the disposal plume is dependent upon the physical characteristics of the sediment, the volume of material disposed, and method of disposal, and typically ranges from 3 to 5% (WES 1986).

Recent studies (SAIC 1985) concluded that the concentration of suspended materials in the turbidity plume, following disposal, will be no greater than 5 to 12 mg/l forty minutes after disposal. These studies were conducted at the MBDS with hydraulically dredged material disposed in 100 meters of water. This method of dredging mixes the sediment with water to form a slurry. The disposal of this mixture represents the maximum possible suspension of material. The bucket dredging technique to be used for this project will maintain the disposal sediments in a cohesive mass, greatly reducing turbidity potentials.

Dredged material which settles on the bottom at MBDS can be expected to remain in place. Near bottom currents are low, averaging less than 7 cm/s (EPA, 1989). Resuspension from storm events is rare and typically results in resuspension of only 4% of the surficial material.

As the material descends through the water column, some of the chemicals adsorbed to the fine particulates may be eluted from the dredged material. The concentration values in the turbidity plume will be considerably less than the bulk chemistry concentrations in the dredged material, since most of the material will remain consolidated. Due to the low natural levels of metals and other chemicals in the clay, the water quality impact, if any, will be contained within the disposal site. EPA determined that water quality impacts from disposal events are temporary and limited to the period immediately following the disposal (EPA 1989).

Recent studies (EPA 1993) for the MWRA offshore outfall impacts evaluated water quality impacts at MBDS from the BIINIP, using the ADDAM's model with input assumptions and data from this study. In that report, EPA found no water quality criteria exceedences outside the mixing zone (disposal site) for the MBDS after four hours.

Physical parameters such as currents, waves, and tidal circulations have been closely monitored for the site (SAIC 1985). This area has contained dredged material on site and does not disperse sediment or chemicals to affect ambient environments. In general, the proposed disposal of an estimated 1.8 million cubic yards of material dredged from the project area will not significantly impact the disposal site given its physical, chemical and biological characteristics and general history of use.

## AQUATIC RESOURCES

### Benthic Infauna

The disposal site has been used for dredged material disposal for a number of years. Disposing sediments at site buries the organisms inhabiting the impact area. This burial process has been of sufficient frequency at MBDS to maintain a disturbed environment at the point of disposal. A specialized population of benthic species have successfully exploited this disturbed niche and rapidly provide biomass and bioturbation to the newly disposed material. These pioneering organisms are already established on the disposal site (SAIC 1985) and their action can quickly rework the newly deposited sediments. The disposal of dredged sediments would bury non-motile and larval/juvenile organisms at MBDS. The same pioneering species can quickly inhabit the newly disposed material by larval and adult recruitment. The overall process of maintaining

a disturbed habitat would provide a productive benthic environment for organisms that rework the substrate. This biological mining of the substrates (bioturbation) homogenizes and oxygenates the upper few centimeters of the sediment. This can allow other organisms to begin inhabiting the substrate (colonization). Larvae settle and metamorphize and adults emigrate into the area, all contributing to restore benthic productivity.

### Finfish

Disposal of dredged material will have a temporary impact on finfish at the site. Adverse impacts to individual organisms could occur but are not expected to be substantial considering the mobile nature of fish. Temporary impacts are expected to come from the temporary loss of benthic species for foraging. Due to the already disturbed nature of the site and the quick recolonizing ability of benthic organisms recovery should occur in the short-term. Any changes to in benthic community structure should be localized and with respect to fisheries resources on a baywide basis.

## WETLAND RESOURCES

Since there are no regulated federal or state wetland resources associated with MBDS, no impacts will occur.

## WILDLIFE

No impacts are anticipated to the existing wildlife at MBDS.

## THREATENED AND ENDANGERED SPECIES

Several endangered whale and turtle species can occur in the Massachusetts and Cape Cod Bays. Endangered whale species have been observed within the two nautical mile circular boundary of the MBDS. The impact of the use of the MBDS on endangered species is currently being assessed by ACOE NED. Use of the site to date has not indicated any impact to threatened or endangered species. Full coordination with the NMFS ensures compliance with the protection of endangered species and their habitats.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

No impacts are anticipated, since no historical or archeological resources of record exist at MBDS.

## SOCIO-ECONOMIC/LAND USE

Since MBDS is an active dredge material site, no additional impacts are expected to site usage or commerce than may presently exist.

## 2.6.2 Boston Lightship Disposal Site (BLDS)

The site is depicted on Figure A1-21.

BLDS is a historic area for dumping of various materials (e.g., barrels). Therefore, prior to any disposal of dredge materials at BLDS, surveys to determine where, if any, barrels occur in the disposal site, and hydrographic surveys of the area are needed to determine if the site is stable. BLDS is an area for which previously collected sidescan sonar records are being analyzed by the United States Geological Survey to map acoustic patterns and related sedimentary environments (Butman et al. 1992).

### 2.6.2.1 Existing Conditions

#### SEDIMENT CHARACTERISTICS

Information collected under the DAMOS (1979a) program indicate that the heavy metal content of the sediments collected from the disposal site were among the highest found in the study between the two Massachusetts Bay Disposal sites. Even still, comparison of the sediment chemistry results with the Massachusetts Dredged Material guidelines show that the metal concentration would be classified as Class I (low).

#### WATER QUALITY AND CIRCULATION

Water quality and circulation conditions at BLDS are presumed to be similar to those at MBDS. Both the MBDS and Boston Lightship are reported to have extremely weak tidal current but could be subject to some wave motion (DAMOS, 1979).

#### AQUATIC RESOURCES

##### Benthic Infauna

A summary of the benthic species collected at BLDS in December of 1977 and May of 1978 indicate a smaller number of individuals and species than at other disposal sites located in the Gulf of Maine (DAMOS 1979b). Dominant benthic species include the polychaetes *Sternapsis scutata*, *Nepthys incisa*, *Maldane sarsi*, *Lumbrineris fragilis*, *Ninoe nigrippes*, *Goniada maculata*, *Ampharete acutifronons*, nemertean worm *Micrura* sp., burrowing anemone *Edwardsia elegans*, and the amphipod *Hippomedon serratus* (DAMOS 1979a).

Mussels (*Modiolus modiolus*) were deployed at BLDS in 1978 to monitor temporal and spatial variations in ambient metal and other chemical concentrations in the sediments (DAMOS 1979b). Results indicated that the mussels at BLDS had metal concentrations which approximated those in animals at Halfway Rock, a reference site. Data indicates that the reference population at Halfway Rock, being closer to terrestrial sources of contamination, is probably exposed to similar or higher concentrations of some trace metals than the mussels held at the disposal site (DAMOS 1979b). However, subsequent samples taken from both the reference and disposal site showed increases of the disposal site concentrations over those of the reference station.

##### Finfish

The Massachusetts Bay area is a productive fishery habitat. Fish reported to occur in the area of the disposal site include cod, dab and gray sole, yellowtail flounder, whiting, Atlantic herring are caught near the vicinity of the Boston Lightship and the MBDS (DAMOS 1979a). Lobster and ocean quahogs are also reported in the area.



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## WETLAND RESOURCES

There are no protectable wetland resources subject to federal or state jurisdiction at BLDS.

## WILDLIFE

Wildlife, including great cormorant (*P. carbo*), herring gull (*L. argentatus*), white winged scoter (*M. deglandi*), common goldeneye (*B. clangula*), bufflehead (*B. albeola*), mallard (*A. platyrhynchos*), black duck (*A. Rubripes*), merganser (*Mergus* spp.) and scaup (*Aythya* spp.) are likely to intermittently utilize BLDS for feeding and resting. Each of these species feed on fish and invertebrates (Martin et al. 1951; Whitlatch 1982; DeGraaf and Rudis 1986) that occur in the area.

## THREATENED AND ENDANGERED SPECIES

BLDS is located in Massachusetts Bay, an area known to be utilized by various marine mammals, but outside the boundaries of the Stellwagen Bank national marine sanctuary. Cetaceans are transients of the disposal site, but are not likely to be impacted by ocean disposal. Endangered whale species are known to congregate above the shallow (30 meter) Stellwagen Bank (U.R.I. 1981) when foraging for prey (e.g., sand lance *Ammonytes americanus*). Endangered species presumed to be transients at BLDS include the finback whale *Balaenoptera physalus*; the sei whale *Balaenoptera borealis*; the humpback whale *Megaptera novaeangliae* and possibly the northern right whale *Eubalaena glacialis* (MBO 1987). Threatened or endangered turtles could transit this area as well. The impact of the use of Boston Lightship on endangered species is currently being assessed by ACOENED. Boston Lightship is further removed from the prime threatened and endangered species habitat at Stellwagen Bank. Use of the site to date has not indicated any impact to threatened or endangered species. Full coordination with the NMFS ensures compliance with the protection of endangered species and their habitats.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

BLDS has historically been used for disposal of dredged material. No historical or archeological resources are expected to occur at the site.

## SOCIO-ECONOMIC/LAND USE

Extensive shipping, fishing, recreational activities, and scientific investigations take place in Massachusetts Bay year round. There are no known interferences from disposal events on this activities (EPA ROD 1993). In addition, the availability of the BLDS for the vast majority of sediments from Boston Harbor provides a potential solution for the disposal of large amounts of dredged material.

### 2.6.2.2 Environmental Consequences

## SEDIMENT CHARACTERISTICS

The BLDS is an historical disposal site located approximately 16 nautical miles from Boston Harbor. BLDS was closed to disposal activities in 1977. The amount of specific site information regarding Boston Lightship is limited. Several studies conducted by the EPA to determine if barrels containing radioactive or other material have been disposed in the area. Studies conducted by the U.S.G.S for the MWRA outfall pipe have been conducted in the vicinity of Boston Lightship to determine sediment and currents in Massachusetts Bay.

Disposal of dredged material should not impact a previously unused site. The material disposed at BLDS came from Boston Harbor and possibly



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surrounding areas. Therefore the chemical signature in the site sediments should be similar to the dredged material.

Capping with parent material could be a viable management option for disposal of silt sediments from Boston Harbor. An argument against disposal at the MBDS is that capping has never occurred at the depth of 80 to 100 meters. The depth at BLDS (60± meters) is similar to the depths at the Portland Disposal Site. Capping has been used successfully at this site for many years (DAMOS 1990).

## WATER QUALITY AND CIRCULATION

A turbidity plume would be created and some chemical would elute into the water column. Sediment disposal simulations for BLDS site using the ADDAM's model, showed that four hours after a 2,000 cy dump that water quality criteria for copper were not exceeded outside the disposal site's boundary (Table A1-11). Since this was true for the summer (stratified) condition, it would be safe to assume it would hold for winter (unstratified) conditions as well. Within the site, soluble copper concentrations in the water column were also estimated to not exceed water quality criteria. After a four hour period the silt/clay cloud was estimated to have a diameter of 2738 feet; silt/clay concentrations within that cloud were estimated to be less than. 8 mg/L (TSS background of 4.5 mg/L + 3.4 mg/L silt/clay). The total volume of silt within the cloud was estimated at 30 cy of solids which would be equivalent to about 3.3% of the initial dump volume (solids plus water). These results indicate that risks to marine resources should be minimal since water quality criteria are met after two hours both within an.d outside the dump site.

Prior to the disposal of dredged material from Boston Harbor, site specific hydrodynamic studies would need to be conducted to verify the DAMOS and USGS studies that show the area is a low energy area, capable of retaining the material in place. Recent studies by Knevel (1993), however, indicate there is such a (depositional) area in the southwestern portion of BLDS along the 50-m contour.

## AQUATIC RESOURCES

### Benthic Infauna

Since BLDS has not been used for disposal for several years, it is possible that the benthic structure may have reached or be near a climax community. Disposal of new material would impact this benthic community and replace it with a pioneering community.

### Finfish

Impacts to finfish would be similar to the impacts described for the MBDS.

## WETLAND RESOURCES

Since there are no regulated wetland resources at BLDS, there will be no impacts.

## WILDLIFE

No impacts are anticipated to the existing wildlife usage at BLDS.

## THREATENED AND ENDANGERED SPECIES

Cetaceans may transient the disposal site, but are not likely to be to impacted by ocean disposal. This area is about 9 nautical miles west of the Stellwagen Bank; and thus sufficiently removed from their main area for feeding and congregating so that problems



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from disposal activities should not occur. Disposal of dredged material at BLDS is not expected to have any substantial adverse impact on endangered species, their prey, or the habitat essential for their survival. Consultation with the NMFS under Section 7 of the Endangered Species Act of 1973 (as amended, 16 U.S.C. 1531 *et seq*), has been initiated to ensure this activity will not jeopardize any endangered or threatened species.

## HISTORICAL AND ARCHEOLOGICAL RESOURCES

BLDS is in an area deemed "sensitive" by the Board of Underwater Archeological Resources because of the number of shipwrecks that have occurred there over time or because historic disposal sites may contain material of archeological interest. However, discussion with the staff of the Board suggests there may not be resources at the specific disposal site. This will be confirmed by the staff upon review of the Board's files about the proposed sites.

## SOCIO-ECONOMIC/LAND USE

BLDS is an inactive disposal site. Extensive shipping, fishing, recreational activities, and scientific investigations take place in Massachusetts Bay year around. There are no known or anticipated interferences from disposal events at this site. The use of the site could provide a solution for the disposal of large amounts of unsuitable material by capping and sequestering the contaminants.

## 3.0 ENVIRONMENTAL EVALUATION - DREDGING SITES

### 3.1 OTHER PROJECT CONSIDERATIONS

The majority of the environmental and socio-economic information concerning Boston Harbor, and the areas to be dredged for the navigation improvement project, are discussed in EIR/S Section 2.0 and 4.0. Therefore, only additional information is covered here.

Besides the navigation improvement project, a 9.5 mile long sewage outfall tunnel currently is being constructed from Deer Island underneath the seafloor into Massachusetts Bay for the MWRA project. Completion of the outfall pipe is expected in 1995. The Third Harbor Tunnel will cross the main ship channel from South Boston to Logan Airport in East Boston. Dredging for the tunnel was completed in 1993. Placement of the tunnel sections for the Third Harbor Tunnel was completed in 1993. In addition barge traffic will be hauling dredged and excavated materials removed from the Central Artery to Spectacle Island.

Interference between construction of the above two projects and the associated dredging of the navigation improvement project is not expected to occur. Construction of the navigation improvement project is not expected to begin until 1996. No interference with the MWRA project is expected. Barge traffic from this project is expected to be minimal. Potential disposal site locations would not interfere with the construction of the outfall tunnel.

Deepening the Federal channels may involve relocating buried utilities. The deepening in the Chelsea River was limited due to the expense involved with relocating the gas siphon. Utilities that were identified include a powerline running generally down the center of the Reserved Channel, telephone cable across the Inner Confluence, a water tunnel, electrical cable and bridge cables across the lower Chelsea River and two water tunnels, a sewer siphon, a gas siphon, electrical cable and fire alarm cable across the upper Chelsea River. The following table lists the known utilities and expected depths.

In most cases, the utilities will be relocated by burying them deeper under the channel. The gas siphon is a special case and will have a protective layer of rip-rap placed over the line rather than actually relocating the siphon.

The deepening of three harbor tributaries will require particular care to avoid damaging utilities crossings. During November 1992 field data were collected using side scan sonar and an array of geophysical instruments which enhanced existing knowledge of buried utilities. While the information obtained does not precisely locate the depth of utilities, it does show either the trench or changes in bottom material densities indicating existence of trench excavation and fill. This information has not been published yet, but some data are currently available.

The berthing areas and bulkheads adjacent to the navigation channels will be investigated to ensure that dredging a deeper channel will not undermine the integrity of the bulkheads.

### 3.2 EXISTING CONDITIONS - ENVIRONMENTAL RESOURCES

#### 3.2.1 Water Quality

The dominant currents in the harbor are tidal in origin, although wind driven currents occur during storms. Freshwater discharges from the Mystic, Charles, and Chelsea Rivers generally overlie the more dense seawater flows from the tides. Freshwater flows average 350 to 500 cubic feet per second (CFS) in the summer. Tidal input is several orders of magnitude greater than freshwater input. Tidal flows



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average 320,000 cubic foot per second (CFS) for a six hour period with volumes ranging from 10.6 billion gallons at low tide to 179.9 billion gallons at high tide (Metcalf and Eddy, 1976, and MDWPC, 1986). Approximately 73.3 billion gallons are exchanged through three channels linked with the President Roads area and one channel linked with Nantasket Roads. In addition, 265 million gallons per day of waste water is released into the harbor system from the Boston regional wastewater treatment plant on Deer Island.

The average tidal range in Boston Harbor is 9.5 feet with spring tidal ranges often in excess of 11 feet. Average current velocities for the Inner Harbor are less than 0.5 knots. Tidal currents in other portions of the harbor vary greatly in speed because of the irregular bottom topography and the large number of islands (Knebel, et.al., 1991). In general, maximum near-bottom current speeds are greatest ( > 10 knots) in constricted channels and depressions, are intermediate (3-6 knots) at locations sheltered by islands and points of land, and are weakest ( < 3 knots) over the shallow subtidal flats (Bumpus, et.al., 1951; U.S. Coast and Geodetic Survey, 1953; Mencher, et. al., 1968; National Ocean Survey, 1977; Signell and Butman, 1990; IN Knebel, et.al., 1991). Maximum current velocities during spring tide in the areas to be dredged are as follows: 0.1 knots in the Mystic River, 0.2 knots in the Chelsea Rivers and 0.7 knots in the Main Ship Channel vicinity (N.O.A.A., 1986).

The quality of water in Boston Harbor has been the target of considerable expenditures of Federal, State and private funds. For the most part, raw sewage and untreated industrial discharges are being rectified by the Massachusetts Water Resources Authority (MWRA) under a court order aimed at cleaning-up Boston Harbor. A new primary sewage treatment plant is currently under construction on Deer Island, including relocation of the ocean outfall from the island to nine miles offshore. The construction of the first battery of secondary treatment upgrades is to begin shortly. Disposal of sewage sludge into Boston Harbor ceased in 1992. This has resulted in a rapid and measurable increase in water quality (MWRA, 1993). Water quality is expected to improve further when the secondary treatment facility on Deer Island is in full operation in the year 2000 (MWRA, 1993). The history of contamination from these and other sources in Boston Harbor can be found in the harbor sediments.

Water quality in Boston Harbor has been found to vary both spatially and temporally. The data contained in Table A1-12 is in general a seasonal summary of previously available data. A more recent data set for June through October 1985 (MDWPC, 1986 and N.England Aquarium, 1990) is also within the ranges listed on this summary table.

Barring localized effects around thermal outfalls from power generating stations, the temperature regime in the harbor is under normal climatic and estuarine controls. The enrichment level in the outer harbor is generally considered to be at a mesotrophic scale without excessive primary production (National Commission on Water Quality, 1976). The inner harbor is also enriched from combined sewer outflows and the high level of nutrients in the river system feeding the harbor.

| UTILITIES | DEPTH (MLW) |
|---|---|
| MWRA Water Tunnel (McArdle) | 38.5 |
| N.E. Telephone Cable | 45.0 |
| Boston Edison Electrical Cable | 40.0 |
| City of Boston Bridge Cable (McArdle) | 45.0 |
| City of Boston Fire Alarm Cable | 45.0 |

| UTILITIES | DEPTH (MLW) |
|---|---|
| MWRA Water Tunnel (to be removed) | 35.1 |
| MWRA Sewer Siphon | 50.8 |
| MWRA Water Tunnel | 45.0 |
| Boston Gas Siphon | 40.3 |
| MBTA Electrical Cable | 40.0 |

Vertically averaged dissolved oxygen levels (MDWPC, 1986) exhibit low values ranging as low as 4.5 ppm in the project area. These values represent summer biological activity in conjunction with organic enrichment of the ecosystem. Oxygen depletion is a substantial problem in many estuaries during times of thermal stratification of the water column. The strengthening and deepening of the water column thermocline limits the circulation and oxygen exchange in the nearbottom waters. As temperatures peak (often in August), available dissolved oxygen levels decrease and cause a corresponding depression in biological activity at the sediment water interface. This "August Effect", as it is commonly referenced, is a major environmental factor in structuring biological communities in the project area.

The Massachusetts Water Resources Authority (MWRA) and the New England Aquarium have measured dissolved oxygen throughout Boston Harbor. MWRA (1992) measurements of bottom waters in the Inner Harbor frequently show DO below the standard 5.0 mg/l, with occasional measurements below 2 mg/l. Low oxygen conditions are much rarer in surface waters, and tend to occur in restricted channels with high combined sewer overflows (CSO) input, such as Fort Point Channel and the Reserved Channel (MWRA, 1992). Dissolved oxygen in the outer harbor and Dorchester Bay measured by MWRA and the Aquarium monitoring programs are nearly always above the 5 mg/l standard for Class SB waters. The water chemistry of the project area, in particular the organic load and its subsequent chemical oxygen demand, is a substantial factor in the ecology of Boston Harbor.

Salinity data indicate the outer harbor is well mixed, while the various regions of the inner harbor are under the influence of freshwater inputs. Essentially, the mouth of the harbor is considered stenohaline and the Inner and Outer Harbor areas are euryhaline. Oil pollution has created problems in many harbor areas and a permanent oil boom is maintained at the mouth of Chelsea Creek to protect the remainder of the harbor from potential spills in the main tanker terminal areas.

Coliform bacteria counts have been collected by several agencies for several decades. Bacterial counts have decreased 10 to 100-fold over the past 50 years in the inner harbor, near Deer Island, Nut Island, Governors Island, President Roads, Nantasket, Moon Head, and Dorchester Bay (MWRA, 1992).

These improvements are related to the construction of treatment plants. Bacterial counts in the inner harbor are lower in the 1980s compared to the 1960s. The extreme violations of fecal coliform water quality measured near Deer Island by the New England Aquarium have not been found since 1988, and water quality near Nut Island has been good since 1987. This improvement in offshore bacterial water quality has been associated with more reliable chlorination of the wastewater treatment plants (MWRA, 1992).

Water quality in the outer harbor varies greatly. In 1989 and 1990, MWRA sampling showed that Carson Beach, Pleasure Bay and Northern Dorchester Bay generally met water quality standards. Samples taken near Calf Island in the outer harbor were all within swimming standards. Southern Dorchester Bay, at the mouth of the Neponset River, generally showed poorer water quality. This area is affected by the Neponset River, storm drains outflow, CSOs and possibly sludge. Samples collected at Dorchester Bay beaches in 1991 by MDC indicate a decrease in the number of postings at the two beaches in Southern Dorchester Bay; Tenaean and Malibu. The decrease in postings at these areas can probably be attributed to the operation of new disinfection facilities at Fox Point and Commercial Point sewer outfalls.

In Boston Harbor productive clam beds cover about 4,700 acres (Figure A1-22) (MWRA 1992). None of these beds are open for recreational clamming because sewage indicator bacteria counts are too high (MWRA, 1992). About 2,900 acres of clam beds are restricted to harvesting only by "master diggers". These licensed diggers must take all clams harvested to a depuration facility, where the shellfish are held in clean water for two days to cleanse themselves of bacteria.

The Massachusetts Division of Marine Fisheries monitors shellfish growing water as well as the clams themselves for bacteriological safety. Some areas of Boston Harbor, especially in Quincy Bay and Hingham Bay, are often conditionally opened, while other areas, like Dorchester Bay, are virtually never open (MWRA, 1992). Clam beds in the inner harbor are prohibited from harvest.

Levels of trace metals in the inner harbor have been related to the sewage discharges, CSO's, urban runoff, and the metals contributed by the major rivers. In the outer harbor, higher levels of metals have been found around the sewage outfalls. The U.S. Environmental Protection Agency has developed water quality criteria designed to protect aquatic organisms from the adverse effects of environmental contaminants. Boston Harbor generally meets the water quality criteria for toxic contaminants (MWRA, 1992). There has been a four-fold decrease in the amount of metals discharged to the harbor by the MWRA between 1981 and 1991. Results of bioaccumulation results conducted by MWRA (1992) in 1991 and other studies indicate or suggest that improvements in MWRA discharges are being reflected in improvements in water quality. Although the quality of discharge from MWRA treatment plants is improving, and is expected to improve, various levels and types of contaminants are still released into the aquatic system. These discharges combined with riverine and direct urban runoff represent a degradation of the Boston Harbor water quality.

### 3.2.2 Sediment Characteristics

#### General Site Environment

The United States Geological Survey (USGS) currently is conducting studies in Boston Harbor, Massachusetts Bay and Cape Cod Bay to define the geological framework of the region and to understand the transport and accumulation of sediments (Butman, et.al., 1992). One of the goals of the USGS study is to develop a sediment data base. The levels of contaminants vary throughout the harbor predominantly depending on hydrology and substrate type.



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In general, metal and organic levels are relatively high in the Inner Harbor and decrease seaward. The surficial sediments represent fine grained material with associated chemicals deposited since the area was last maintained. The results of the chemical sampling reflect the normal sedimentological trends of increased chemical levels with those substrates of higher total organic carbon and silt-clay content (Boehm and Farrington, 1984). The Mystic River (sampling stations A and B) exhibited the highest contaminant levels and was also the most recently dredged. The material accumulated at these stations represents the highest levels in the harbor, apparently derived from the Mystic River drainage area. In contrast, the least contaminated material in the harbor is also found in the Mystic River at Station C. This station is typical of the pristine lean clay layer of the deeper sediments without deposition of a recent silt/clay overburden.

An acoustic impedance survey of the Federal channels to be dredged was performed by ACOE in November 1992. This survey was conducted to locate and determine the amount of silt (maintenance layer), clay, and rock. This survey was also used to assist in locating utilities.

Upland Disposal Testing

The Massachusetts Department of Environmental Protection requires information on additional parameters (total petroleum hydrocarbons) and toxic characteristic leaching procedure (TCLP) in order to evaluate the suitability of dredged material for upland disposal. Chemical testing was also performed for sodium and chlorides at the request of the interagency work group members and because both sodium and chloride can have an impact on ground water if the sediment is disposed of upland and leaching occurs (at unlined sites).

The averages for total petroleum hydrocarbon (TPH) concentrations and Total Organic Carbon (TOC) for all sites tested are presented in Table A1-13. The highest average concentrations of TPH was found at the Mystic Pier 1 site and the lowest average concentration of TPH was found at the Conley 11-13 site. The highest average concentration of TOC occurred at Edison Barge Intake and Edison Barge Berth (13.0% and 10.2% respectively) and the lowest average concentration of TOC occurred at the Gulf Oil site (1.7%).

Toxic characteristic leaching procedure (TCLP)

If the bulk chemical concentration in the sediment tested equaled or exceeded the Massachusetts Department of Environment bulk soil concentration for TCLP analysis, then there is a mathematical chance that the TCLP test could exceed threshold limits. In order to know if the parameter of interest would exceed the EPA regulatory limit, a TCLP test must be performed in order to verify if the sediment has hazardous characteristics. Only chromium and lead exceeded the mathematical thresholds for requiring TCLP analysis. Table A1-14 is a summary of the Massachusetts DEP Bulk Soil Concentration limits along with the lead and chromium bulk and TCLP concentrations in relation to the regulatory limits. In all cases the TCLP results were orders of magnitude below the regulatory levels. Therefore, none of the sediments to be dredged in Boston Harbor show hazardous characteristics.

Table A1-15 shows the concentration of sodium and chloride found at each site tested. The highest concentration of sodium occurred at Eastern Minerals (40140 mg/kg) and the Mystic Piers had the highest percent of chloride (2.0%).

### 3.2.3 Biological Resources

In July and November 1986 benthic biological sampling was conducted at thirteen (13) stations in the proposed dredging area. Finfish samples and

water column parameters were also obtained at various locations. In general, the benthic population in Boston Harbor is described below, based on results from thirteen (13) stations randomly located throughout the project area and sampled in two seasons. The sampling program used a 0.04m Van Veen grab and screened samples through a 0.5mm sieve. Additional details can be found in the 1988 Environmental Assessment.

All three tributaries of the Boston Harbor navigation improvement project contained on average a high number of organisms per square meter (4,798; S.D. = 8623.2) in July. The average number of species recovered in July was eight (S.D. = 8.4). The dominant organisms were the polychaetes *Capitella capitata* (54.8 %, S.D. = 28.3); *Polydora ligni* (15.3%, S.D. = 7.1); and *Polydora aggregata* (12.3%, S.D. = 11.7).

The inner harbor rivers and the Reserved Channel undergo remarkable reductions in densities between seasons. Theoretically, a population can rebound from nearly an azoic state (induced by low dissolved oxygen levels) through adult recruitment. Between July and November, a statistically significant ($p < 0.005$) reduction in benthic population densities and diversity occurred. The November population contained on average a much lower number (29; S.D. = 71.5) of organisms per square meter and number of species (0.4; S.D. = 0.7). The dominant organisms were the polychaetes *Polydora ligni* (20.0%; S.D. = 11.5); *Streblospio benedicti* (17.9%, S.D. = 16.8); the shore shrimp *Crangon septemspinosa* (11.0%, S.D. = 19.0); and the amphipod crustacean *Ampelisca abdita* (6.7%, S.D. = 11.5).

This tremendous reduction in benthic productivity is not uncommon in urban estuaries where the cumulative effects of high organic load, vessel wakes, increasing water temperature, reduced wind mixing, and increased water column stratification combine with microbial activities that peak in late summer to reduce dissolved oxygen levels. The dissolved oxygen stress is often severe enough to eliminate non-motile benthic populations -- the so-called "August effect".

Given the cyclic (annual) nature of low dissolved oxygen levels in Boston Harbor, the benthic inhabitants are well adjusted to colonizing and recolonizing azoic substrates annually. This type of pioneering species assemblage can be expected quickly to recolonize a dredged area with minimal disruption in benthic productivity.

The polychaetes *Capitella capitata* and *Streblospio benedicti* are the dominant benthic organisms present in the project area. Both of these species are tolerant of physical and chemical stresses that are characteristic of urban harbors such as Boston. Each of these species are "r - strategists," i.e. species whose life history is characterized by small body size, short generation times and high reproduction (r) rate (Grassle and Grassle, 1984). *Capitella capitata* has shown generation times as short as three weeks (Tenore and Chesney, 1985). These life history attributes allow the proliferation of this species within the project area on a cyclic basis. High densities of *Capitella capitata* were found in July but not in November. This cycle of proliferation and die-off keeps the benthic population in a state of dynamic equilibrium. Project areas which were azoic in both sampling periods may have a sufficient additional stress of sulphidic or petroleum compounds accumulating in the substrate so that it is intolerable to even these species (James and Gibson, 1980). This cycle of recolonization by the benthos can be expected to allow rapid biogenic reworking and recolonization of the newly exposed clay layers in the post dredging phase.

The soft shelled clam *Mya arenaria* is the most common commercial shellfish within the Boston Harbor area. Blue mussels *Mytilus edulis* and duck clams *Macoma balthica* are also found in shellfish beds but are not harvested. Densities of shellfish beds have been documented by Jerome et al. (1966), Chesmore et al, (1971) and Iwanowicz et al. (1973)

and these data can be referred to for detailed information.

As described in the previous section, waters overlying the shellfish beds are contaminated by wastes from sewage outfalls, resulting in the presence of coliform bacteria in the shellfish. The beds are under the jurisdiction of Massachusetts Department of Environmental Protection and are closed to commercial and noncommercial harvesting, except by Master Diggers who must have the clams depurated at a purification plant.

Most of the productive soft shelled clam beds near the proposed dredging project are closed except for restricted areas near Logan Airport and a seasonal area in Pleasure Bay, the latter located immediately southwest of Castle Island. Logan Airport beds are one nautical mile north of President Roads and the beds at Pleasure Island are about two nautical miles west of President Roads. Shellfish beds open to Master Diggers are predominantly within the lower bays and are distant from the shipping channels and project areas.

The limited amount of lobstering within the Boston area takes place primarily in Quincy, Dorchester, and Hingham Bays. Lobstering is minimal or nonexistent in the areas to be primarily affected by the proposed work.

Fisheries resources of the Inner and Outer Harbors have been inventoried by previous studies. These studies include the MES (1972, 1972 a, b, c; 1972; 1976 a, b; 1977 a, b) and Haedrich and Haedrich (1974) studies which developed information in the Lower Mystic River. Data in the Outer Harbor were developed by Jerome et. al. (1966), Chesmore et. al. (1971) and Iwanowicz et. al. (1973).

The studies on the lower Mystic River were concentrated in the area between Amelia Earhart Dam and the Mystic River (Tobin) Bridge. Haedrich and Haedrich (1974) found that the seasonal species composition was similar to other northeast harbor communities. Winter flounder, smelt and alewives are found in the river throughout the year and are, therefore, considered residents. Ocean pout and blueback herring are summer residents, whereas sea herring is considered a winter resident. With the exception of ocean pout, these residents were identified in the 1986 NED biological sampling effort.

In July and November 1986 finfish were sampled by NED using surface and bottom variable mesh (15 cm to 2 cm) gill nets (approximately 2.5 by 70 meters) with paired deployments and a six (6) meter otter trawl where possible. Rough bottom topography restricted trawling to the Mystic River and heavy ship traffic destroyed some of the gill nets. Sampling for finfish was therefore opportunistic for site and duration. The results of the July and November finfish sampling can be found in Table A1-16.

Finfish sampling identified anadromous finfish, resident finfish and lobster as occurring in the project area. In a recent report by the National Oceanic and Atmospheric Administration (N.O.A.A., 1984), anadromous finfish species were identified as being of special concern in the project area. Each of these organisms occur in seasonal cycles throughout the project area as summarized in Table A1-17.

Information on spawning species, numbers and quality of spawn and their significance to regional resources is imprecise and sketchy. Since the principal streams discharging into the inner harbor rivers have dams located on them, tidal spawns of smelt and alewives are unlikely. In addition, it is not known if winter flounder use Boston's Inner Harbor for spawning as well as an area of local feeding. From the habits of these fish and from their behavior in the Mystic River channel area, they appear to stay in particular resident areas within the Inner and Outer harbors. Larval contribution to the eventual recruitment of these fish in other areas is not known.

In summary, a spring/summer movement of anadromous finfish occurs through the project area as they move into spawning (freshwater) tributaries. Lobsters and flounder are generally in the outer harbor (areas of high productivity) preferring cool waters. In summer, as water temperatures rise, productivity in benthic habitats sharply decline in response to low dissolved oxygen in the near bottom water column, restricting fauna to the outer harbor (Main Ship Channel) areas. By fall, the Inner Harbor has juvenile flounder feeding on shore shrimp while waters are cooling toward winter spawning temperatures. In winter, finfish, except for the cold water spawning flounder, and lobster move offshore as harbor water temperatures decrease. This fall/winter water cooling allows a balance of the oxygen depletion that occurred in the warmer seasons. High organic load freshwater inputs and warming water temperatures initiate the complex cycle in the spring.

Offshore and longshore areas of the harbor were trawled for finfish in the studies done by the Massachusetts Division of Marine Fisheries. Atlantic silverside, mummichog and Atlantic tomcod were the predominant species found in the longshore trawls. Some of the offshore sampling sites yielded high densities of winter flounder, Atlantic tomcod, fourspine stickleback, and rainbow smelt. The highest densities of finfish were taken during the months of September and October, with Atlantic silverside and winter flounder the predominant species. The densities of finfish dropped during the winter months of December through March as the fish moved offshore to winter feeding grounds.

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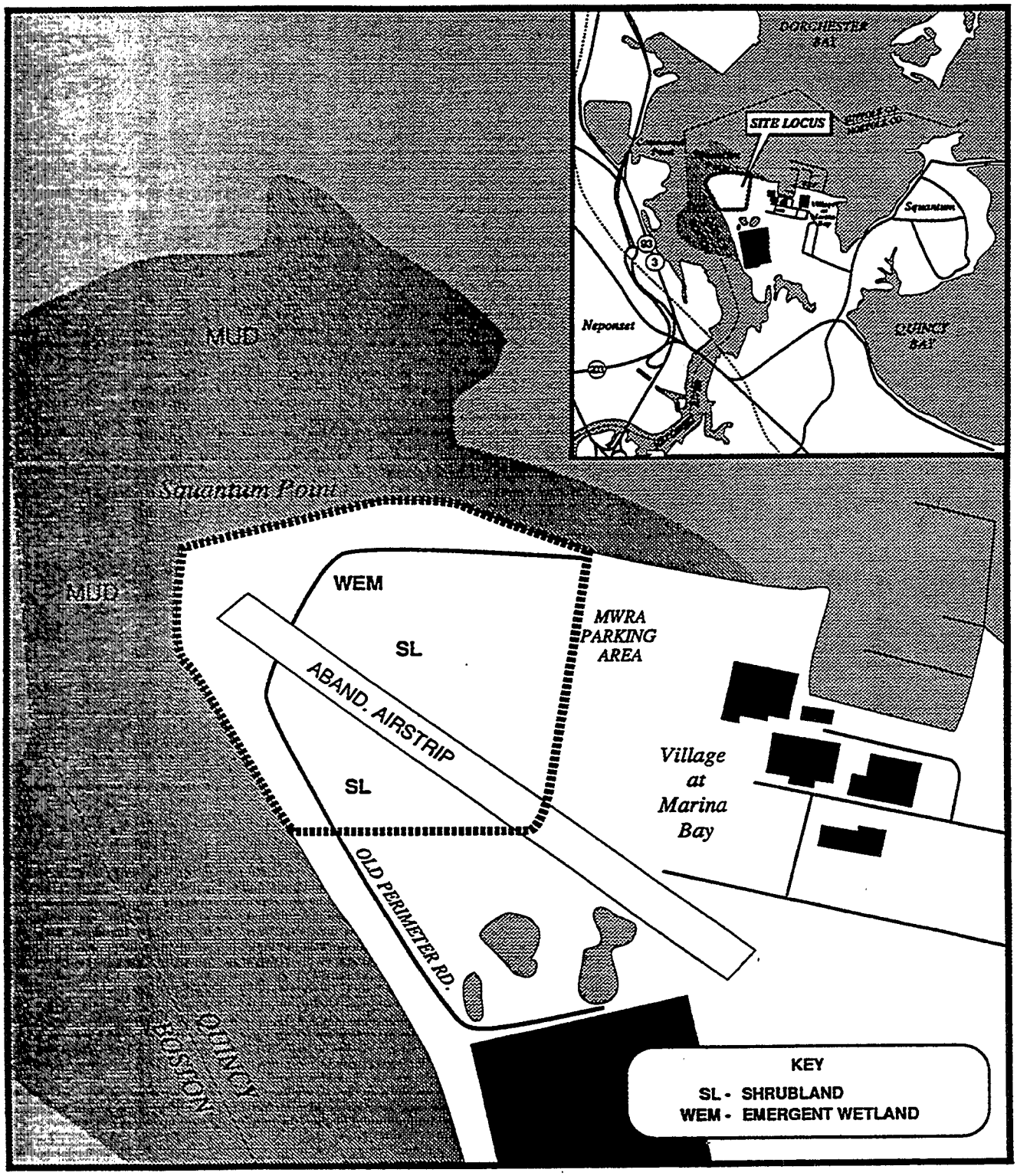
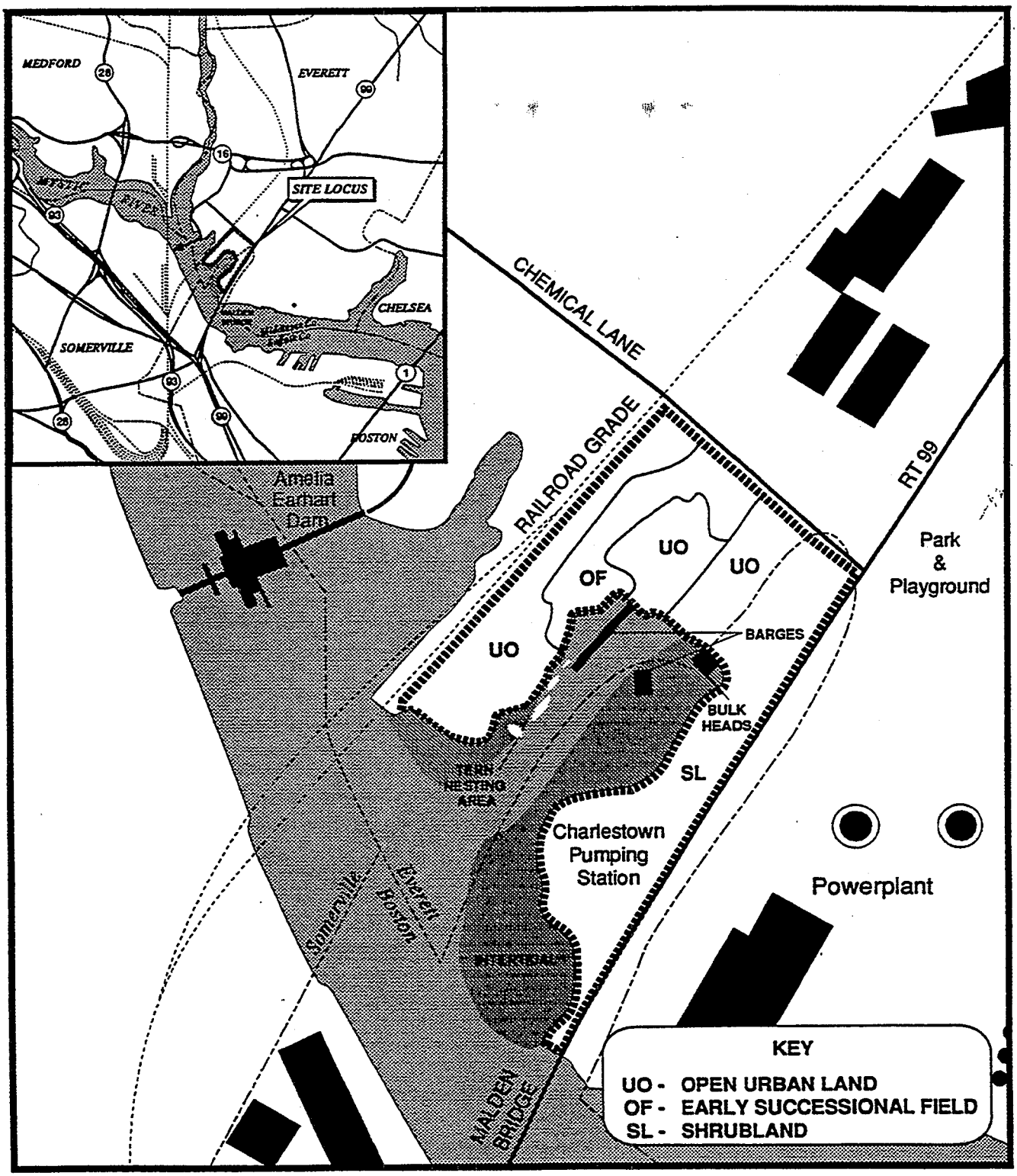
| **Boston Harbor Dredging Project EIR/S** | Figure A1-1. General locations of short-listed disposal site alternatives. |
| *Scale:* 0 — 10 *Approx. Scale in Miles* | *Source:* USGS Quadrangles Revised by NAI to reflect pertinent site conditions. |

A1120




| Boston Harbor Dredging Project EIR/S | Figure A1-2. Site map for potential disposal site, Quincy-03 (Squantum Point). |
|---|---|
| N<br>Scale:<br>0 100 200<br>Scale in Meters | Source:<br>USGS Quadrangle Boston South, MA, 1987<br>Revised by NAI to Reflect Pertinent Site Conditions |

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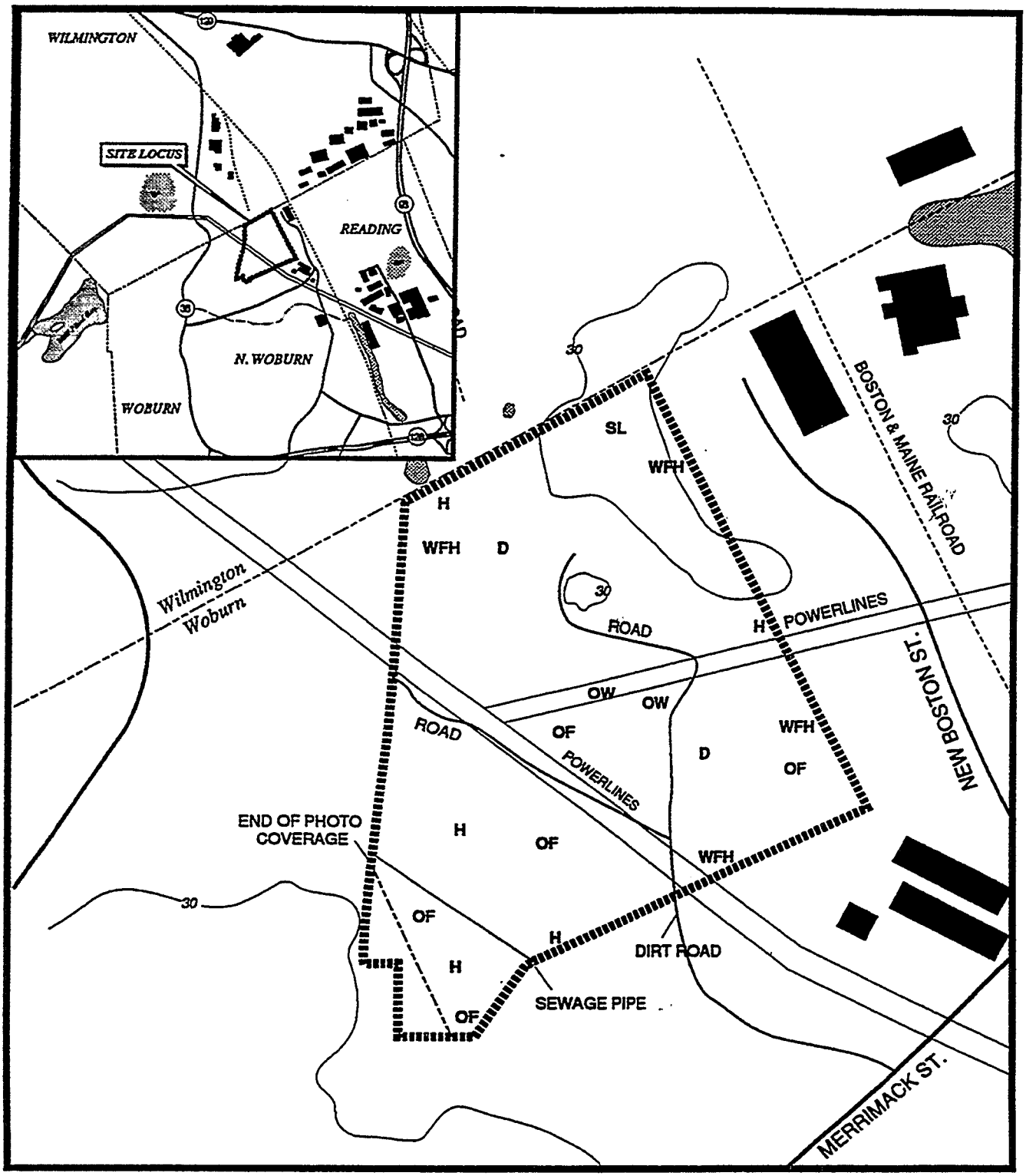
| **Boston Harbor Dredging Project EIR/S** | Figure A1-3. Site map for potential disposal site, Everett. |
| *Scale:* 0 100 200 *Scale in Meters* | *Source:* USGS Quadrangle North Boston, MA, 1985 Revised by NAI to Reflect Pertinent Site Conditions |

A1-122

380




| Boston Harbor Dredging Project EIR/S | Figure A1-4. Site map for potential disposal site, Woburn-11. |
|---|---|
| N<br>Scale:<br>0 100 200<br>Scale in Meters | Source:<br>USGS Quadrangle Reading, MA, 1987<br>Revised by NAI to reflect pertinent site conditions |

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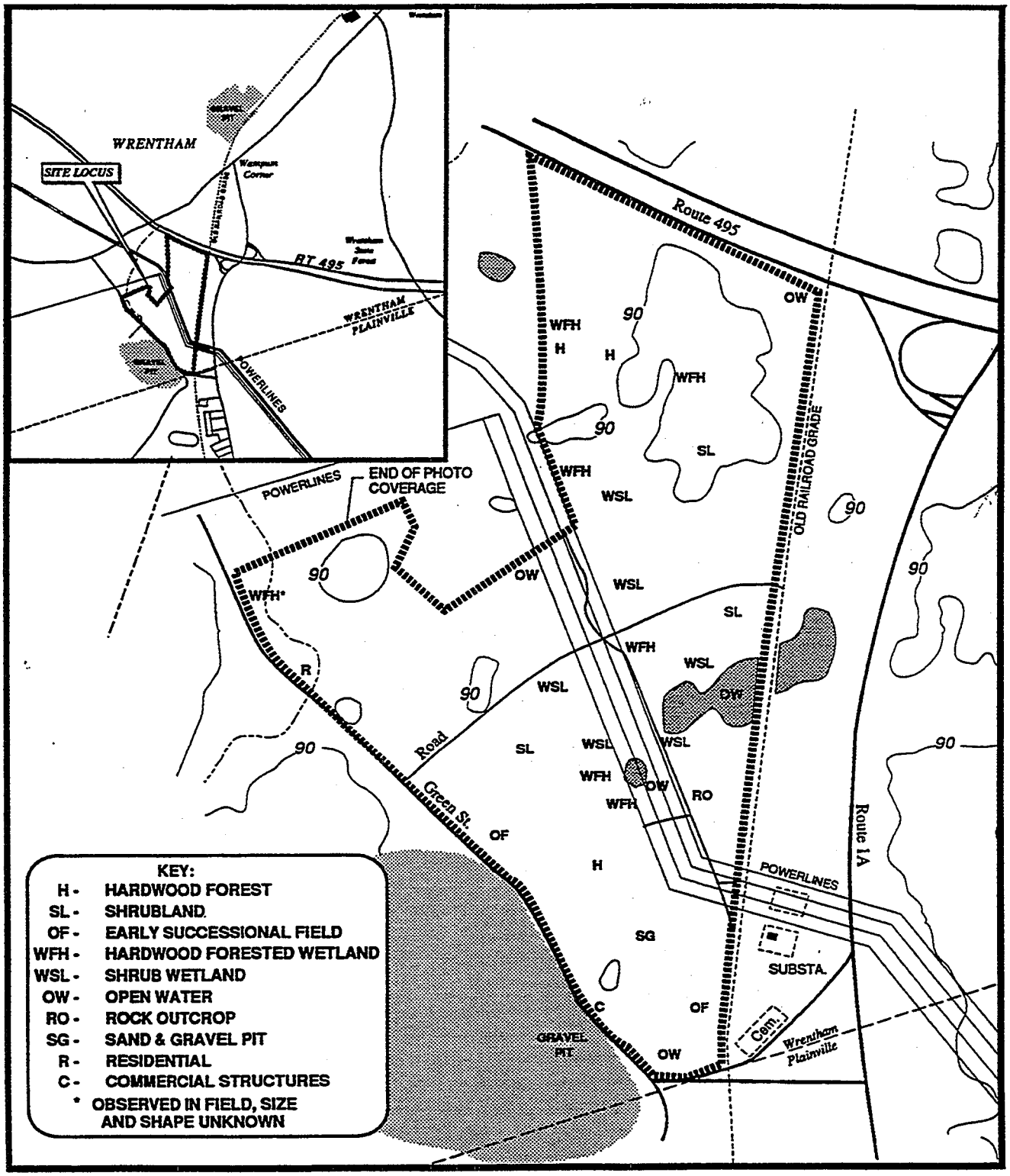
A-123




| Boston Harbor Dredging Project EIR/S | Figure A1-5. Site map for potential disposal site, Wrentham-495. |
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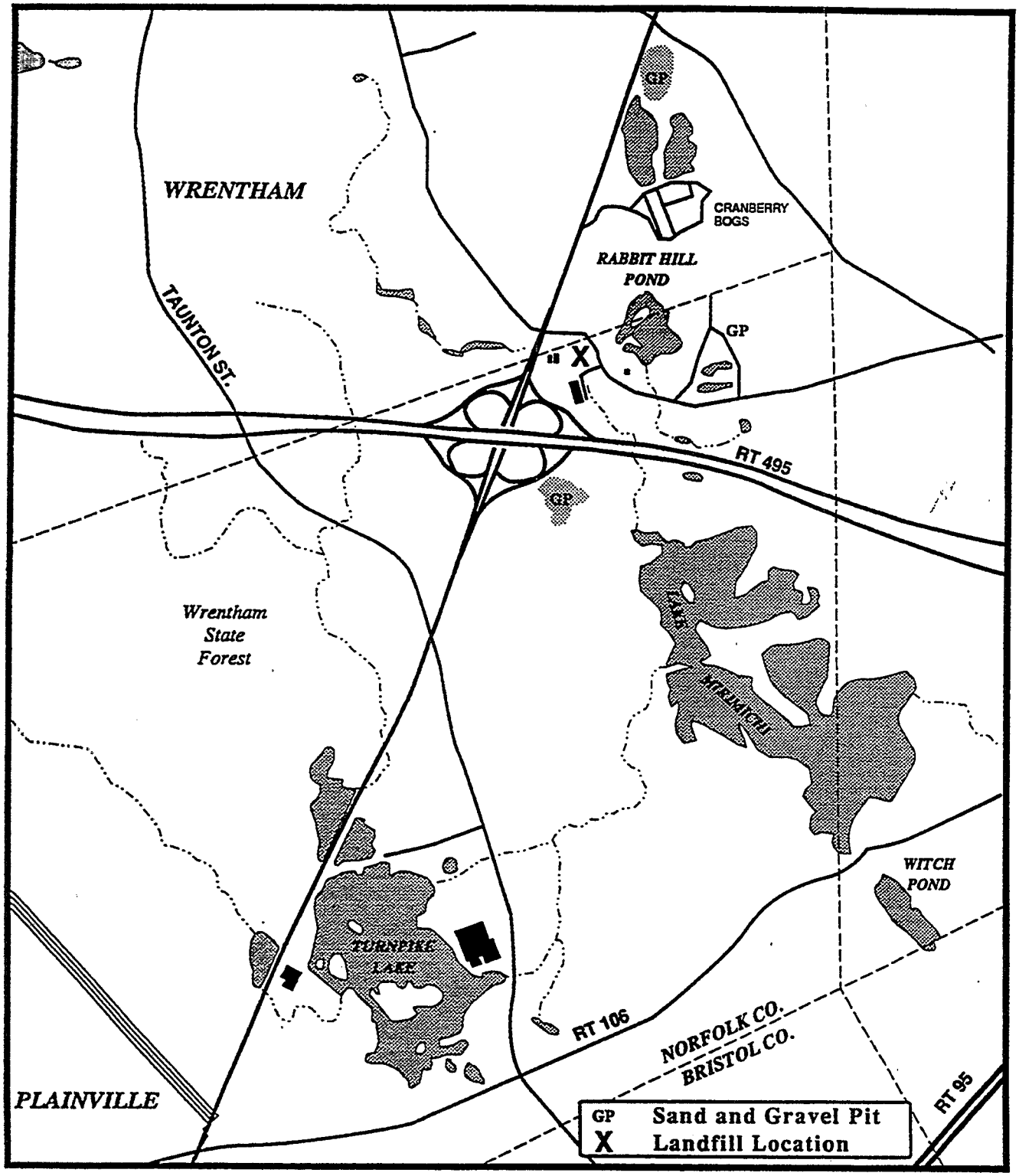
| N<br>*Scale:* 0 50 100 Scale in Meters | *Source:*<br>USGS Quadrangle Franklin, MA 1987<br>Revised by NAI to reflect pertinent site conditions. |

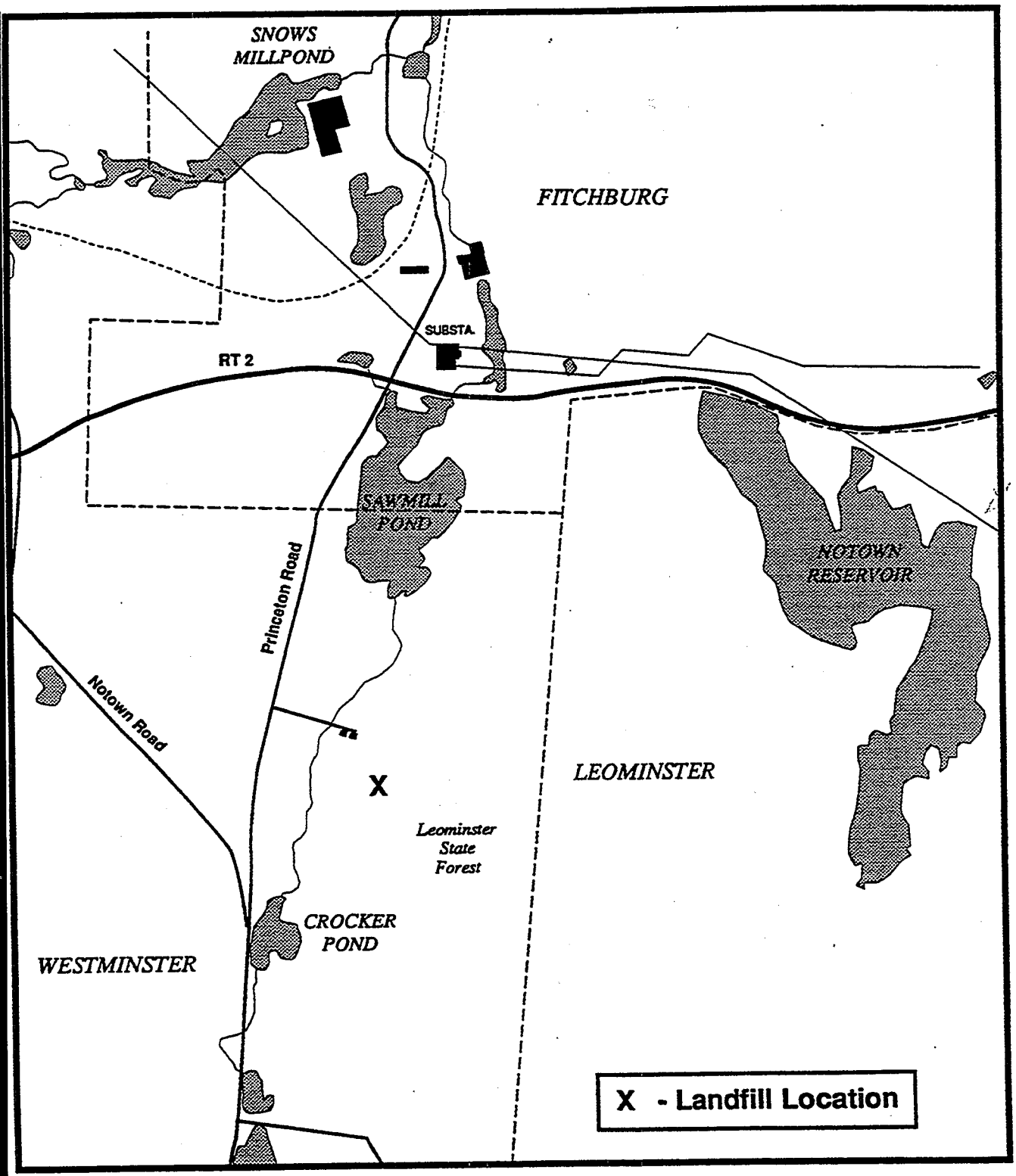
AT-124




| Boston Harbor Dredging Project EIR/S | Figure A1-6. Site map for the Plainville Landfill site. |
|---|---|
| N<br>Scale: 0 1000 2000<br>Scale in Feet | Source:<br>USGS Quadrangle Franklin, MA 1987<br>Revised by NAI to reflect pertinent site conditions. |



AT-125




| Boston Harbor Dredging Project EIR/S | Figure A1-7. Site map for the Fitchburg/ Westminster Landfill site. |
|---|---|
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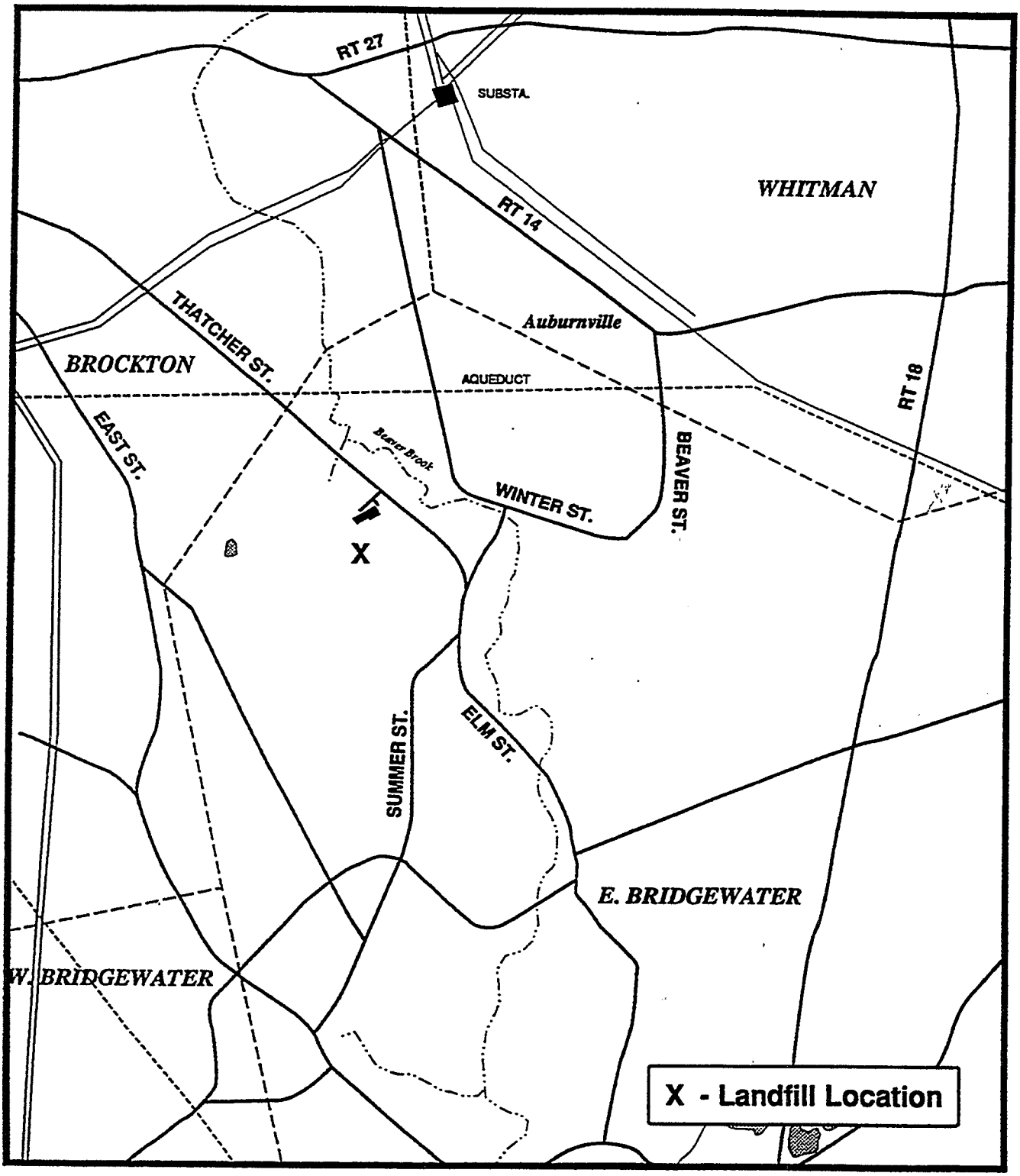
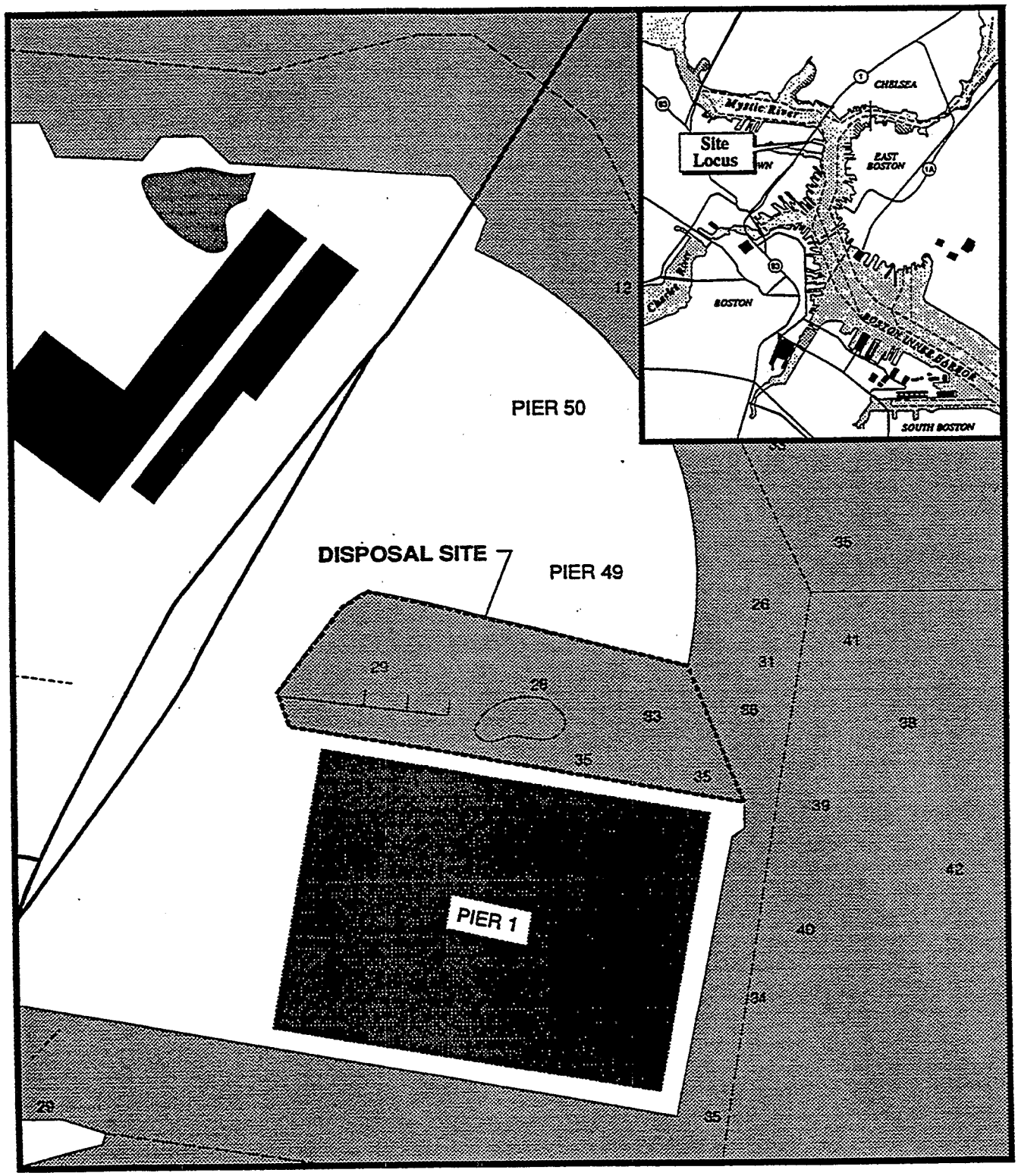
A1-126



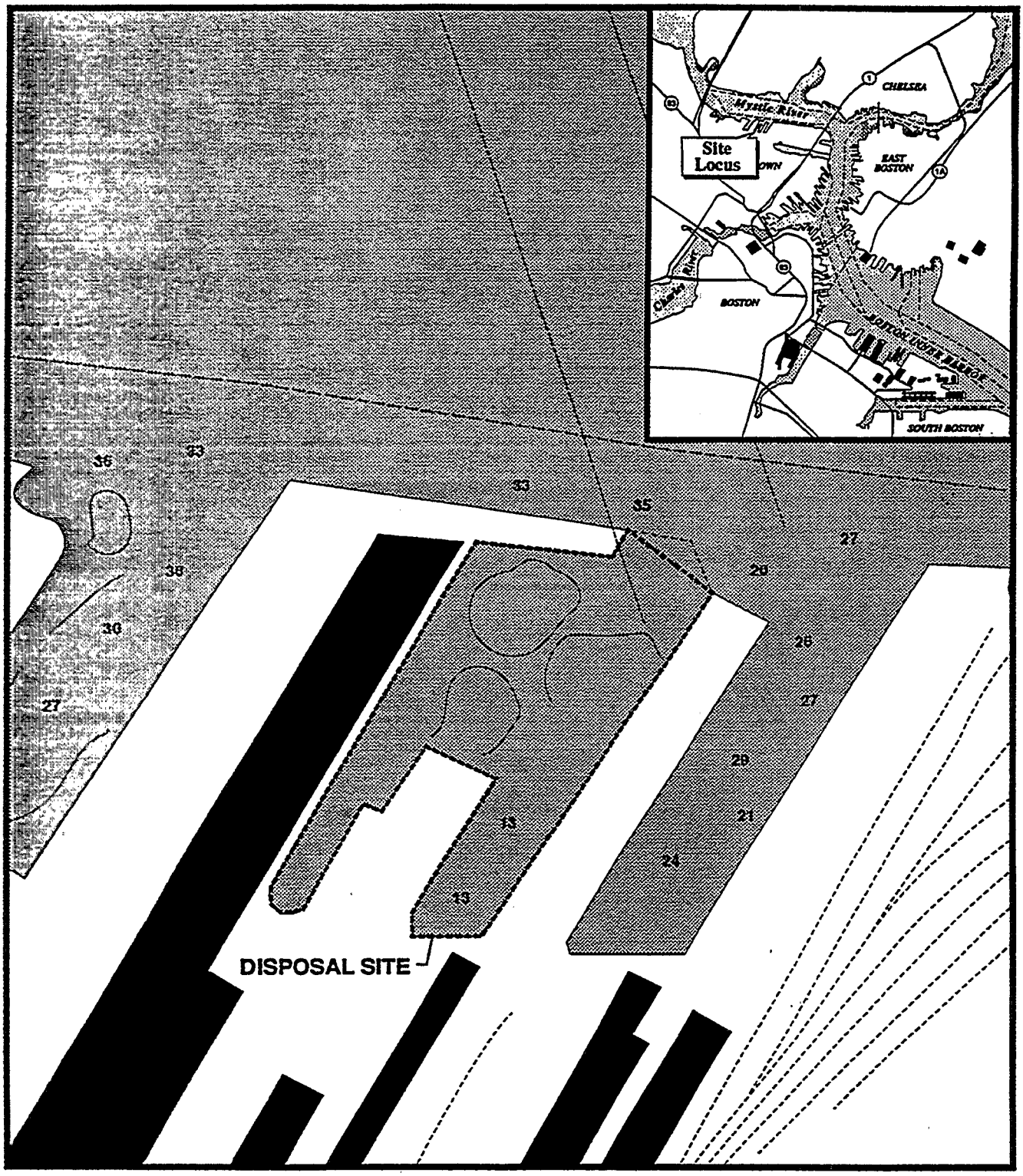

| Boston Harbor Dredging Project EIR/S | Figure A1-8. Site map for BFI Northern Disposal Inc. (E. Bridgewater) Landfill site. |
|---|---|
| N<br>Scale:<br>0 1000 2000<br>Scale in Feet | Source:<br>USGS Quadrangle Whitman, MA 1977<br>Revised by NAI to reflect pertinent site conditions. |

AH127

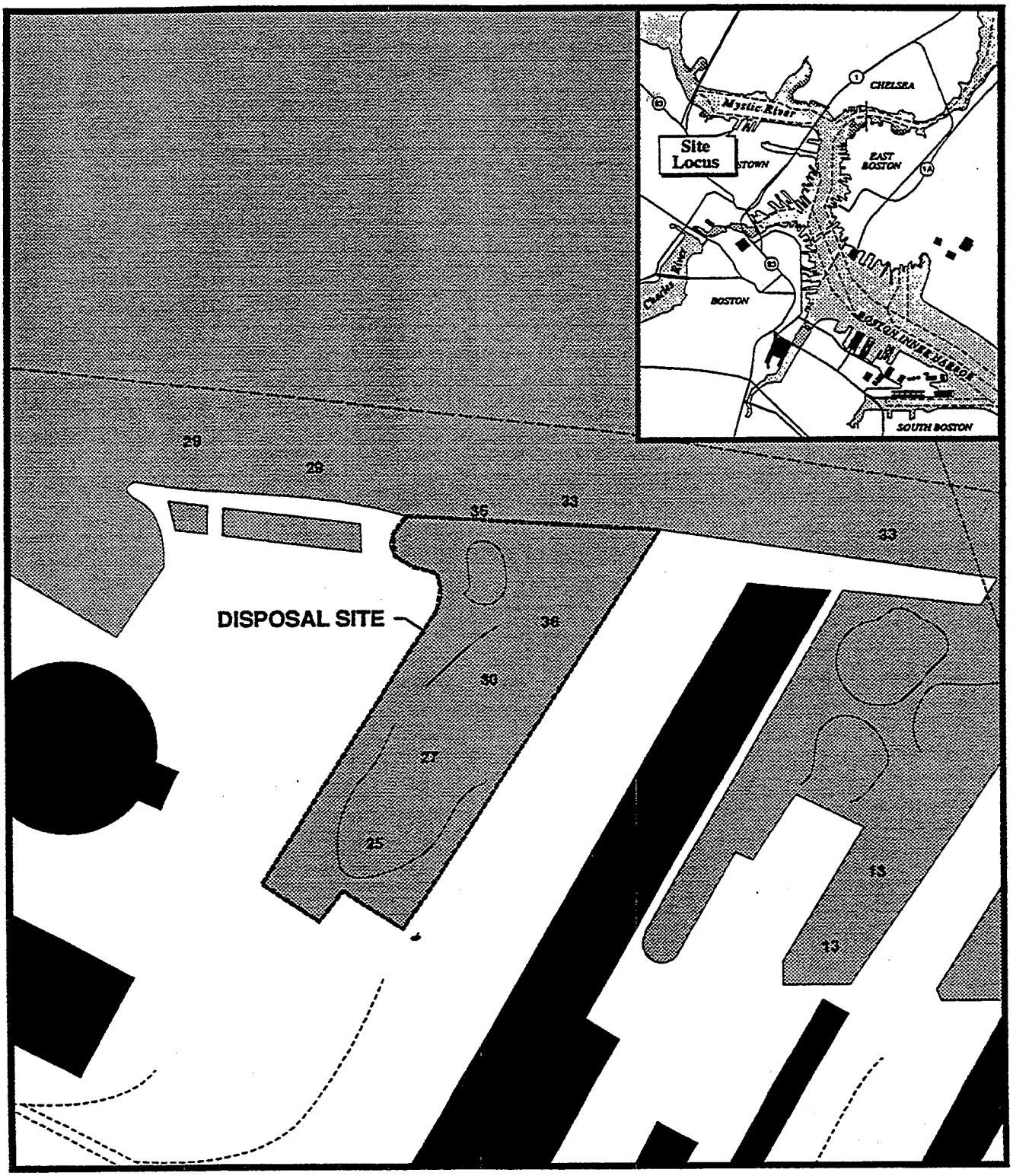



| Boston Harbor Dredging Project EIR/S | Figure A1-9. Site map for Mystic Piers site |
|---|---|
| N<br>Scale: 0 50 100<br>Scale in Yards | Source:<br>Boston Harbor Navigation Chart |

AT-128

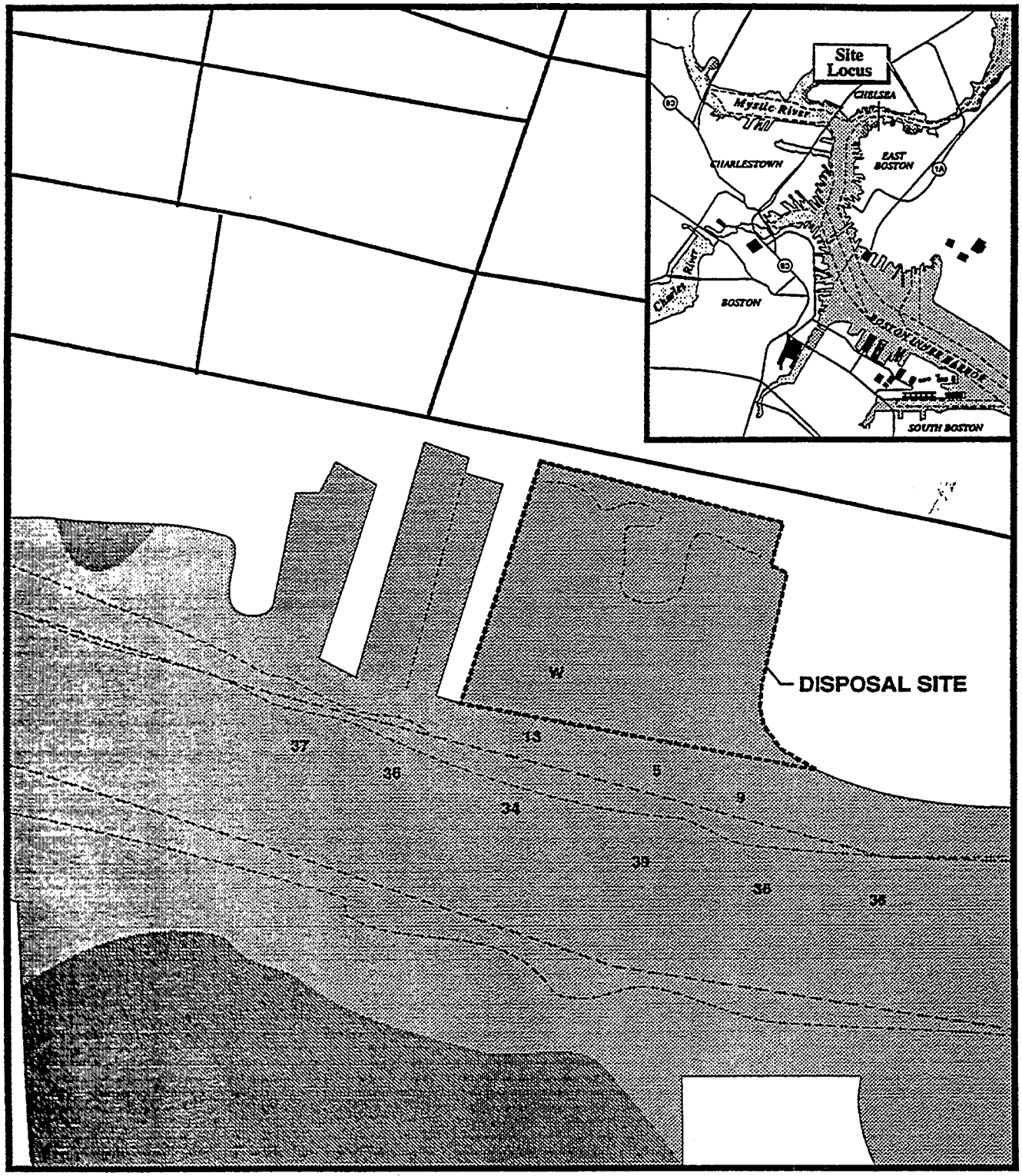



| Boston Harbor Dredging Project EIR/S | Figure A1-10. Site map for Revere Sugar site |
|---|---|
| N | Scale: 0 50 100 Scale in Yards |
| | Source: Boston Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | Figure A1-11. Site map for Amstar site |
|---|---|
| N<br>Scale: 0 50 100<br>Scale in Yards | Source:<br>Boston Harbor Navigation Chart |

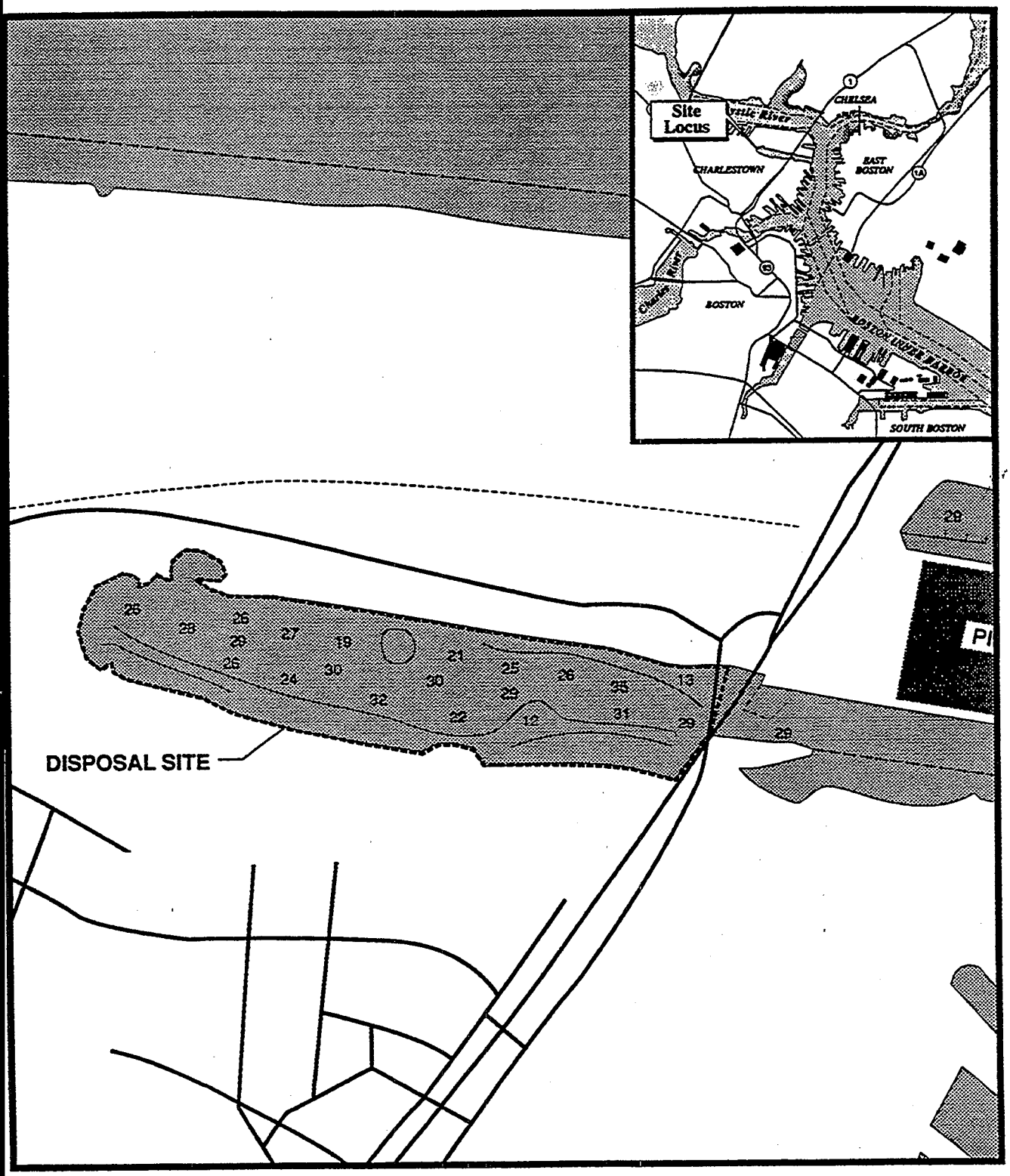
A1-130




| Boston Harbor Dredging Project EIR/S | Figure A1-12. Site map for Cabot Paint site. |
|---|---|
| N<br>Scale: 0 50 100<br>Scale in Yards | Source:<br>Boston Harbor Navigation Chart |

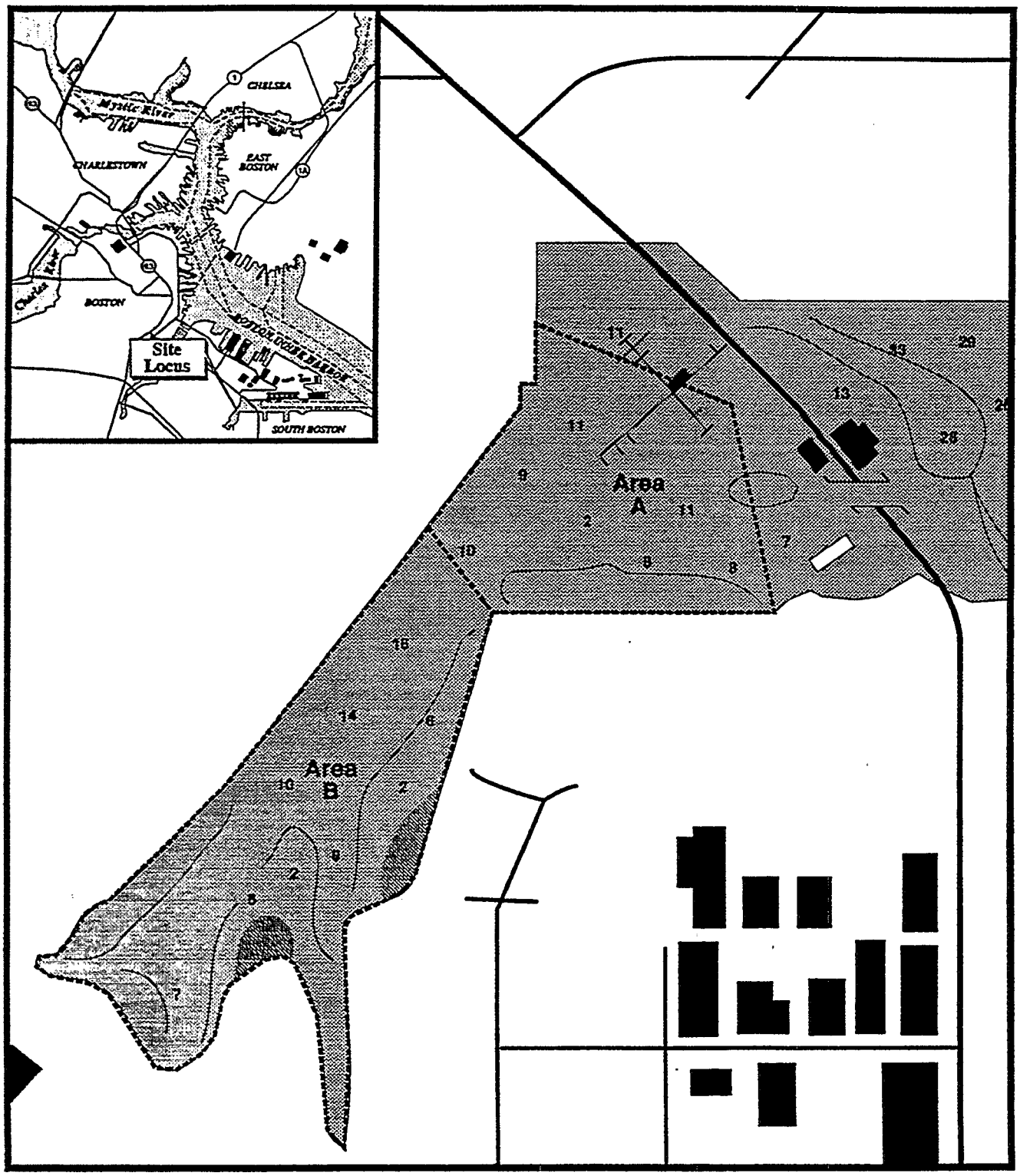


A1-131

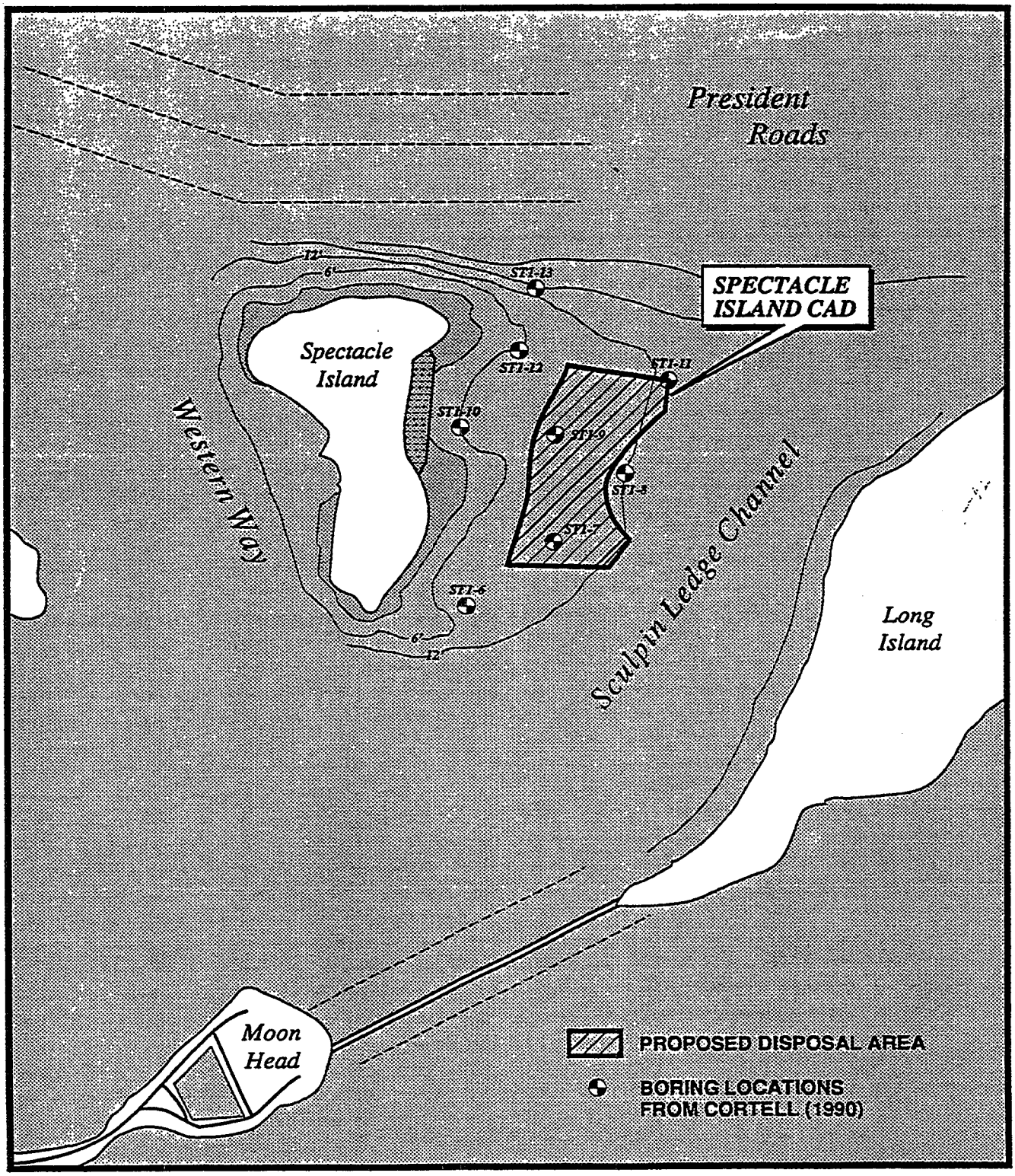



| Boston Harbor Dredging Project EIR/S | Figure A1-13. Site map for Little Mystic Channel site. |
|---|---|
| N<br>Scale: 0 100 200<br>Scale in Yards | Source:<br>Boston Harbor Navigation Chart |

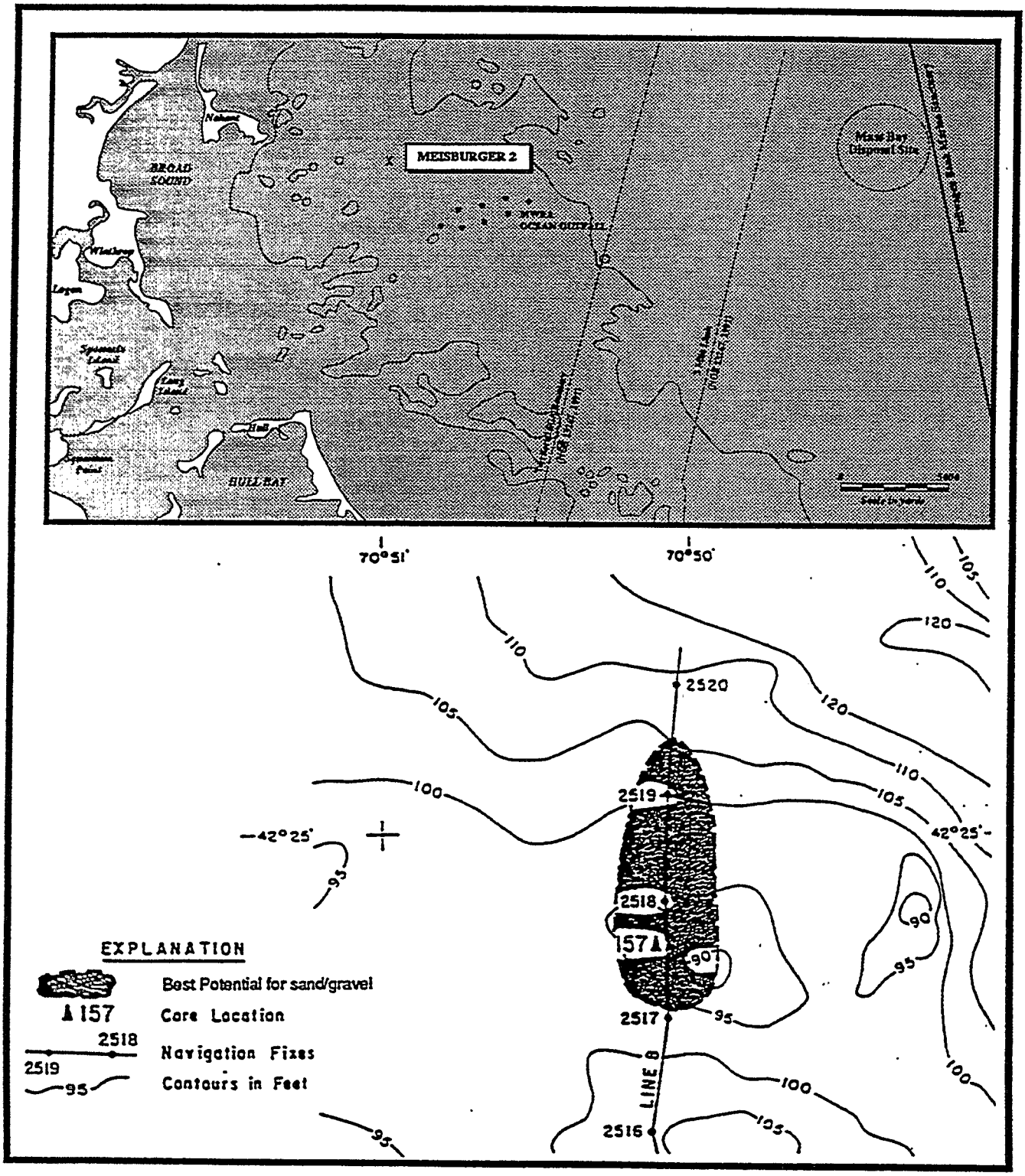
A1-132




| Boston Harbor Dredging Project EIR/S | Figure A1-14. Site map for Reserved Channel site. |
|---|---|
| N | Scale: 0 100 200 Scale in yards |
| | Source: Boston Harbor Navigation Chart |




| Boston Harbor Dredging Project EIR/S | Figure A1-15. Site map for Spectacle Island CAD site. |
|---|---|
| N<br>*Scale:*<br>Scale in Yards<br>500 0 1000 | *Source:*<br>NOS Chart No. 13270<br>Sediment Classifications from Cortell 1990 |




| Boston Harbor Dredging Project EIR/S | Figure A1-16. Site map for Meisburger 2 site. |
|---|---|
| N | *Scale:* Scale in Yards 500 0 1000 |
| | *Source:* Metcalf & Eddy Inc., 1992 |

A1-135

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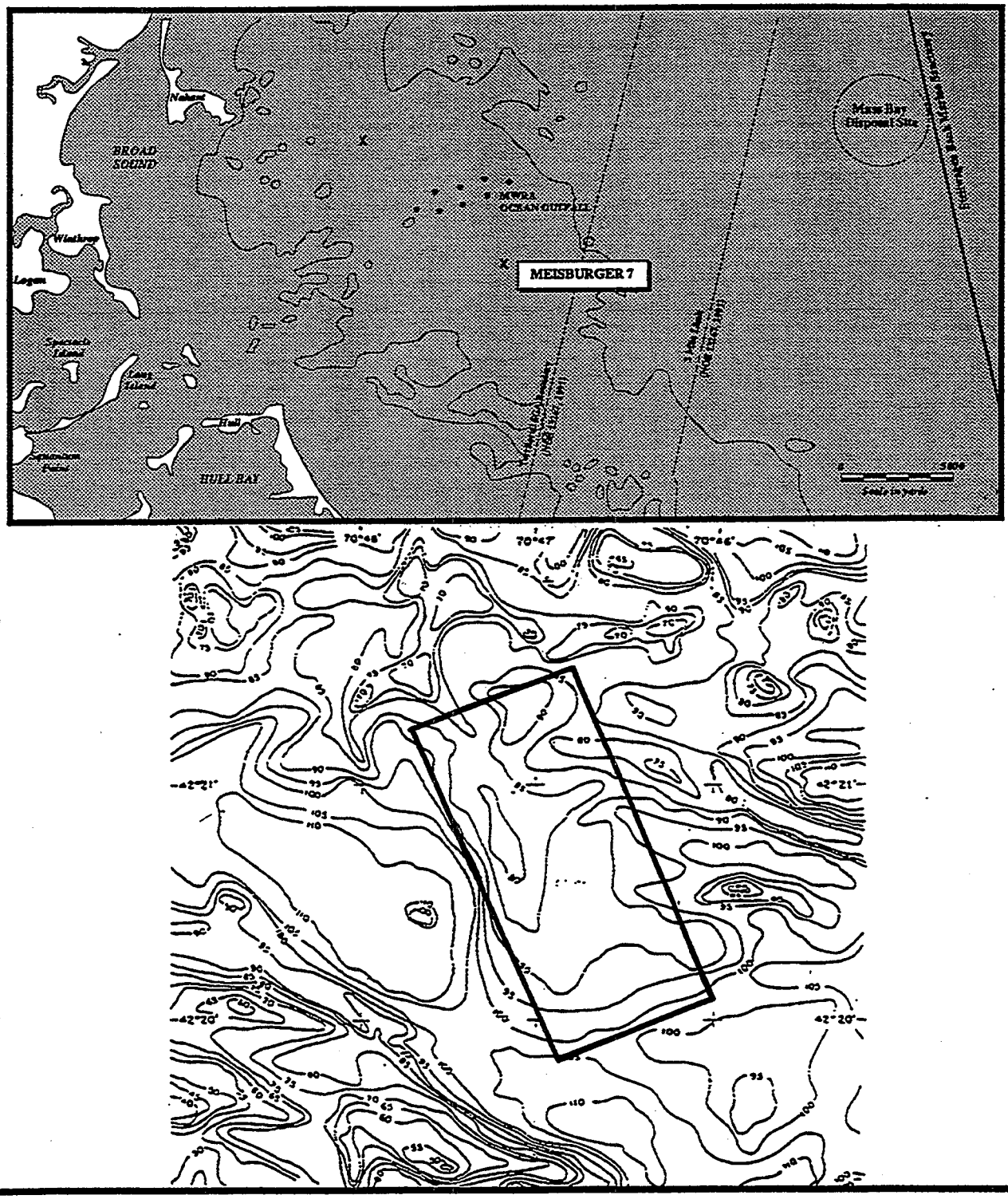
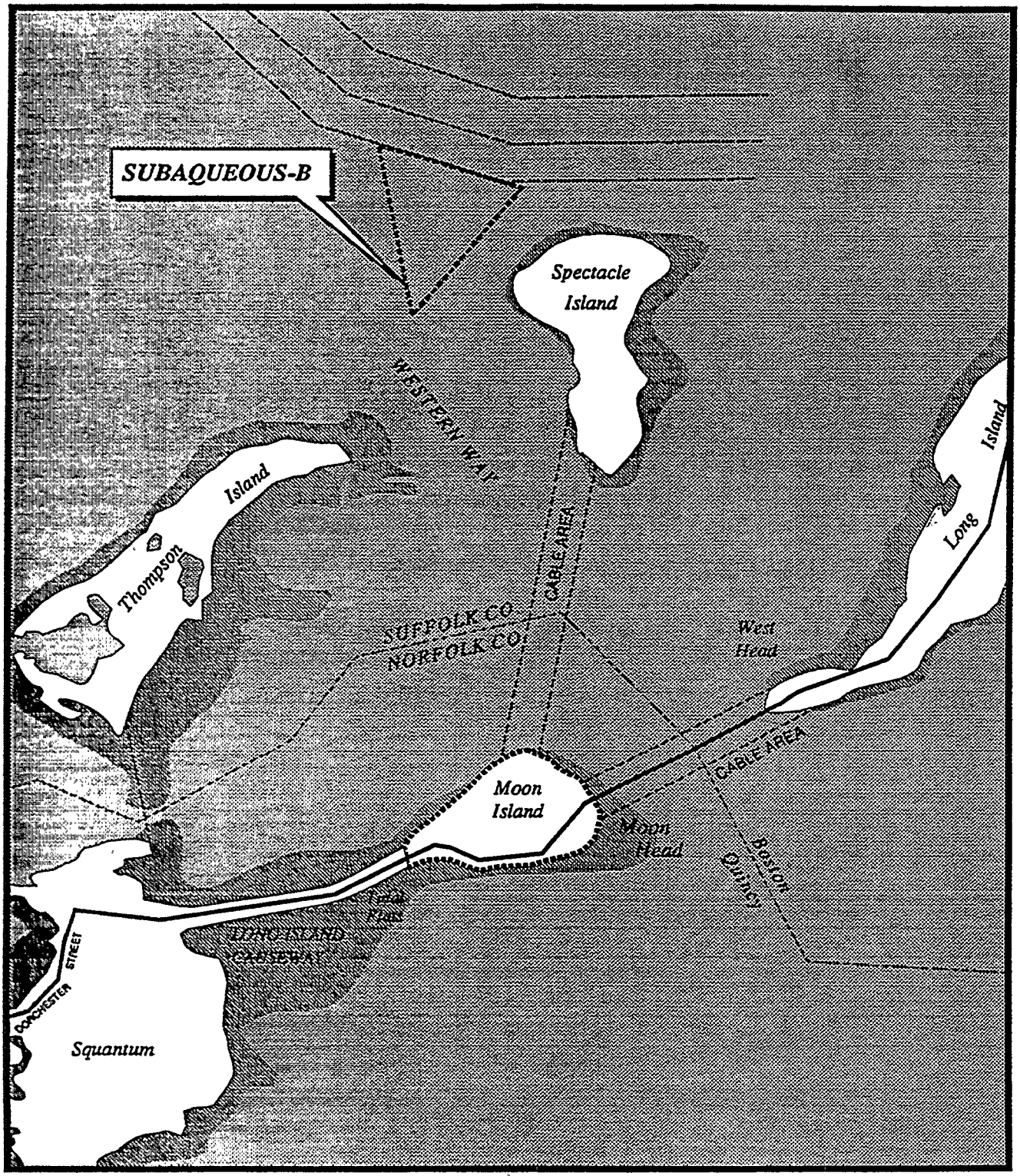



| Boston Harbor Dredging Project EIR/S | Figure A1-17. Site map for Meisburger 7 site.<br>* GENERAL AREA WITHIN WHICH DISPOSAL SITE WOULD BE LOCATED. |
|---|---|
| N<br>*Scale:*<br>Scale in Yards<br>0 1000 2000 | *Source:*<br>Metcalf & Eddy Inc., 1992 |

A1-136




| Boston Harbor Dredging Project EIR/S | Figure A1-18. Site map for potential disposal site, Subaqueous-B |
|---|---|
| N | Scale: 0 1000 2000 Scale in Feet |
| | Source: Boston Inner Harbor Navigation Chart |

A1-137

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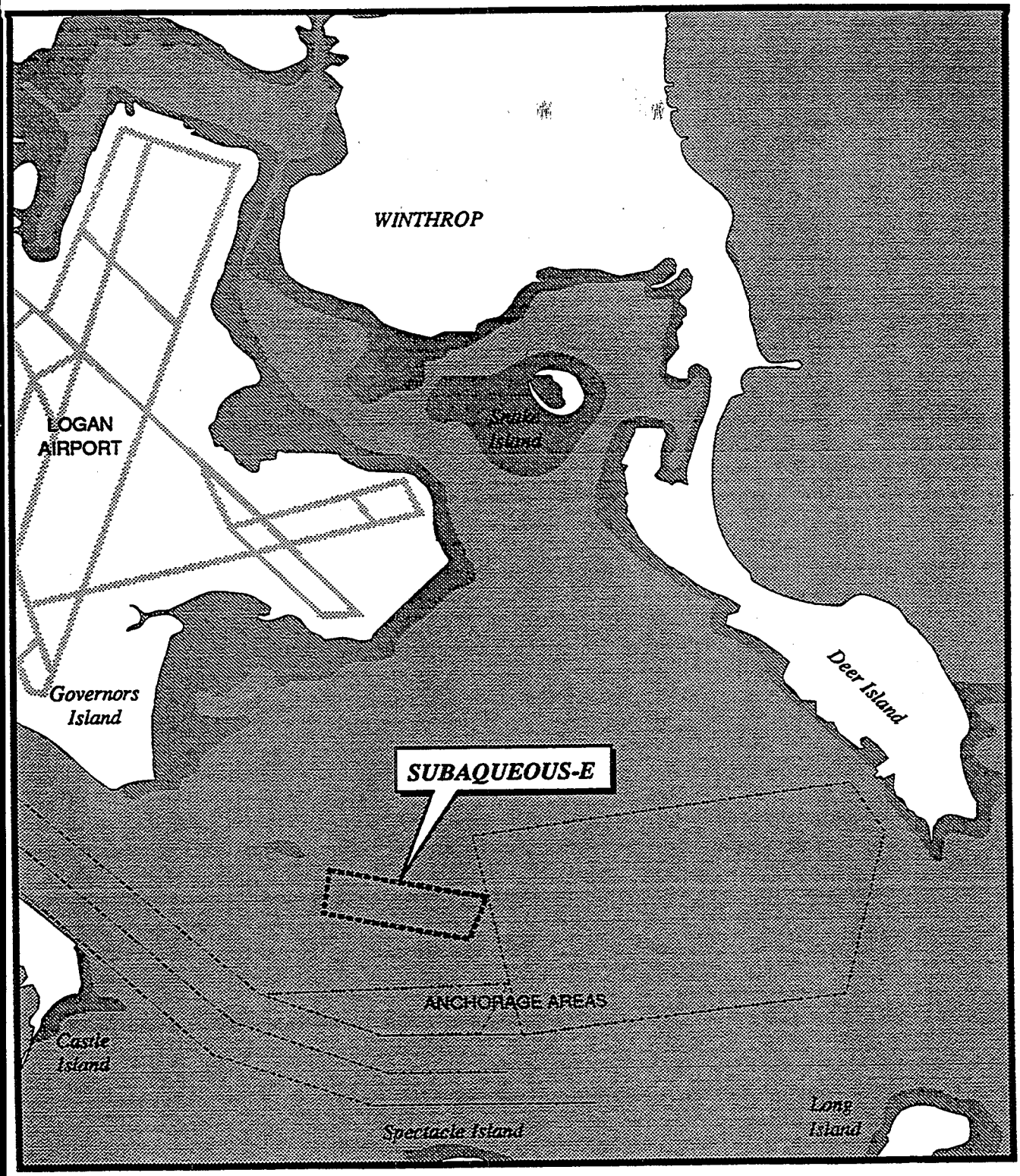
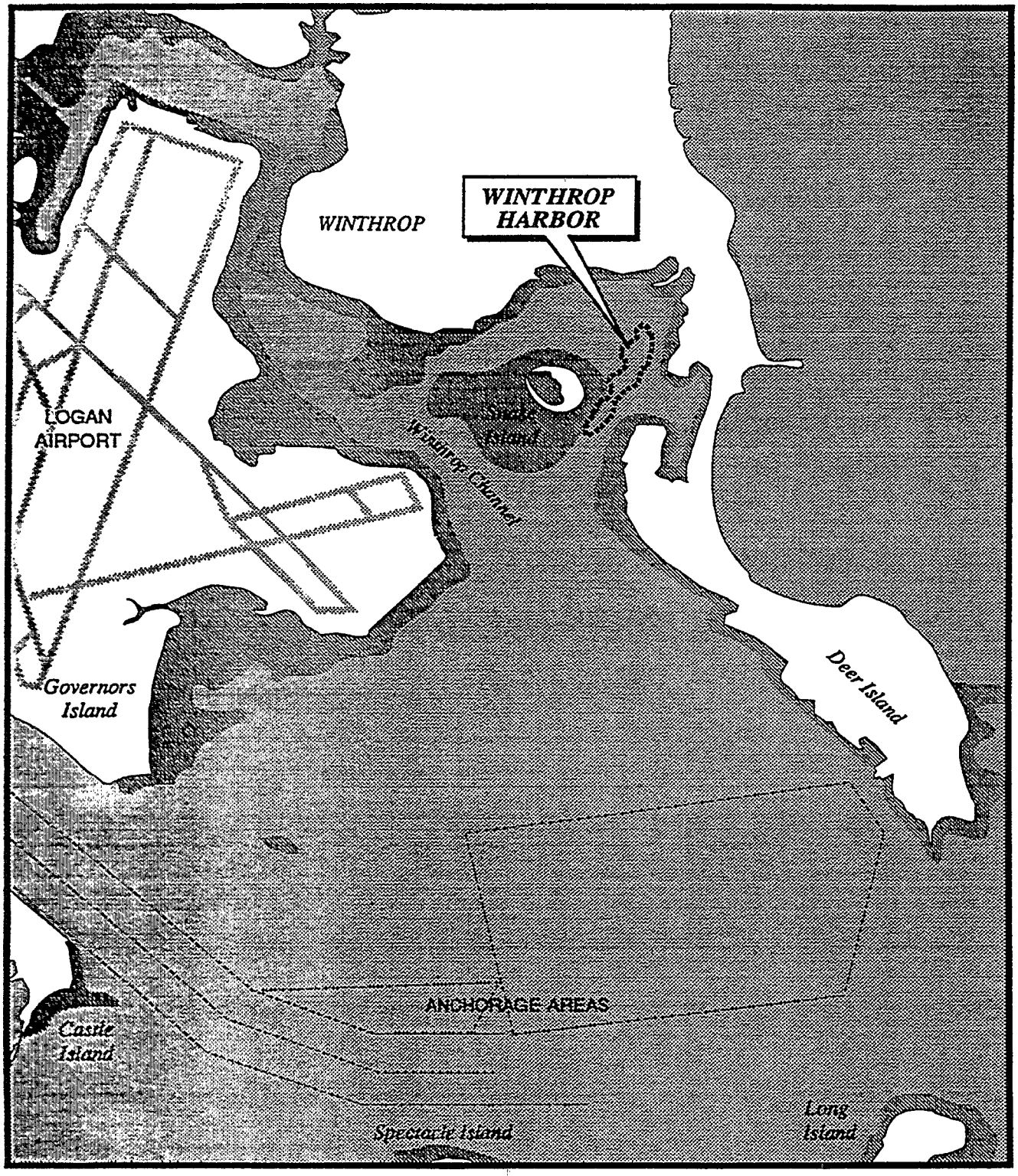



| Boston Harbor Dredging Project EIR/S | Figure A1-19. Site map for potential disposal site, Subaqueous-E. |
|---|---|
| N | *Scale:* 0 400 800 Scale in Yards |
| | *Source:* Boston Inner Harbor Navigation Chart |

A1-138




| Boston Harbor Dredging Project EIR/S | Figure A1-20. Site map for potential disposal site, Winthrop Harbor. |
|---|---|
| N | *Scale:* 0 400 800 Scale in Yards |
| | *Source:* Boston Inner Harbor Navigation Chart |

| | |
|---|---|
| Boston Harbor Dredging Project EIR/S | Figure A1-21. Site map for Boston Lightship and MBDS Sites. |
| Scale: 0 5000 Scale in yards | Source: Boston Harbor Navigation Chart |

A1-140

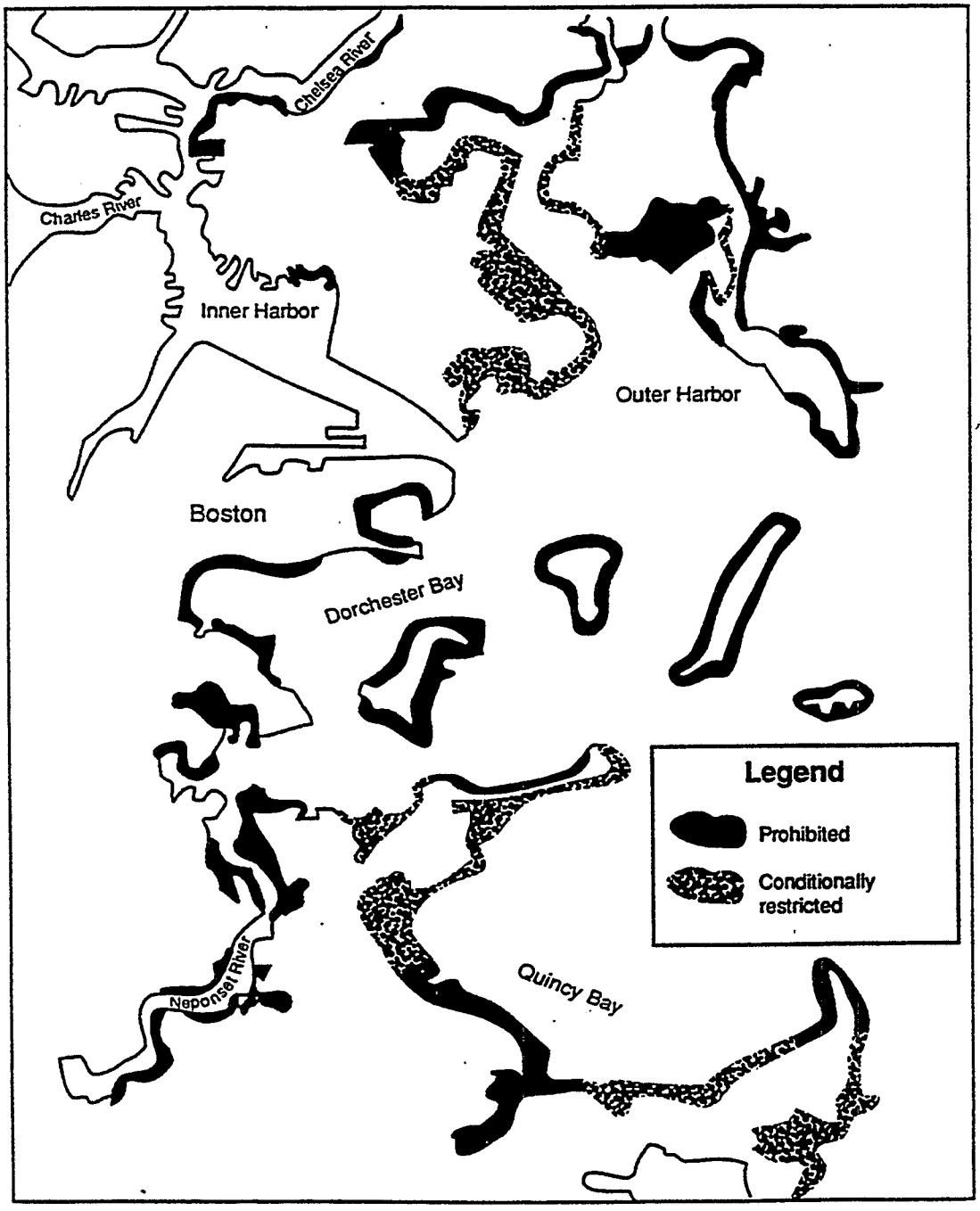



**Figure A1-22. Prohibited and restricted clam beds in Boston Harbor. There are many acres of soft-shell clam beds in Boston Harbor, but none are open for unrestricted harvest.**

(From MWRA "State of Boston Harbor:1991" report)

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TABLE A1-1. LANDFILL CHARACTERISTICS

| | PLAINVILLE | FITCHBURG/ WESTMINISTER | E. BRIDGEWATER |
|---|---|---|---|
| DAILY CAPACITY | | | |
| Total Waste Capacity | 850-925 cy/day | 350 cy/day | 1075 cy/day |
| Available Waste Capacity[1] | 150-200 cy/day | 200 cy/day | 75 cy/day |
| Cover Capacity | 500 cy/day | 250 cy/day | 400 cy/day |
| Available Cover Capacity | 100 cy/day | Unknown | Variable |
| ANNUAL TOTAL CAPACITY | 350,000 cy/yr | 100,000 cy/yr | 250,000 cy/yr |
| STOCKPILING CAPACITY[2] | | 200,000 cy | 8,000-10,000 cy |
| WASTE MATERIAL LIMITATIONS | | | |
| Dewatering | No free standing water | No free standing water | No free standing water |
| Solids | ≥40% solids | ≥25% solids | ≥20% solids |
| Odor | Deodorizing suggested | Must have no odor | If odor, BFI will lime |
| COVER MATERIAL LIMITATIONS | Must meet DEP standards for TCLP[3], pH, solids, reactivity, ignitability. | Must meet 310 CMR 19 regulations. | Must meet DEP standards for TCLP, PCBs, reactivity, corrosivity, free liquid, solids. Odor must be inoffensive to community. No large boulders. |
| ESTIMATED CLOSURE DATE | 1995, but proposed expansions would extend until 2000. | 1997 | 1996 |
| TOWN/BOARD OF HEALTH REQUIREMENTS | Verbal coordination needed | Coordination with 2 local boards | Coordination needed |

(Continued)

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TABLE A1-1. (CONTINUED).

| | PLAINVILLE | FITCHBURG/ WESTMINISTER | E. BRIDGEWATER |
|---|---|---|---|
| SPECIAL WASTE RECEIVED IN PAST | Waste water treatment plant grit and screenings | Wastewater treatment plant sludge. | Sewage sludge, petroleum contaminated soil. |
| TRUCKING LIMITATIONS | | | |
| Number/day | No limitations | No limitations | No limitations |
| Operating hours | 7 AM - 3 PM | 7 AM - 3 PM | 7 AM - 3 PM |
| TIPPING FEE[4] | $56/cy | $70/cy | $28/cy |
| DISTANCE TO SITE | 35 mi. | 45 mi. | 25 mi. |

[1]Capacity available for project dredged material.
[2]Unlined cover material can be stockpiled.
[3]Toxic Characteristic Leaching Procedure. An EPA-derived test for hazardous characteristics.
[4]Approximate costs assuming an average ratio of 1.4 tons/cy; actual tipping fees are based on weight.

TABLE A1-2. ESTIMATED ABUNDANCE (NO./$m^2$) OF BENTHIC INFAUNA (RETAINED ON A 0.5 mm MESH SIEVE) COLLECTED BY 0.023 $m^2$ PONAR GRAB FROM PROPOSED DISPOSAL SITES IN BOSTON HARBOR, APRIL 28-29, 1993.

| | STATION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAXA | MP-1 | MP-2 | RS-1 | RS-2 | RS-3 | AM-1 | AM-2 | CP-1 | CP-2 | LMC-1 | LMC-2 | LMC-3 | LMC-4 | RC-1 | RC-2 | RC-3 | RC-4 |
| Oligochaeta | 43 | 817 | 473 | 172 | 172 | 559 | | 1806 | 86 | | 13717 | 258 | 86 | 2451 | 15480 | | 26574 |
| *Asabellides oculata* | | | | | | | 43 | | | | | | | | | | |
| *Capitella capitata* | | 4171 | 2838 | 2967 | | 215 | | 43 | | | 1892 | | | | 645 | | 1677 |
| *Caulleriella* sp. | | | | | 688 | | | | 43 | 86 | 387 | | 43 | | | | |
| Cirratulidae | | | | | | | | | | | 258 | | | | | | |
| *Cistenides hyperborea* | | | | | | | | 43 | | | 43 | | | | | | |
| *Dodecaceria* sp. | | 43 | | | | | | | | | | | | | | | |
| *Eteone* sp. | | | | | | | | | | | 86 | | | | | | |
| *E. heteropoda* | | | | | | | | | | | 86 | | | | | | |
| *E. longa* | | | | | | | | | | | | | | | | | |
| *Fabricia sabella* | | 172 | 129 | | | | | | | | 43 | | | | | | 215 |
| *Harmothoe* sp. | | | 172 | | | | | | | | 43 | 43 | | | 43 | | |
| *H. extenuata* | | | 43 | | | | | | | | | | | | 43 | | |
| Hesionidae | | | | | | | | | | | | | | | 43 | | |
| *Leitoscoloplos robustus* | | | | | | | | | | | | | | 86 | 172 | | |
| *Microphthalmus aberrans* | | | 473 | | | | | 215 | | | | | | | 129 | | |
| Nereidae | | | | | | | | | | | | | | 43 | | | 172 |
| *Nereis diversicolor* | | | | | | | | 43 | | | | | | | 172 | | |
| Orbiniidae | | | | | | | | | | | | | | 258 | 215 | 43 | |
| *Paranaites kosteriensis* | | | | | | | | | | | | | | | | | |
| *Pholoe minuta* | | | | | | | | | | | 43 | | | | | | |

(Continued)

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TABLE A1-2. (CONTINUED)

| TAXA | STATION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MP-1 | MP-2 | RS-1 | RS-2 | RS-3 | AM-1 | AM-2 | CP-1 | CP-2 | LMC-1 | LMC-2 | LMC-3 | LMC-4 | RC-1 | RC-2 | RC-3 | RC-4 |
| *Polycirrus* sp. | | | | | | | | | | | | | | | 172 | | |
| *Polydora* sp. | | | | | | | | | | | 43 | | | | | | |
| *P. aggregata* | | 258 | | | | | | | | | 731 | | | | | | |
| *P. cornuta* | | 86 | 43 | 43 | | 2107 | | 301 | 86 | | 559 | 215 | | | 1419 | 43 | 129 |
| *Pygospio elegans* | | | | | | | | | | | | | | | 43 | | |
| *Spio* cf. *limicola* | | | | | | | | | | | 86 | | | | | | |
| *S. thulini* | | | | | | | | | | | 43 | | | | | | |
| *Spiophanes bombyx* | | | | | 86 | 301 | 301 | 4902 | 1548 | 43 | 2709 | 2021 | 129 | | 1548 | 215 | |
| *Streblospio benedicti* | | | | 43 | | | | | | | | | | 43 | | | |
| Chironomidae | | | | 43 | | | | | | | | | | | | | |
| Collembola | | | | | | | | | | | | | | | | | |
| *Ampelisca abdita* | | | | | | | | | | | 43 | | | | | | |
| *Balanus crenatus* | | | 43 | | | | | | | | | | | | | | |
| *Carcinus maenas* | | | | | | | | | | | 86 | | | | 43 | | 215 |
| *Corophium* sp. | | | 43 | | | | | | | | 1333 | | | | 43 | | 2580 |
| *C. acherusicum* | | | | | | | 43 | | | | | | 43 | | | | |
| *C. insidiosum* | | | | | | | | | | | | 43 | | | | | |
| *Crangon septemspinosa* | | | | | | | | | | | | | | | | | |
| *Diastylis sculpta* | | | | | | | | | | | | | | | | | |
| *Dulichia* sp. | | | 86 | | | | 43 | | | | | | | | | | |
| Harpacticoida | | | | | | | | | | | | | | | | | |

(Continued)

TABLE A1-2. (CONTINUED)

| TAXA | STATION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MP-1 | MP-2 | RS-1 | RS-2 | RS-3 | AM-1 | AM-2 | CP-1 | CP-2 | LMC-1 | LMC-2 | LMC-3 | LMC-4 | RC-1 | RC-2 | RC-3 | RC-4 |
| *Microdeutopus* sp. | | | | | | | | | | | 258 | | | | | | |
| *M. gryllotalpa* | | | 172 | | | 86 | | 43 | | | 2322 | | 43 | | 688 | | 1505 |
| Ostracoda | 43 | | | | | | | | | | | | | | | | |
| *Pagurus longicarpus* | | | | | | 43 | | | | | | | | | | | |
| *Semibalanus balanoides* | | 43 | | | | | | | | | | | | | | | |
| *Crepidula* sp. | | | | | | | | | | | | | | | 43 | | |
| *C. fornicata* | | | | | | | | | | | 86 | | | | 129 | | |
| *C. plana* | | | | | | 43 | | | | | 43 | | | | | | |
| *Nassarius trivitatus* | | | | | | | | | | | | 43 | | | | | |
| *Niatella* sp. | | D | | | | | | | | | | | | | | | |
| *Littorina littorea* | | | | | | | | | | | 129 | | | | | | |
| *Mya arenaria* | | D | | | | | | | | | 43 | | | 86 | | | 43 |
| Mytilidae | | D | D | D | | | | | | | | | | | | | |
| *Tellina agilis* | | | | | | | | | | | | | | | 86 | | |
| *Ciona intestinalis* | | 86 | | | | | | | | | | 43 | | | | | |
| Athecata | | | | | | | | | | | | P | | | | | |
| *Obelia dichotoma* | | | P | | | | | | | | | | | | | | |
| Rhynchocoela | | | 43 | | | | | | | | | | | | | | 86 |
| Nematoda | 11,954 | 236,672 | 17,329 | 215 | 9,933 | | 1,806 | 1,591 | | | 2,838 | 13,932 | 2,752 | 129 | | | 16,641 |

(Continued)

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TABLE A1-2. (CONTINUED)

| TAXA | STATION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HP-1 | HP-2 | RS-1 | RS-2 | RS-3 | AM-1 | AM-2 | CP-1 | CP-2 | LHC-1 | LHC-2 | LHC-3 | LHC-4 | RC-1 | RC-2 | RC-3 | RC-4 |
| Ascidian | | 43 | | | | | | | | | | | | | | | |
| *Molgula* sp. | | 43 | | | | | | | | | | | | | | | |
| *Polycarpa fibrosa* | | 43 | | | | | | | | | | | | | | | |
| Total Abundance (no./m$^2$) | 86 | 17,759 | 241,230 | 20,597 | 1,161 | 18,287 | 430 | 9,202 | 3,354 | 129 | 27,907 | 16,598 | 3,096 | 3,096 | 21,156 | 301 | 49,837 |
| Total No. Discrete Taxa[a] | 2 | 11 | 13 | 6 | 4 | 8 | 4 | 9 | 5 | 2 | 22 | 8 | 6 | 7 | 14 | 4 | 10 |
| % Polychaeta | 0 | 27 | 2 | 15 | 67 | 20 | 80 | 59 | 50 | 100 | 25 | 14 | 5 | 13 | 22 | 88 | 4 |
| % Crustacea | 0 | 1 | <1 | <1 | 0 | 1 | 10 | 2 | 0 | 0 | 15 | 1 | 11 | 1 | 4 | 12 | 9 |
| % Biva | | | | | | | | | | | | | | | | | |

TABLE A1-3. SEDIMENT CHARACTERISTICS IN THE VICINITY OF POTENTIAL DISPOSAL SITE EAST OF SPECTACLE ISLAND, 1988[a].

| PARAMETER[a] | ST1-7 (0-2')[b] | ST1-8 (0-1') | ST1-8 (1-6.25') | ST1-9 (0-2') | ST1-11 (0-2') | ST1-12 (0-1.5') |
|---|---|---|---|---|---|---|
| Arsenic | 9.2 | 14.8 | 27.8 | 3.8 | 2.5 | 13.1 |
| Cadmium | 0.7 | 0.8 | 0.8 | <0.5 | 0.8 | 2.8 |
| Chromium | 16.0 | 19.2 | 25.3 | 12.1 | 19.1 | 20.9 |
| Copper | 8.7 | 18.0 | 17.1 | 5.3 | 22.4 | 14.1 |
| Lead | 7.5 | 14.4 | 10.1 | 9.5 | 16.1 | 11.7 |
| Mercury | <0.01 | 0.06 | <0.01 | 0.02 | 0.11 | 0.06 |
| Nickel | 15.5 | 15.8 | 23.5 | 10.5 | 20.1 | 22.8 |
| Vanadium | 22 | 23 | 39 | 17 | 20 | 37 |
| Zinc | 32.2 | 35.8 | 41.2 | 64.0 | 37.7 | 53.8 |
| % Water | 27 | 26 | 37 | 27.6 | 24 | 20 |
| % Volatile Solids | 3 | 2 | 2 | 0.8 | 9 | 2 |
| % Oil and Grease | 0.042 | 0.032 | 0.020 | 0.080 | 0.025 | <0.010 |
| Total Petroleum Hydrocarbons | <100 | 200 | 100 | <100 | <100 | <100 |
| % Total Organic Carbon | 0.52 | 1.40 | 1.20 | 0.60 | 0.64 | 0.77 |
| Polychlorinated Biphenyls | TR | 0.02 | ND | ND | TR | ND |
| % Silt/Clay | 48 | 23 | 50 | 31 | 21 | 7 |
| Classification | 1A | 2A | 3A | 1A | 1B | 2A |

Source: Cortell 1990b
[a]All results in mg/kg (ppm) dry weight unless otherwise noted.
[b]Depth below sediment surface
TR = Traces below detection limit
ND = Not detected

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TABLE A1-4. COPPER CONCENTRATIONS AT A POSITION WHEN COPPER IS DILUTED BELOW WATER QUALITY CRITERIA AT THE SPECTACLE ISLAND CAD DURING FLOOD AND EBB TIDES OF DIFFERENT VELOCITIES.

EBB TIDE

| | 0.6 KNOTS | | | | 0.3 KNOTS | | | |
|---|---|---|---|---|---|---|---|---|
| DEPTH (ft) | TIME TO DILUTION (hrs) | COPPER[a] (mg/l) | DISTANCE FROM DISPOSAL (ft) | SILT CLOUD DIA. AT TIME (ft) | TIME TO DILUTION (hrs) | COPPER (mg/l) | DISTANCE FROM DUMP (ft) | SILT CLOUD DIR. AT TIME (ft) |
| 1.0 | 2.00 | 0.00273 | 7,000 | 1,002* | 2.17 | 0.00275 | 4,000 | 1,089* |
| 6.0 | 3.67 | 0.00286 | 13,000 | 1,985 | 3.83 | 0.00262 | 7,000 | 2,124* |
| 10.0 | 2.50 | 0.00251 | 9,000 | 1,267 | 2.50 | 0.00259 | 4,500 | 1,372* |

FLOOD TIDE

| | 0.4 KNOTS | | | | 0.2 KNOTS | | | |
|---|---|---|---|---|---|---|---|---|
| DEPTH (ft) | TIME TO DILUTION (hrs) | COPPER[a] (mg/l) | DISTANCE FROM DISPOSAL (ft) | SILT CLOUD DIA. AT TIME (ft) | TIME TO DILUTION (hrs) | COPPER (mg/l) | DISTANCE FROM DUMP (ft) | SILT CLOUD DIR. AT TIME (ft) |
| 1.0 | 2.00 | 0.00220 | 5,000 | 994 | 2.17 | 0.00288 | 2,500 | 1,089* |
| 6.0 | 3.67 | 0.00278 | 9,000 | 1,991* | 3.83 | 0.00279 | 4,500 | 2,102* |
| 10.0 | 2.50 | 0.00277 | 7,000 | 1,372* | 2.33 | 0.00254 | 3,000 | 1,183* |

[a]Wq criteria for copper = 0.0029 mg/l
*interpolated from values in output

TABLE A1-5. DOMINANT FISH SPECIES[a] AND LOBSTERS IN TRAWLS CONDUCTED IN AN AREA JUST WEST[b] OF THE MWRA PROPOSED OUTFALL BY MASSACHUSETTS DIVISION OF MARINE FISHERIES, 1991-92.

| COMMON NAME | 5/91 | 5/92 |
|---|---|---|
| FISH | PERCENT COMPOSITION | |
| Ocean pout | 35 | 15 |
| Longhorn sculpin | 21 | 19 |
| Winter flounder | 19 | 33 |
| Atlantic cod | 17 | 10 |
| Yellowtail flounder | 7 | 16 |
| All other spp. | 1 | 7 |
| Total | 100% | 100% |
| | ABUNDANCE | |
| Total # Indiv. | 655 | 685 |
| Trawl length (min) | 20 | 13 |
| Total CPU[c] est. (20 min) | 655 | 1054 |
| AMERICAN LOBSTER (Count) | | |
| Total # Indiv. | 17 | 60 |
| Total CPU[c] est. (20 min) | 17 | 92 |

[a]Those making up > 10% of the catch
[b]Approx. 42°23' N, 70°49' W ("Rosie's Hole")
[c]Catch Per Unit

TABLE A1-6. MAXIMUM CONCENTRATION (mg/l) OF COPPER AND SILT/CLAY IN THE WATER COLUMN AT THE MEISBURGER 7 DISPOSAL SITE UNDER STRATIFIED CONDITIONS ESTIMATED BY THE ADDAM'S MODEL FOUR HOURS AFTER A SINGLE DUMP OF 2,000 CU. YDS.

| | MAX. CONCENTRATION OUTSIDE THE MIXING ZONE[a] | | MAX. CONCENTRATION WITHIN THE MIXING ZONE | | |
|---|---|---|---|---|---|
| DEPTH (FT) | COPPER[b] | SILT/ CLAY[c,d] | COPPER | SILT/ CLAY | SILT/CLAY CLOUD DIA. (ft) |
| 5 | 0.00035 | 5.1 | 0.00035 | 5.1 | |
| 60 | 0.00036 | 10.3 | 0.00038 | 10.6 | |
| 85 | 0.00066 | NE | 0.0012 | NE | |
| 95 | 0.00046 | 8.2 | 0.00064 | 14.9 | 2581 |

*WQ criteria, Copper = 0.0029 mg/l
[a]Mixing zone = disposal area boundary
[b]Background, Copper = 0.00035 mg/l
[c]Background, TSS = 4.5 mg/l (average value)
[d]Conc. silt/clay = Background TSS (4.5) + concentration on grid above background.

TABLE A1-7. SEDIMENT CHARACTERISTICS IN VICINITY OF PROPOSED SUBAQUEOUS CONTAINMENT SITES B AND E AND WINTHROP HARBOR CONTAINMENT SITE.

| | LOCATION | | | |
|---|---|---|---|---|
| | SUBAQ B[b] | | SUBAQ E[c] | WINTHROP HARBOR[d] |
| PARAMETER[a] | ST1-14 | ST1-15 | B-33-L | MEAN |
| % Silt/Clay | 3 | 5 | -- | 84.4 |
| As | 3.3 | 4.8 | 9 | 5.6 |
| Cd | 0.6 | 1.0 | 4.9 | 1.0 |
| Cr | 12.8 | 30.7 | 57 | 123.0 |
| Cu | 10.5 | 47.7 | 105 | 100.0 |
| Pb | 11.6 | 32.7 | 62 | 138.0 |
| Hg | 0.06 | 0.22 | 0.34 | 0.32 |
| Ni | 16.2 | 30.6 | 18 | 28.0 |
| Zn | 40.4 | 81.7 | 142 | 149.0 |
| PCBs | TR | TR | <0.05 | <0.1 ppm |
| % Volatile solids | 1 | 1 | -- | -- |
| Oil and grease | <100 | 600 | 0.40 | -- |
| Total petroleum hydrocarbon | <100 | 400 | -- | -- |
| % Total organic carbon | 0.2 | 0.3 | -- | .70 |

[a] Results in mg/kg (ppm) unless otherwise noted; all values relative to dry weight.
[b] Cortell, 1990b
[c] Massport, 1990
[d] Army Corps of Engineers, (NED) 1992

TABLE A1-8. MAXIMUM CONCENTRATION (mg/1) OF COPPER AND SILT/CLAY IN THE WATER COLUMN AT THE SUBAQUEOUS E SITE DURING MAXIMUM EBB AND FLOOD TIDES UNDER UNSTRATIFIED CONDITIONS ESTIMATED BY THE ADDAM'S MODEL FOUR HOURS AFTER A SINGLE DUMP OF 1,000 CU. YDS.

| | MAX. CONCENTRATION (mg/L) OUTSIDE THE MIXING ZONE[f] | | MAX. CONCENTRATION (mg/L) WITHIN THE MIXING ZONE | | |
|---|---|---|---|---|---|
| **EBB TIDE** | | | | | |
| DEPTH (ft) | COPPER[a,b] | SILT/ CLAY[c,d] | COPPER | SILT/ CLAY | SILT/CLAY CLOUD DIA. (ft) |
| 1.0 | 0.0012 | 4.9 | 0.0013 | 5.1 | 2220 |
| 3.0 | 0.0013 | 4.1 | 0.0014 | 5.3 | 2220 |
| 10.5 | 0.0017 | NE[e] | 0.0019 | NE | 2220 |
| **FLOOD TIDE** | | | | | |
| DEPTH (ft) | COPPER[a,b] | SILT/ CLAY[c] | COPPER | SILT/ CLAY | SILT/CLAY CLOUD DIA. (ft) |
| 1.0 | 0.0040[b] | 14.4 | 0.0040[b] | 14.4 | 2222 |
| 2.0 | 0.0058[b] | NE[d] | 0.0058[b] | NE | 2222 |
| 3.0 | 0.0039[b] | 14.2 | 0.0039[b] | 14.2 | 2222 |

[a]Background, Copper = 0.00035 mg/L.
[b]WQ Criteria, Copper = 0.0029 mg/L.
[c]Background, Total Suspended Solids = 4.5 mg/L.
[d]Model results were added to the background level to derive a predicted value.
[e]Not estimated in model run.
[f]Mixing zone = disposal site boundary.

TABLE A1-9. PHYSICAL AND BULK CHEMICAL ANALYSIS OF WINTHROP HARBOR SEDIMENTS[a].

| SAMPLE | FINES (%) | TOC (%) | As (ppm) | Cd (ppm) | Cr (ppm) | Cu (ppm) | Hg (ppm) | Ni (ppm) | Pb (ppm) | Zn (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 77.3 | 0.53 | 5.5 | 0.6 | 57* | 40 | 0.14 | 21 | 85 | 79 |
| B | 86.4 | 0.65 | 5.3 | 1.2 | 120 | 91 | 0.36 | 27 | 140* | 130 |
| C | 83.1 | 0.43 | 4.9 | 0.6 | 68 | 43 | 0.25 | 23 | 166* | 84 |
| D | 49.3 | 0.53 | 3.9 | 0.7 | 85 | 77 | 0.24 | 18 | 107* | 96 |
| E | 52.5 | 0.42 | 2.5 | 0.4 | 46 | 34 | 0.16 | 13 | 96 | 65 |
| F | 75.2 | 0.56 | 4.5 | 0.9 | 79 | 64 | 0.18 | 20 | 101* | 86 |
| G | 69.7 | 0.65 | 4.9 | 0.9 | 85 | 70 | 0.18 | 22 | 76 | 110 |
| H | 90.6 | 0.66 | 6.9 | 1.1 | 140* | 100 | 0.38 | 32 | 140* | 140 |
| I | 91.4 | 0.43 | 6.5 | 0.5 | 72 | 40 | 0.21 | 30 | 230** | 83 |
| J | 91.2 | 0.92 | 4.6 | 1.4 | 140* | 110 | 0.33 | 30 | 170* | 130 |
| K | 85.0 | 0.61 | 6.6 | 0.9 | 130* | 90 | 0.37 | 31 | 130* | 120 |
| L | 8.9 | 0.93 | 8.4 | 1.9 | 180* | 90 | 0.37 | 31 | 250** | 210* |
| M | 93.4 | 0.96 | 6.1 | 2.0 | 200* | 170 | 0.46 | 38 | 200* | 240* |
| N | 91.7 | 0.89 | 6.1 | 2.0 | 190* | 160 | 0.44 | 34 | 100* | 240* |
| O | 92.1 | 0.87 | 6.1 | 1.9 | 170* | 150 | 0.40 | 30 | 100* | 210* |
| P | 92.8 | 0.88 | 6.5 | 2.1 | 190* | 170 | 0.45 | 36 | 100* | 250* |
| Q | 90.6 | 0.93 | 6.6 | 1.7 | 134* | 130 | 0.52 | 33 | 150* | 240* |
| MEAN | 82.4 | 0.70 | 5.6 | 1.0 | 123* | 100 | 0.32 | 28 | 138 | 149 |

TOC: Total Organic Carbon; As: Arsenic; Cd: Cadmium; Cr: Chromium; Cu: Copper; Hg: Mercury; Ni: Nickel; Pb: Lead; Zn: Zinc.
* Class II sediments according to Massachusetts Guidelines.
** Class III sediments according to Massachusetts Guidelines.
[a]11992. Winthrop Harbor Environmental Assessment.

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TABLE A1-10. WINTHROP HARBOR BENTHIC INVERTEBRATES, FALL 1989.[a]

| | SAMPLE STATION | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 9 | 10 | 11 | 12 | 13 | MEAN | % OF TOTAL |
| | (NUMBER OF INDIVIDUALS PER 0.04m$^2$ VAN VEEN GRAB) | | | | | | | | | |
| Oligochaeta | 0 | 6 | 2 | 0 | 15 | 0 | 7 | 22 | 6.5 | 21.4 |
| Polychaeta | | | | | | | | | | |
| *Streblospio benedicti* | 1 | 28 | 9 | 12 | 57 | 4 | 20 | 49 | 16.4 | 53.9 |
| *Microphthalmus* sp. | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 1.3 | 4.1 |
| *Nephtys ciliata* | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 1.1 | 3.7 |
| *Polydora ligni* | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0.5 | 1.6 |
| *Scoloplos robustus* | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0.4 | 1.2 |
| *Clymenella torquata* | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0.3 | 0.8 |
| *Scolopios* sp. | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.1 | 0.4 |
| Cirratulidae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0.1 | 0.4 |
| Gastropoda | | | | | | | | | | |
| *Nassarius trivittatus* | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0.3 | 0.4 |
| Bivalvia | | | | | | | | | | |
| *Mya arenaria* | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0.5 | 2.1 |
| Mytilidae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.4 |
| Crustacea | | | | | | | | | | |
| *Ampelisca abdita* | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 1.4 | 4.5 |
| *Corophium insidiosum* | 0 | 0 | 4 | 1 | 1 | 0 | 2 | 1 | 1.1 | 3.7 |
| *Gammarus* sp. | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.8 |
| *Balanus improvisus* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.4 |

[a]All samples collected 31 October, 1989.
See Figure EA-4 for sample locations.

Source: Army Corps of Engineers, NED. 1992. Winthrop Harbor Environmental Assessment.

TABLE A1-11. MAXIMUM CONCENTRATION (mg/l) OF COPPER AND SILT/CLAY IN THE WATER STRATIFIED COLUMN AT THE BOSTON LIGHT SHIP DISPOSAL SITE UNDER SUMMER CONDITIONS ESTIMATED BY THE ADDAM'S MODEL FOUR HOURS AFTER A SINGLE DUMP OF 2,000 CU. YDS.

| | MAX. CONCENTRATION OUTSIDE THE MIXING ZONE[a] | | MAX. CONCENTRATION WITHIN THE MIXING ZONE | | |
|---|---|---|---|---|---|
| DEPTH (ft) | COPPER[b] | SILT/ CLAY[c,d] | COPPER | SILT/ CLAY | SILT/CLAY CLOUD DIA. (ft) |
| 1 | 0.00036 | 5.2 | 0.00035 | 5.2 | |
| 50 | 0.00035 | 5.5 | 0.00036 | 5.5 | |
| 108 | 0.00051 | NE | 0.00066 | NE | |
| 145 | 0.00038 | 6.3 | 0.00042 | 7.9 | 2738 |

[a]Mixing zone = Disposal site boundary
*WQ criteria, Copper = 0.0029 Mg/L
[b]Background, Copper = 0.00035 Mg/L
[c]Background, Total Suspended Solids = 4.5 mg/L
[d]Conc. silt/clay = Background TSS (4.5) + concentration on grid above background

TABLE A1-12. WATER QUALITY DATA, BOSTON HARBOR[1]

| Parameters[2] | River Complex | Outer Harbor | Outside Harbor |
|---|---|---|---|
| Temperature °C. | 0-21 | 0-22 | 0-20.5 |
| Salinity % | 4-32 | 21-34 | 28-34 |
| **Chemical[2]** | | | |
| D.O., ppm | 2.41-11.49 | 6.02-14.0 | 6.48-12.65 |
| Nitrogen mg/l | | | |
| Ammonia - N | 0.01-1.0 | 0.01-14.0 | 0.01-0.40 |
| Nitrate - N | 0.22-1.2424 | .001-.570 | 0.002-.940 |
| Phosphorus mg/l | | | |
| Total | 0.05-1.02 | .024-1.33 | 0.010-.133 |
| Ortho | .007-.924 | .010-1.17 | 0.018-.082 |
| Zinc[3] ppb | 30.6-62.2 | 7.8-16.7 | |
| Copper[3] ppb | 2.8-6.6 | 1.9-8.6 | |
| Lead[3] ppb | 2.2-10.6 | 1.2-2.7 | |
| Nickel[3] ppb | 7.2-13.6 | 0.1-13.6 | |
| Chromium[3] ppb | 0.2-3.69 | 0.1-1.2 | |
| Cadmium[3] ppb | 0.34-0.56 | 0.11-1.10 | |
| **Biological(2)** | | | |
| Bacterial cts. (coliform) | 0-96,000 | 0-10,000 | 0-4,200 |

(1) Table from Jason Cortell Associates (1977)

(2) New England Aquarium (1973)

(3) New England Aquarium (1972) (values are for soluble phase)

N.B.: Sampling by MDWPC (1986) is within the described ranges, but not averaged here since it only occurred June through October.

TABLE A1-13. AVERAGE CONCENTRATION OF TOTAL ORGANIC CARBON AND TOTAL PETROLEUM HYDROCARBONS. MASSPORT DREDGING PROJECT.

| SITE | AVG. CONC. TOC (%) | AVG. CONC. TPH |
|---|---|---|
| Army Base 1-3 | 3.9 | 3233 |
| Army Base 4-9 | 2.7 | 2390 |
| Boston Edison Intake | 5.4 | 2851 |
| Conley 11-13 | 4.1 | 1310 |
| Conley 14-15 | 3.1 | 3127 |
| Distrigas | 6.6 | 4393 |
| Eastern Minerals | 3.6 | 2425 |
| Boston Edison Barge Berth | 10.2 | 3650 |
| Gulf Oil | 1.7 | 1820 |
| Moran | 5.6 | 3035 |
| Mystic 2, 49, 50 | 2.4 | 2175 |
| Mystic Pier 1 | 3.7 | 4640 |
| North Jetty | 3.1 | 2627 |
| Prolerized | 5.0 | 3970 |
| Revere Sugar | 4.5 | 3000 |

TABLE A1-14. COMPARISON OF AVERAGE LEAD AND CHROMIUM CONCENTRATIONS (MG/L) WITH MASSACHUSETTS DEP BULK SOIL CONCENTRATIONS (MG/L) FOR TCLP ANALYSIS. MASSPORT DREDGING PROJECT.

| SITE | MASS DEP BULK SOIL LIMIT FOR CR AND PB (MG/KG) | AVERAGE BULK SEDIMENT CONC. (MG/KG) CR | PB | EPA REG. LEVEL FOR CR & PB (MG/L) | TCLP RESULTS (MG/L) CR | PB |
|---|---|---|---|---|---|---|
| Army Base | 100 | 146 | 111 | 5 | ND | 0.33 |
| Boston Edison Intake | 100 | | 103 | 5 | | |
| Conley | 100 | 188 | 140 | 5 | ND | 0.29 |
| Distrigas | 100 | 149 | 657 | 5 | ND | 0.41 |
| E. Minerals | 100 | 242 | 221 | 5 | ND | 0.23 |
| Boston Edison Barge Berth | 100 | 173 | 175 | 5 | ND | 0.35 |
| Gulf Oil | 100 | 135 | 156 | 5 | ND | 0.17 |
| Moran | 100 | 100 | 350 | 5 | 0.07 | 0.26 |
| Mystic Piers | 100 | 164 | 299 | 5 | ND | 0.31 |
| North Jetty | 100 | 189 | 321 | 5 | ND | 0.46 |
| Prolerized | 100 | 151 | 476 | 5 | ND | 0.47 |
| Revere Sugar | 100 | 178 | 501 | 5 | 0.16 | 0.39 |

TABLE A1-15. CONCENTRATION OF SODIUM AND CHLORIDE FOR MASSPORT DREDGING PROJECT.

| SITE | SODIUM (MG/KG) | CHLORIDE % |
|---|---|---|
| Conley | 3250 | 1.9 |
| Army Base | 3600 | 1.8 |
| Moran | 5930 | 2.1 |
| North Jetty | 5560 | 1.8 |
| Eastern Minerals | 40140 | 1.6 |
| Mystic Pier | 6560 | 2.0 |
| Gulf Oil | 10650 | 1.1 |

TABLE A1-16. FINFISH SAMPLING IN BOSTON HARBOR - JULY 1986

OUTER MAIN SHIP CHANNEL

Type of Gear: Gillnets
Number of deployments: 4 (2 demersal and 2 pelagic)
Length of deployments: 6 hours each

| Species | Total Number | Average Length (cm) (+ S.D) | Total Weight (kg) (+ S.D) |
|---|---|---|---|
| Pleuronectes americanus | 6 | 33.3(+ 7.0) | 0.46 |
| Osmerus mordax | 2 | 16.75 (+ 0.35) | – |
| Alosa pseudoharengus | 1 | 22.0 | – |
| Brevoortia tyrannus | 1 | 35.0 | 1.0 |
| Homarus americanus | 2 (1 male, 1 female) | 7.5 (+ 0.42) | 0.5 |
| Cancer borealis | 4 (4 female) | 10.55 (+ 0.66) | 0.28(+0.06 |

OUTER MAIN SHIP CHANNEL

Type of Gear: Gillnets
Number of deployments: 4 (2 demersal and 2 pelagic)
Length of deployments: 6 hours each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight (kg) (+ S.D.) |
|---|---|---|---|
| Pleuronectes americanus | 24 (63 % female) | 16.6 (+ 11.3) | 0.5(+0.16 |
| Scophthalmus aquosus | 1 (female) | 26.0 | 0.25 |
| Scomber scombrus | 1 (male) | 24.0 | 0.15 |
| Alosa aestivalis | 1 (male) | 15.9 | – |
| Myoxocephalus octodecemspinosus | 1(female) | 28.7 | 0.25 |
| Cancer borealis | 12 (66.7% male) | 9.1(+ 1.8) | 0.0 |
| Carcinus meanas | 1 (male) | 6.1 | |

Note: Ectoparasitic infection on all Pleuronectes americanus

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TABLE A1-16. (CONTINUED)

MAIN SHIP CHANNEL

Type of Gear: Gillnets
Number of deployments: 2 (demersal)
Length of deployments: 6 hours each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight(kg) (+ S.D.) |
|---|---|---|---|
| Pleuronectes americanus | 2 | 28.5 (+ 0.12) | 0.48(+0.004) |
| Scophthalmus aquosus | 1 | 29.0 | 0.45 |
| Osmerus mordax | 1 | 15.2 | |

MAIN SHIP CHANNEL

Type of Gear: Gillnets
Number of deployments: 2 (demersal)
Length of deployments: 6 hours each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight(kg) + S.D.) |
|---|---|---|---|
| Pleuronectes americanus | 5 | 18.6(+ 9.97) | 0.2 |
| Osmerus mordax | 4 | 18.4(+ 3.0) | - |
| Scopthalmus aquosus | 2 | 13.2(+ 4.7) | - |
| Microgadus tomcod | 1(female) | 23.5 | 0.4 |
| Cancer borealis | 5(60% male) | 6.9 (+0.5) | 0.12 |
| Carcinus maenas | 1 | 3.2 | - |

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TABLE A1-16. (CONTINUED)

MYSTIC RIVER

Type of Gear: Gillnets
Number of deployments: 2 (demersal)
Length of deployments: 6 hours each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight (kg) (+ S.D.) |
|---|---|---|---|
| Osmerus mordax | 1 | 15.5 | |
| Carcinus meanas | 24 (100% female) | 3.34 (+ 1.59) | 0.015 |

Finfish Sampling in Boston Harbor - July 1986
Mystic River

Type of Gear: Otter trawl
Number of deployments: 9
Length of deployments: 5 minutes each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight(K (+ S.D.) |
|---|---|---|---|

None

MYSTIC RIVER

Type of Gear: Gillnets
Number of deployments: 2 (demersal)
Length of deployments: 6 hours each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight(K (+ S.D.) |
|---|---|---|---|
| Osmerus mordax | 1 | 19.0 | |
| Carcinus maenas | 16 (75%female) | 4.82 (+ 0.67) | 0.03 |

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TABLE A1-16. (CONTINUED)

MYSTIC RIVER

Type of Gear: Otter Trawl
Number of deployments: 4
Length of deployments: 5 minute each

| Species | Total Number | Average Total Length (cm) (+ S.D.) | Average Weight(kg) (+ S.D.) |
|---|---|---|---|
| Pleuronectes americanus | 443 (58.3% male) | 9.59 (+ 3.51) | 0.014 |
| Scophthalmus aqousus | 23 | 8.87 (+4.19) | 0.018 |
| Alosa aestivalis | 12 | 11.2 (+1.67) | - |
| Osmerus mordax | 14(66.6% female) | 13.1 (+3.95) | - |
| Menidia menidia | 7 | 11.1 (+0.42) | |
| Myoxocephalus octodecemspinosus | 2 | 8.3(+ 0.42) | - |
| Crangon septemspinose | 5796 | (3.62 total) | |
| Carcinus maenas | 72 (50% female) | 4.54 (+ 1.12) | 0.026 |

TABLE A1-16. (CONTINUED)

BOSTON HARBOR (1986)

MYSTIC RIVER

| July | November |
|---|---|
| (Ni = 277.1, Ns = 2.2) | (Ni = 6.25, Ns = 0.25) |
| Capitella capitata (61.8%) | Streblospio beneticti (33.3%) |
| Polydora aggregata (9.0%) | Crangon septemspinosa (33.3%) |
| Polydora ligni (8.1%) | Gastropoda (33.3%) |
| Caulleriella sp. (8.1%) | |

CHELSEA RIVER AND CONFLUENCE AREA

| July | November |
|---|---|
| (Ni = 11,180.4 Ns = 16.5) | (Ni = 51.6, Ns = 0.75) |
| Polydora aggregata (28.0%) | Streblospio benedicti (20.3%) |
| Polydora ligni (24.9%) | Tubificidae (32.2%) |
| Capitella capitata (17.2%) | Tharyx acutus (16.1%) |

RESERVED CHANNEL

| July | November |
|---|---|
| (Ni = 409.4, Ns = 2.0) | (Ni = 15.6, Ns = 0.38) |
| Capitella capitata (85.5%) | Polydora ligni (60.0%) |
| Eteone flava (5.3%) | Ampelisca abdita (20.0%) |
| | Modiolus modiolus (20.0%) |

Ni = Mean # of Individuals/m2
Ns = Mean # of Species/m

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TABLE A1-17. DOMINANT SPECIES BY TRIBUTARY

BOSTON HARBOR (1986)

## MYSTIC RIVER

| July | November |
|---|---|
| Ni = 277.1, Ns = 2.2) | (Ni = 6.25, Ns = 0.25) |
| Capitella capitata (61.8%) | Streblospio beneticti (33.3%) |
| Polydora aggregata (9.0%) | Crangon spetemspinosa (33.3%) |
| Polydora ligni (8.1%) | Gastropoda (33.3%) |
| Caulleriella sp. (8.1%) | |

## CHELSEA RIVER AND CONFLUENCE AREA

| July | November |
|---|---|
| (Ni = 11,180.4 Ns = 16.5) | (Ni = 51.6, Ns = 0.75) |
| Polydora aggregata (28.0%) | Streblospio benedicti (20.3%) |
| Polydora ligni (24.9%) | Tubificidae (32.2%) |
| Capitella capitata (17.2%) | Tharyx acutus (16.1%) |

## RESERVED CHANNEL

| July | November |
|---|---|
| (Ni = 409.4, Ns = 2.0) | (Ni = 15.6, Ns = 0.38) |
| Capitella capitata (85.5%) | Polydora ligni (60.0%) |
| Eteone flava (5.3%) | Ampelisca abdita (20.0%) |
| | Modiolus modiolus (20.0%) |

Ni = Mean # of Individuals/m2
Ns = Mean # of Species/m