Final Environmental Impact Statement

Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project

Prepared by
U.S. Environmental Protection Agency,
New England Region

In cooperation with
U.S. Army Corps of Engineers,
New England District

October 2004

EPA United States Environmental Protection Agency New England

US Army Corps of Engineers

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

October 18, 2004

Subject: Final Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project

Dear Interested Party:

Enclosed please find a Public Notice of Availability (PNA) announcing the release of the "Final Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project" (FEIS) for public review. The package that is available for review includes the FEIS, the Executive Summary, appendices, and the Site Management and Monitoring Plan (SMMP). In addition to the PNA, I have enclosed the additional information that you requested be provided to you for this review.

The FEIS is being released by the U.S. Environmental Protection Agency, New England Region in cooperation with the U.S. Army Corps of Engineers, New England District and was prepared consistent with the requirements of the National Environmental Policy Act and the Marine Protection, Research, and Sanctuaries Act to evaluate the potential environmental impacts associated with the designation of open-water dredged material disposal sites in the Rhode Island Region. The public review period for the FEIS, and SMMP begins October 22, 2004 and closes on November 30, 2004 at 5:00 p.m.

Further information can be obtained from and written comments submitted to:

Olga Guza
US EPA, New England Region
One Congress Street
Suite 1100, CWQ
Boston, MA 02114-2023
Facsimile to (617) 918-1505
Phone: (617) 918-1542
Electronic Mail: R1_RISEIS@EPAMAIL.EPA.GOV

Sincerely,

Linda M. Murphy, Director
Office of Ecosystem Protection

EPA United States Environmental Protection Agency New England

US Army Corps of Engineers®

Public Notice Of Availability
Final Environmental Impact Statement (FEIS) for
Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project
October 22, 2004

The Final Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (FEIS), the Executive Summary, and the Draft Site Management and Monitoring Plan (SMMP) is available for public review.

The FEIS is being released by the U.S. Environmental Protection Agency, New England Region (EPA) in cooperation with the U.S. Army Corps of Engineers, New England District (Corps) and was prepared consistent with the requirements of the National Environmental Policy Act, and the Marine Protection, Research, and Sanctuaries Act to evaluate the potential environmental impacts associated with the designation of open-water dredged material disposal sites in the Rhode Island Region. The public review period for the FEIS and SMMP begins October 22, 2004 and closes on November 30, 2004 at 5:00 p.m. Should the public have comments on either the FEIS or the SMMP, the written comments should be sent to:

Olga Guza
US EPA, New England Region
One Congress Street
Suite 1100, CWQ
Boston, MA 02114-2023
Facsimile to (617) 918-1505
Electronic Mail: R1_RISEIS@EPAMAIL.EPA.GOV

Comments should be submitted in writing no later than November 30, 2004 **at 5:00 p.m.**

You also may review and/or obtain electronic copies of the notice announcing the availability of the FEIS at the EPA home page at the Federal Register http://www.epa.gov/fedrgstr/. The FEIS and the SMMP are available for review and/to obtain at the following EPA Web Page address: http://www.epa.gov/region1/eco/ridredge/index.html

The FEIS and the SMMP are available for inspection at the following locations:

EPA New England Library
11th Floor
One Congress Street
Suite 1100
Boston, MA 02114-2023

EPA Public Info Reference Unit
Room 2904 (rear)
401 M Street, SW.
Washington, DC 20004

EPA Narragansett Lab
Library
27 Tarzwell Drive
Narragansett, RI 02882

Additional copies of the FEIS are also available at the following locations:

Westerly Public Library
44 Broad St.
Westerly, RI 02891

Cross Mills Public Library
4417 Old Post Rd.
Charlestown, RI 02813

South Kingstown Public Library
1057 Kingstown Rd.
Peace Dale, RI 02879

Narragansett Public Library
35 Kingston Rd.
Narragansett, RI 02882

North Kingston Free Library
100 Boone St.
North Kingston, RI 02852

Davisville Free Library
481 Davisville Rd.
North Kingstown, RI 02852

East Greenwich Free Library
82 Pierce St.
East Greenwich, RI 02818

Pontiac Free Library
101 Greenwich Ave.
Warwick, RI 02886

Warwick Public Library
600 Sandy Lane
Warwick, RI 02889

Cranston Public Library
140 Sockanosset Cross Rd.
Cranston, RI 02920

Providence Public Library
225 Washington St.
Providence, RI 02903

Pawtucket Public Library
13 Summer St.
Pawtucket, RI 02860

East Providence Public Library
41 Grove Ave.
East Providence, RI 02914

Barrington Public Library
281 County Rd.
Barrington, RI 02806

George Hail Free Library
530 Main St.
Warren, RI 02885

Rogers Free Library
525 Hope St.
Bristol, RI 02809

Swansea Free Public Library
69 Main St.
Swansea, MA 02777

Dighton Public Library
395 Main St.
Dighton, MA 02715

Berkley Public Library
1 North Main St.
Berkley, MA 02779

James White Memorial Library
5 Washburn Rd.
East Freetown, MA 02717

Somerset Public Library
1464 County St.
Somerset, MA 02726

Fall River Public Library
104 North Main St.
Fall River, MA 02720

Essex Public Library
238 Highland Rd.
Tiverton, RI 02878

Brownell Library
Commons
Little Compton, RI 02937

Portsmouth Free Public Library
2658 East Main Rd.
Portsmouth, RI 02842

Middletown Public Library
700 West Main Rd.
Middletown, RI 02842

Newport Public Library
Aquidneck Park, 300 Spring St.
Newport, RI 02840

Jamestown Philomenian Library
26 North Rd.
Jamestown, RI 02835

Island Free Library
Box 1830 Dodge St.
Block Island, RI 02807

Kingston Free Library
2605 Kingstown Rd.
Kingston, RI 02881

Robert Beverly Hale Library
2601 Commodore Perry Highway
Wakefield, RI 02879

Willett Free Library
45 Ferry Rd.
Saunderstown, RI 02874

FINAL
ENVIRONMENTAL IMPACT STATEMENT

FOR THE

RHODE ISLAND REGION LONG-TERM DREDGED MATERIAL DISPOSAL SITE EVALUATION PROJECT

Prepared By: U.S. Environmental Protection Agency – New England Region

In cooperation with:

U.S. Army Corps of Engineers – New England District

Comments or inquiries should be directed to:

Olga Guza
US EPA, New England Region
One Congress Street
Suite 1100, CWQ
Boston, MA 02114-2023
Tel. No. (617)918-1542
Facsimile to (617)918-1505
Electronic Mail: R1_RISEIS@EPAMAIL.EPA.GOV

APPROVED BY:

Robert W. Varney Regional Administrator EPA New England	Thomas L. Koning Colonel, Corps of Engineers District Engineer
Date: 10/6/04	Date: 10/7/04

EXECUTIVE SUMMARY

Introduction and Background

Maintenance of adequate navigation depth in the states' marine terminals, port facilities, and private marinas is vital to the economies of Rhode Island and southeast Massachusetts (referred to as the Rhode Island Region). Commercial shipping and recreational boating industries throughout the Rhode Island Region rely on the continued viability of these facilities. To ensure continued use, economic viability, and safety of the region's navigation channels and navigation-dependant facilities, periodic dredging must be performed to remove accumulated sediment. Maintenance dredging in the RIR has become both difficult and costly due to the absence of a designated long-term ocean disposal site in the region. In an effort to ease the burden, the Governor of Rhode Island requested (September 21, 2000) (Appendix B) that the U.S. Environmental Protection Agency (EPA), in cooperation with the U.S. Army Corps of Engineers (Corps), consider the designation of a long-term dredged material disposal site in Rhode Island Sound (pursuant with the Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. §§ 1401 *et seq.*). In response to this request, EPA Region 1 and the Corps New England District initiated an evaluation to determine if there was a need to designate one or more long-term ocean dredged material disposal sites as part of the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project in waters offshore of Rhode Island or offshore of southeastern Massachusetts, referred to herein as the Rhode Island Region (RIR) (Figure ES-1). This evaluation was conducted pursuant to the Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. Section 1401 *et seq*. In the letter requesting EPA and the Corps' consideration of designating a long-term disposal site, the Governor cited difficulties that navigational facilities were experiencing due to a backlog of maintenance dredging activities. This backlog stemmed from a lack of environmentally acceptable and cost-effective disposal options available to the navigation community.

Through a site screening process that considered the 5 general and 11 specific criteria in the MPRSA as well as evaluation factors specific to the RIR, EPA identified two potential alternative open-water dredged material disposal sites that warranted a more detailed evaluation. If designated, one or more of these sites could be used for disposal of dredged material found suitable for open-water disposal from navigation projects and other sources from Rhode Island and southeastern Massachusetts. EPA's designation of an ocean disposal site does not authorize or result in the disposal of any particular material at the site. Designation only makes a site available for disposal, and disposal at a designated site is only one of a number of disposal options that are evaluated for proposed dredging projects.

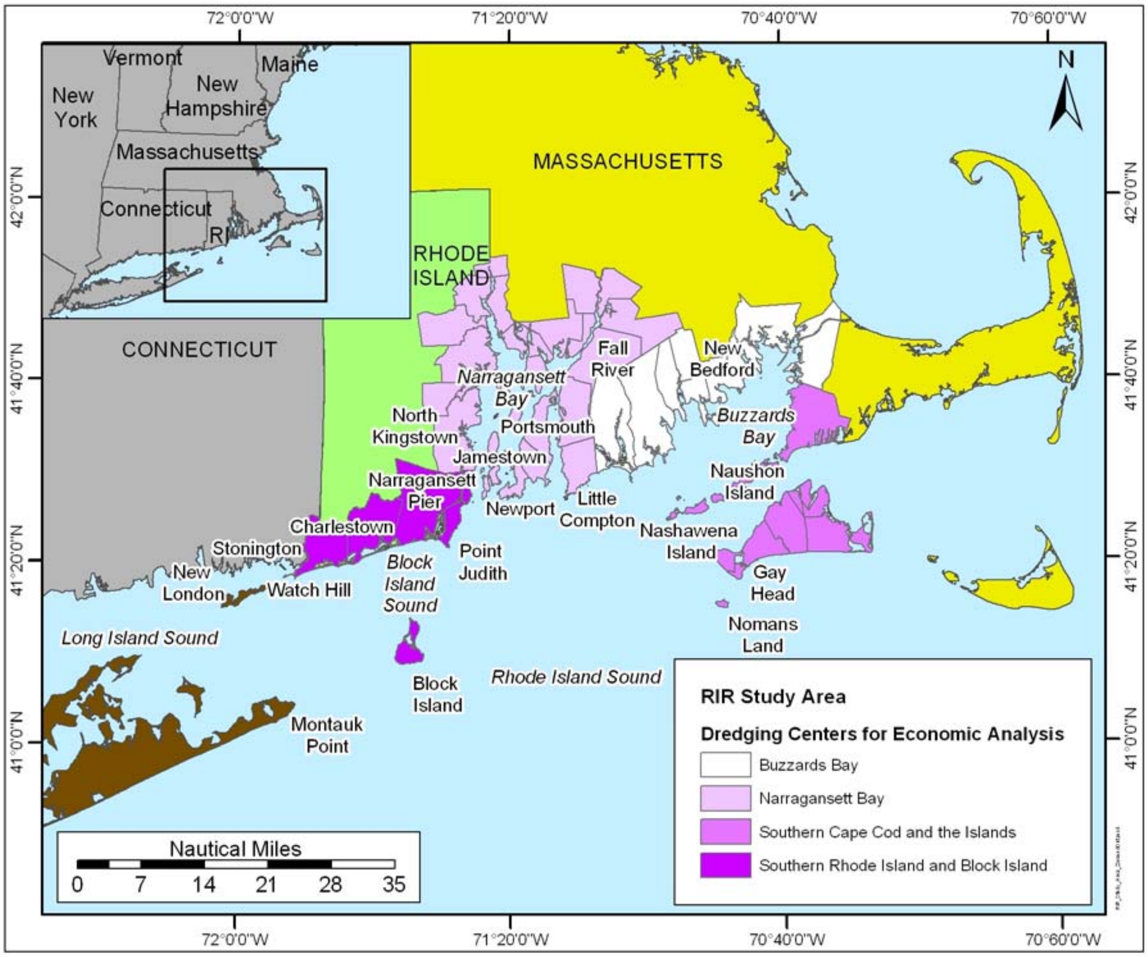

Figure ES-1. Rhode Island Region Study Area.

This Draft Environmental Impact Statement (EIS) has been prepared in accordance with the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4321 *et seq.*, to evaluate the potential environmental impacts associated with (1) the proposed action (designating one or more potential dredged material disposal sites in the RIR) and (2) a no action alternative. While EPA is not legally required to subject its disposal site designation process under MPRSA to environmental review under NEPA, EPA is preparing this Final EIS in compliance with EPA's "Statement of Policy for Voluntary Preparation of National Environmental Policy Act": 63 Fed. Reg. 58045-58046. The Corps is participating in the development of this Final EIS as a cooperating agency. This document describes the effort required in the site designation process which includes a comprehensive assessment of all current and future dredging needs, identification of all the potential disposal sites, and an assessment of potential impacts associated with the designation of a long term disposal site.

This Final EIS is being published together with a Final Site Management and Monitoring Plan (SMMP) for public review and comment. Such comments may be provided in writing (by mail, facsimile, or electronic mail). At least 30 days after the issuance of the Final EIS, EPA will issue a final rulemaking that, among other things, states what the agency decision is, identifies all alternatives considered, and states whether all practical means to avoid or minimize environmental harm from the proposed action have been adopted.

EPA Wants Your Input on the Final EIS

EPA requests and encourages comments on the Final EIS for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Comments may be submitted:

By mail to:
Olga Guza
U.S. EPA New England, Region 1
One Congress Street, Suite 1100
Mail Code CWQ
Boston, MA 02114-2023

By facsimile to: (617) 918-1505

By electronic mail to:
R1_RISEIS@EPAMAIL.EPA.GOV

Purpose and Need for Agency Action

The purpose of this EIS is to evaluate whether EPA should designate one or more long-term ocean disposal sites in the RIR (Figure ES-1). The designation of one or more such sites would provide an alternative disposal option for the region's dredged material. Maintaining the existing channels and periodically improving the region's waterways are important for sustaining the economic and recreational value of a safe and efficient water transportation resource. The ability to support marinas and port facilities by providing an environmentally sensitive, practicable dredged material disposal alternative is important for current and future needs of this region.

Large amounts of dredged material are generated from maintenance dredging of navigation channels (to improve navigability), marinas, and port facilities and from improvement dredging (to create new facilities or expand or deepen existing facilities). An estimated 8.7 MCY of dredged material will be generated in the RIR in the next 20 years (Table ES-1). This estimate was based on studies conducted in both 1984 and 2002 by the Corps, which reviewed historic dredging activities, quantities, dredging cycles, and disposal methods as well as future dredging and disposal needs using information collected from a questionnaire sent to navigation facilities in Rhode Island and southeastern Massachusetts. Material that was most likely to be used for beach nourishment or other beneficial uses was not included in final volume projections. This estimate also does not include the 2003 Providence River and Harbor Maintenance Project disposal at Site 69B that began in early 2003, or recent proposals to create liquid natural gas (LNG) terminals in the Fall River area.

Table ES-1. Summary of Total Federal and Non-Federal Dredging Needs and Future Quantities of Dredged Material for the Rhode Island and Southeastern Massachusetts Region by 2021.

	Facilities Surveyed	Responses Received	2002-2006 (CY)	2007-2011 (CY)	2012-2016 (CY)	2017-2021 (CY)	20-year Total (CY)
Federal Projects[1]	NA	NA	1,303,700	1,468,200	63,200	880,750	3,715,850
Non-Federal Facilities[2]	450	178	3,357,044	681,150	563,800	453,585	5,055,579
Totals[3]	NA	NA	**4,660,744**	**2,149,350**	**627,000**	**1,334,335**	**8,771,429**

NA Not applicable.

CY cubic yards.

[1] The total volume for the Federal Navigation Projects does not include projects that will beneficially use dredged material, such as beach nourishment. This totals 919,500 CY. Additionally, the New Bedford/Fairhaven Harbor Project, which totals 1,783,500 CY, is not included because the Corps has already established that the material is unsuitable for offshore disposal.

[2] The total volume estimate does not include known surveyed non-Federal facilities that will incorporate beneficial use of dredged material, such as beach nourishment. This is estimated at 1,200,000 CY.

[3] Quonset Point/Davisville is excluded because the dredging associated with the proposed container port, between 8 and 14 MCY, is not a Federal project and its realization is not known at this time.

Alternatives Evaluated under this EIS

This Final EIS analyzes the no action alternative and the potential environmental impacts associated with two alternative open water dredged material disposal sites identified as potential candidates following a site screening process. This screening process was conducted using specific site designation criteria described in the MPRSA (40 CFR 228.5 and 40 CFR 228.6) as well as criteria and concerns specific to the RIR as identified through public and inter-agency meetings.

The activities and impacts analyzed in this Final EIS focus exclusively on ocean disposal. However, during the overall EIS process, alternatives to ocean disposal were considered in accordance with NEPA. These included beneficial uses of the dredged material, upland alternatives, treatment technologies, and the no action alternative. This Final EIS determined that none of these alternatives could provide the necessary holding capacity or would meet the long-term regional dredged material disposal management objectives for the RIR. Other recent regional studies reached the same conclusion. Therefore, those disposal options were not evaluated in detail in this Final EIS.

A Zone of Siting Feasibility (ZSF) was identified as the reasonable and practical area within the RIR in which a dredged material site could be located (Figure ES-2). The RIR ZSF encompassed Rhode Island Sound, Block Island Sound, and the area of the continental shelf south to a distance approximately 30 nautical miles (nmi) from the mouth of Narragansett Bay. The ZSF covers an area of 1,100 nmi^2 and reflects the maximum distance offshore that is practical for transporting dredged material to a potential disposal site using long-haul bottom dump barges.

Once the ZSF was established, a two-tiered screening process was conducted using the MPRSA site designation criteria. This process involved reviewing and evaluating available biological, chemical, and physical data and considered other uses of the ocean within the ZSF. Tier 1 screening ruled out areas where a potential disposal site should not be considered. Tier 2 screening identified areas where a disposal site was feasible. Additional information on the biological resources and physical conditions and habitats within these areas was further evaluated to determine locations with the least impact to biological resources. The two open-water alternatives analyzed are Site W and Site E.

Site W is a 1-nmi square with its center located at 41˚ 13’51”N and 71˚ 22’49”W (NAD 83). The site is located approximately 9 nmi south of Point Judith, RI and roughly 6.5 nmi due east of Block Island. The site is located over a topographic depression, where the maximum water depth is about 130 ft (Figure ES-2). Water depths of the surrounding area are between 113 and 118 ft to the north, east, and south. The southeastern portion of the site shoals more rapidly than the northern and western areas. The boundaries for Site W are set on the east and west by navigational channels, in the south by depth restrictions and to the north by anecdotal reports that it is a finfish trawling zone. Site W encompasses an active dredged material disposal site, Site 69B, which was selected in 2001 under MPRSA Section 103 and became active in April 2003 to accept dredged material found suitable for ocean disposal from the Providence River and Harbor Maintenance Dredging Project and nearby areas.

Native surface sediments in and around Site W are predominantly fine and very fine sands, with the northeast corner of the site having relatively high gravel content. However, the bottom type is changing due to active disposal from the Providence River and Harbor Maintenance Dredging Project. The material from the Providence River and Harbor Maintenance Dredging Project is mainly consolidated clay, silt, and fine sands. The benthic community in and around Site W is very similar to that found in nearby areas and is typical of the open-water silty-sand/sand communities found in Rhode Island Sound. The site is within a region of relatively low fish productivity and the species found there are similar to those found elsewhere in central Rhode Island Sound. No significant shellfish concentrations exist at Site W but the area does support a moderate lobster population. Site W is not a concentration area for any marine mammals or threatened or endangered species, though some species may be found transiting or feeding on local concentrations of prey items within the area.

Site E is a 1-nmi square with its center located at 41˚ 15' 36"N and 71˚ 09' 36"W (NAD 83). The site is located 15 nmi southeast from Point Judith, Rhode Island and 17.7 nmi northeast of Block Island, Rhode Island, in water depths from 123 to 135 ft (Figure ES-2). Site E is located on a gently sloping plane that deepens to the south and east. The native sediments at the site are predominantly medium to fine sands, with some finer-grained sediments (i.e., silt) along the southeastern boundary. An area of mixed sediment types is present in the northeastern quadrant of the site. The boundaries of Area E are set in the northwest by a navigational channel buffer zone on the inbound lane to Buzzards Bay, in the northeast by depth restrictions (erosion potential), and in the south by an identified finfish trawling zone.

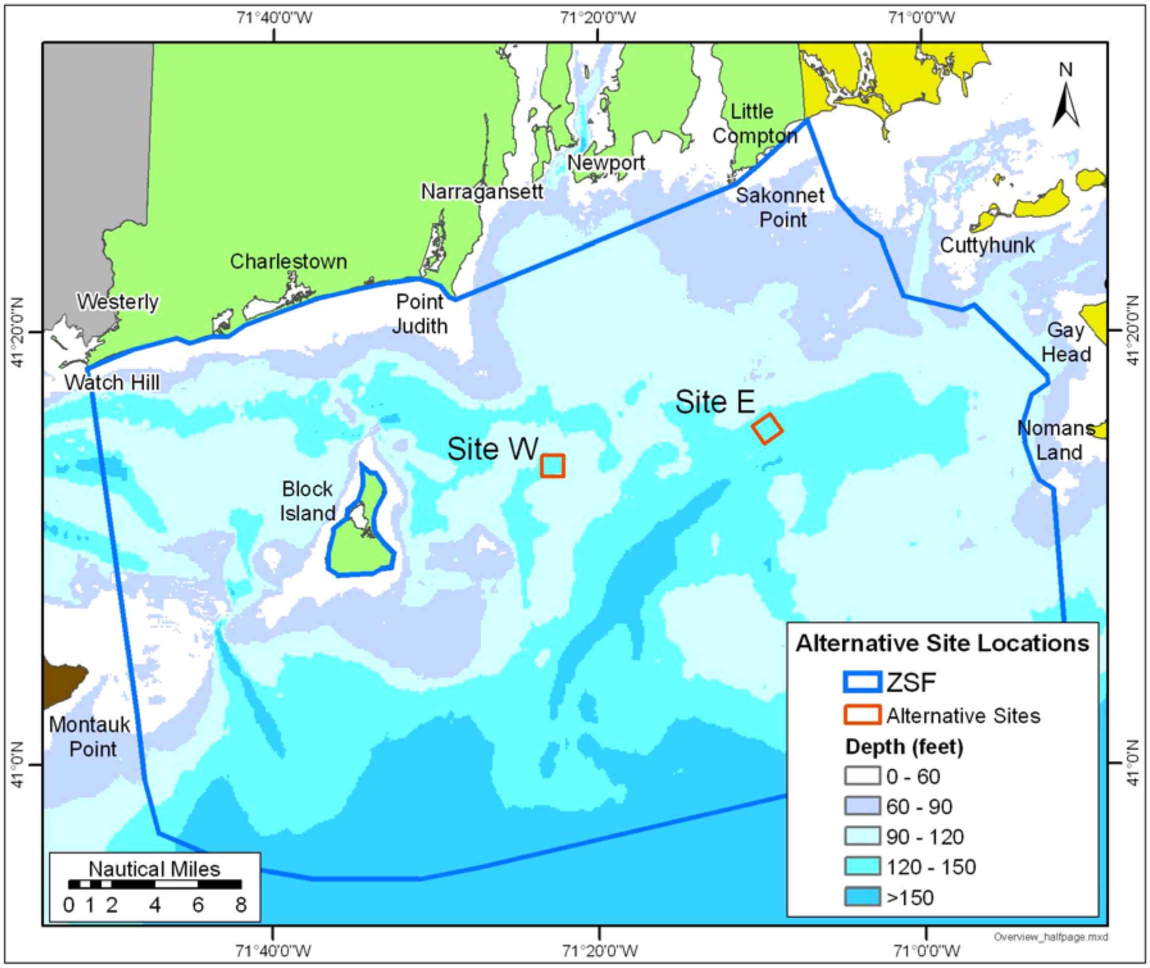

Figure ES-2. Alternative Ocean Dredged Material Disposal Sites Evaluated in this Final EIS.

The benthic community in and around Site E is very similar to that found in the nearby area and is typical of the open-water silty-sand/sand communities found in Rhode Island Sound. The site is within a region of relatively low fish productivity and the species found there are similar to those found elsewhere in central Rhode Island Sound. No significant shellfish concentrations exist at Site E. Site E appears to have a smaller lobster population than the surrounding areas because the sediments are not conducive to burrowing nor do they provide adequate shelter for lobster. Site E is not a concentration area for any marine mammals or threatened or endangered species, though some species may be found transiting or feeding on local concentrations of prey items within the area.

Summary of Environmental and Socioeconomic Impacts of the Alternatives

Environmental and socioeconomic impacts that may result from taking no action (i.e., not designating a long-term ocean disposal site) and from disposing of dredged material at either of the alternative sites (i.e., Site E and Site W), were considered in the Final EIS. Table ES-2 summarizes the key information for each alternative and concludes whether there is likely to be an impact, a minor impact, or no impact. For purposes of this evaluation, a minor impact is defined as an impact that is either short-term or mitigable or both.

Environmental and Socioeconomic Impacts of the Alternative Sites

The MPRSA recognizes that sediment disposal activities can cause physical, chemical, or biological impacts to the environment as well as socioeconomic impacts. Consideration of the 5 general and 11 specific criteria during the evaluation and designation process identifies potential impacts and helps identify the alternative that provides the least environmental impact and the greatest socioeconomic benefit. Generally, known impacts of the dredged material process documented in numerous studies were also considered.

Physical, chemical, biological, and socioeconomic factors were evaluated in the Final EIS including:

- Geological setting and physical oceanography including sediment transport and erosion potential
- Sediment characteristics and sediment quality
- Water quality
- Biological resources including plankton, benthic invertebrates, finfish, shellfish, lobster, marine mammals and marine and coastal birds
- Rare, threatened, and endangered species
- Contaminant bioaccumulation potential
- Socioeconomic impacts
- Air quality and noise

Of the 5 general and 11 specific MPRSA criteria, only 2 general and 3 specific criteria were discriminating factors in the evaluation of the two alternative sites. The geographic position (228.6(a)(1)) of the alternative sites places each within the outer portions of Rhode Island Sound, a water body that is exposed to wind and wave energy from the northwest Atlantic Ocean. While little difference in the wind and wave climate was found between the sites, Site W provides limited protection from some storms by Block Island to the west. Available current records, while limited at Site E, suggest that the average currents at Site E may be slightly higher than at Site W, and under some wind and wave conditions, may result in somewhat higher sediment transport and erosion at Site E compared to Site W (228.6(a)(6)). Based on these considerations and the results of modeling, Site E has the greater potential for violating water quality requirements outside of the site boundaries following disposal compared to Site W (228.5(b)).

The footprint of Site W coincides with the currently selected Site 69B, which is currently receiving dredged material from the Providence River and Harbor Navigation Project and is thus an active dredged material disposal site ((228.6(a)(7) and 228.5(e)). Site E has not received dredged material, thus it is an area that has not been disturbed by ocean disposal practices.

The remaining evaluation criteria did not discriminate in the evaluation of the alternatives. Dredged material disposal was found to have either no impact or only minor impact on the resources described in these criteria at either alternative site. Minor impacts included those that were short term, such as temporary loss of benthic communities, or those that could be mitigated using site management practices such as strategic placement of finer grained disposal material at the center of the site to minimize the potential for sediment transport outside the site and possible water quality exceedences.

Impacts of the No Action Alternative

Following NEPA requirements, an EIS must evaluate a "No Action Alternative." Evaluation of this alternative involves identifying the environmental and socioeconomic impacts that would result if the proposed action did not take place. These impacts can then be assessed and compared with the impacts of the proposed action and the other "action" alternatives. For this Final EIS, the No Action Alternative consists of not designating an ocean site for the long-term disposal of dredged material in the RIR.

The lack of a designated long-term ocean dredged material disposal site does not mean that all dredging would stop because other disposal options, such as upland disposal, could occur. As described in the recently completed Providence River and Harbor Maintenance Project Final EIS, the use of such sites could result in some terrestrial impacts. However, upland sites with sufficient volume to address the long-term dredged material disposal needs in Rhode Island could not be identified. For example, the evaluation found potential impacts to water quality in areas adjacent to upland sites and to groundwater from runoff at land-based disposal sites. Other issues identified under that EIS included slight increases in impacts to coastal birds and to coastal and terrestrial endangered or threatened species. Additionally, impacts to air quality caused by emissions from vehicles required to transport the dredged material to an upland site, were also identified as well as intermittent and temporary increases in terrestrial noise if an upland disposal site were available.

Use of a currently selected disposal site (Site 69B) for material found suitable for ocean disposal under the MPRSA Federal and Regional testing programs could also continue until 2008 plus an additional 5-year period. While the permitting process is designed to ensure that no unacceptable adverse impacts occur from ocean disposal of dredged material, some changes to the environment may occur. However, the duration of impacts resulting from using Site 69B, a selected site, would be reduced when compared with the alternative of designating a long-term site. Thus, the quantity of material disposed of offshore at a selected site would be limited when compared with the designation of a long-term site.

In contrast, the use of selected sites would increase the potential that additional sites in the ocean would be necessary over the long term and would increase the potential for disturbance of additional areas in the ocean (greater cumulative impact) when compared with a designated long-term ocean disposal site. The availability of a designated long-term dredged material disposal site also would reduce the costs associated with finding and selecting other sites, minimize the potential for dredging delays, and eliminate project-specific uncertainty (including project review time and cost) of the site selection process by evaluating the cumulative impacts of all proposed dredged material from the RIR to be placed at the proposed site.

The socioeconomic impacts of the No Action Alternative involved evaluation of the (1) economic losses from a lack of dredging, and (2) subsequent impacts to navigation-dependent industries and those individuals depending on those industries for their livelihood. This evaluation considered the worst-case scenario, one in which no dredging would occur at all because of the lack of a viable disposal location. Under this scenario, shoaling in navigation channels, harbors, and marinas would continue to reduce channel depths. Severe shoaling could potentially reduce the depths of channels enough to increase the likelihood of vessel groundings, the occurrence of pollution events, and the risk to humans. This scenario would also curtail commercial and private navigation-dependent uses, reducing the facilities' economic contribution to the region.

Cumulative Impacts

A cumulative impact on the environment results from the incremental impact of an action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. A cumulative impact assessment is important because significant cumulative impacts can result from several smaller actions that by themselves do not have significant impacts (Table ES-3). With respect to the disposal of dredged material at the designated sites in the RIR, cumulative economic impacts could occur if a long-term disposal site were not designated for the region, especially to activities such as shipping and boater recreation.

Other potential cumulative impacts that may affect the RIR include the introduction of contaminants from land based sources, the atmosphere, and other activities (e.g., nonpoint source pollution or spills from vessel). However, disposal of dredged material is not expected to transfer unaccepted levels of contaminants to the ocean or increase contaminant availability because the permitting process for material proposed for ocean disposal requires thorough characterization and must not adversely affect human health, the marine environment or other ocean uses per MPRSA. The changes in sediment type, and thus to habitat, at the sites are also expected to be small and may add structure to the seafloor that could provide additional habitat types in the region. Alteration of the habitats from other uses of the ocean in this region could also occur but with generally similar impact depending on the project specifics.

Overall, the impact of dredged material disposal relative to other possible perturbations is not expected to be long-term or significant; therefore, only minimal cumulative environmental impacts from designation of a long-term ocean dredged material disposal site are expected.

Table ES-2. Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	**Alternatives**		
	Site E	**Site W**	**No Action**
Depth (ft) (*§ 228.6(a)(1)*)	**No Impact**	**No Impact**	**No Impact**
	Depth 125–133 ft Site Capacity 27.5 MCY	Depth: 116-132 ft Site Capacity 20 MCY (~15 MCY will be available after the completion of Providence River)	No changes from present conditions
Sedimentation and Erosion (*§ 228.6(a)(7)*) LTFATE model: erosion by waves and currents of standard mound configuration for five storm conditions; fine-grained, cohesive sediments	**Minor Impact**	**Minor Impact**	**No Impact**
	LTFATE storms occurring 3–5 times/yr (7.0-ft wave height; maximum current = 8 cm/s; peak wave period = 5.6 sec) maximum total erosion = 0.25 ft; LTFATE 5–10 yr storm (14.7-ft wave height; maximum current = 8 cm/s; peak wave period = 8.4 sec) maximum erosion = 0.49 ft LTFATE major hurricane condition (15-yr storm return period; 16.0-ft wave height; maximum current = 25 cm/s; peak wave period = 9.5 sec) maximum total erosion = 0.76 ft	LTFATE storms occurring 3–5 times/yr (7.1-ft wave height; maximum current = 8 cm/s; peak wave period = 5.3 sec) maximum total erosion = 0.21 ft; LTFATE 5–10 yr storm (13.7-ft wave height; maximum current = 8 cm/s; peak wave period = 8 sec) maximum total erosion = 0.43 ft LTFATE major hurricane condition (15-yr storm return period; 14.9-ft wave height; maximum current = 25 cm/s; peak wave period = 9 sec) maximum total erosion = 0.69 ft	No changes from present conditions
Water Column (Transport) (*§ 228.6(a)(6)*) and Water Quality (*§ 228.5(b)*) STFATE model: disposal operations modeling, including dredged material deposition and residual plume transport, used to evaluate potential for water quality violations; characteristic dredged material; recent elutriate test data for projects from the RIR; specific site current conditions.	**Impact**	**Minor Impact**	**No Impact**
	Tidal currents 10-20 cm/s Depth averaged currents 25 cm/s toward the northeast (10% > 25 cm/s frequency of occurrence) Intermittent, short-term changes within residual plumes following disposal TSS concentrations return to predisposal levels within 4 hr Substantial potential for water quality impacts outside of site under typical and worst-case conditions (8 of 16 model runs) Neither use of smaller barges nor implementation of other site management practices would reduce potential for water quality violations outside of site	Tidal currents 12-13 cm/s Depth averaged currents 20 cm/s toward the northwest (10% > 20 cm/s frequency of occurrence) Intermittent, short-term changes within residual plumes following disposal TSS concentrations return to predisposal levels within 4 hr Limited potential for water quality impacts outside of site under worst-case conditions (2 of 16 model runs)[1] Use of smaller barges and other site management practices could reduce potential for (mitigate) water quality violations outside of site	No changes from present conditions

[1]Site management practices will mitigate the potential for water quality impacts outside the site.

Table ES-2 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	**Alternatives**		
	Site E	**Site W**	**No Action**
Sediment Quality (*§ 228.6(a)(4)*)	**Minor Impact**[2]	**Minor Impact**[2]	**No Impact**
	Medium to fine sand Contaminants are (1) low in concentration and similar to areas outside the site, and (2) consistently below concentrations considered adverse to organisms. No toxicity data are available. Assumed low due to low contaminant levels. Required testing and site management would minimize exposure of organisms to unacceptable contaminant levels.	Fine to very fine sand Contaminants are (1) low in concentration and similar to areas outside the site, and (2) consistently below concentrations considered adverse to organisms. Sediments are not toxic to benthic organisms, based on 10-day amphipod bioassays. Required testing and site management would minimize exposure of organisms to unacceptable contaminant levels.	No changes from present conditions
Plankton and Larval Forms (*§ 228.6(a)(2)*) (*§ 228.6(a)(9)*) (*§ 228.6(a)(10)*)	**No Impact**	**No Impact**	**No Impact**
	Short-term entrainment losses; losses would be small with respect to entire populations in the RIR	Short-term entrainment losses; losses would be small with respect to entire populations in the RIR	No changes from present conditions
Benthos (*§ 228.6(a)(2)*) (*§ 228.6(a)(9)*)	**Minor Impact**[3]	**Minor Impact**[3]	**No Impact**
	Benthic community consisting primarily of Mollusca, Crustacea, and Annelida, of which most species have limited ability to burrow through deposited sediment. Abundance = 34,800/square meter Species = 60/grab Diversity (*H'*) = 3.9 Habitat Quality RPD = >2.2 – >5.9 Stage: = I-II, III OSI = 7.0–10.0 Short-term reductions in abundance and diversity within the site. Recovery to levels similar to predisposal within a few years after disposal	Benthic community consisting primarily of Mollusca, Crustacea, and Annelida, of which most species have limited ability to burrow through deposited sediment. Abundance = 32,400/square meter Species = 53/grab Diversity (*H'*) = 3.4 Habitat Quality RPD = 0.9–2.6 Stage: = I-II, III OSI = 4.0–9.0 Short-term reductions in abundance and diversity within the site. Recovery to levels similar to predisposal within a few years after disposal	No changes from present conditions

[2]Disposal will potentially change the sediment type from what is there now; however monitoring has documented that recolonization and habitation at disposal sites occurs within a few years.
[3]Monitoring has documented that benthic disturbances at dredged material disposal sites are short-term and that sites recover within a few years.

Table ES-2 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	**Alternatives**		
	Site E	**Site W**	**No Action**
Fish, Lobster, and Other Invertebrates (*§ 228.6(a)(2)*) (*§ 228.6(a)(9)*)	**Minor Impact**	**Minor Impact**	**No Impact**
	Not in an area of distinctive lobster, shellfish, or finfish resources Relatively homogeneous bottom habitat; nearby high-relief habitat **Lobster**–small lobster population exists at site August 2003 CPUE; 6.4 lobsters/trap **Ocean quahog** only commercial shellfish species at site–small quahog population exists at site (1.32 quahog/square meter) and would be reduced by disposal; immediate recovery outlook poor because of sediment changes and slow clam growth rates. [4] Site is not significant ocean quahog resource **Finfish**–July 2003 CPUE 64.6 fish/tow 15 species Demersal species predominant Short-term local disruption and potential loss of non-migratory finfish species during disposal. Finfish recovery to levels similar to predisposal probable.	Not in an area of distinctive lobster, shellfish, or finfish resources Relatively heterogeneous bottom habitat; nearby high-relief habitat **Lobster**–small lobster population exists at site July 2002 CPUE; 4.6 lobsters/trap; August 2003 CPUE western boundary 6.6 lobsters/trap **Ocean quahog** only commercial shellfish species at site–small quahog population exists at site (0.93 quahog/square meter) and would be reduced by disposal; immediate recovery outlook poor because of sediment changes and slow clam growth rates.[4] Site is not significant ocean quahog resource **Finfish**–July 2003 CPUE western boundary 70.8 fish/tow 13 species Demersal species predominant Short-term local disruption and potential loss of non-migratory finfish species during disposal. Finfish recovery to levels similar to predisposal probable.	No change from present conditions
Birds, Mammals, Reptiles (*§ 228.6(a)(2)*)	**No Impact**	**No Impact**	**No Impact**
	Species occasionally visit the site but do not rely on it for critical habitat	Species occasionally visit the site but do not rely on it for critical habitat	No changes from present conditions
Endangered Species (Section 7 ESA consultation by NMFS and FWS is currently in progress)	**No Impact**	**No Impact**	**No Impact**
	Species occasionally visit the site but do not rely on it for critical habitat. Action will not impact species that might transit the area.	Species occasionally visit the site but do not rely on it for critical habitat. Action will not impact species that might transit the area.	No changes from present conditions

[4]Quahog and shellfish population densities are low. Disposal would cover any existing shellfish.

Table ES-2 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	**Site W**	**No Action**
Bioaccumulation Potential (*§ 228.6(a)(9)*)	**No Impact**	**No Impact**	**No Impact**
	Contaminant levels in water and sediment are low at the site; bioaccumulation potential would therefore be low. Material acceptable for ocean disposal would not be expected to have significant bioaccumulation potential	Contaminant levels in water and sediment are low at the site; bioaccumulation potential would therefore be low. Material acceptable for ocean disposal would not be expected to have significant bioaccumulation potential	No changes from present conditions
Fishing Activities (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact**	**No Impact**	**No Impact**
	Not in unique fishing area	Not in unique fishing area	No changes from present conditions
Shipping, Navigation (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact**	**No Impact**	**Impact**
	Not located in navigation or shipping lanes	Located adjacent to shipping approach lane to Providence Harbor	Greater potential for delays, groundings, casualties
Beaches and Swimming (*§ 228.5(b) and §228.6(a)(3)*)	**No Impact**	**No Impact**	**No Impact**
	Closest beach is 11.4 nmi to the north Transport to beaches not likely	Closest beach is 8.3 nmi to the west Transport to beaches not likely	No changes from present conditions
Parks / Natural Areas / Sanctuaries and Research Preserves (*§ 228.5(b) and §228.6(a)(8)*)	**No Impact**	**No Impact**	**No Impact**
	No resources identified in the site	No resources identified in the site	No changes from present conditions
Historic / Archaeological Resources (*§ 228.6(a)(11)*)	**No Impact**	**No Impact**	**No Impact**
	No resources identified in the site	No resources identified in the site	No changes from present conditions
Other Human Uses (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact**	**No Impact**	**No Impact**
	No resources identified in the site	No resources identified in the site	No changes from present conditions
Use of previous disposal sites (*§ 228.6(a)(7)*)	**Impact**[5]	**No Impact**[6]	**No Impact**[4]
	No previous use as a disposal site	Actively used as a disposal site	No changes from present conditions
Air Quality/Noise (*NEPA Requirement*)	**No Impact**	**No Impact**	**Minor Impact**
	No expected adverse impacts to air quality or noise Reduced onshore impacts, depending on disposal alternatives used on a project-specific basis.	No expected adverse impacts to air quality or noise Reduced onshore impacts, depending on disposal alternatives used on a project-specific basis.	Potential impact if upland disposal usage increases; increase in noise and reduction in air quality from truck traffic transporting large volumes of material to upland locations. Potential impacts onshore, depending on disposal alternatives used on a project-specific basis.

[5]This impact is defined as increasing the total area of seafloor subject to disruption if this alternative were selected.
[6]This impact characterization is defined as restricting the area of potential disruption due to previous, recent use of the site for disposal of dredged material found acceptable for ocean disposal.

Table ES-2 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	**Alternatives**		
	Site E	**Site W**	**No Action**
Economic Impacts (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact**	**No Impact**	**Minor Impact**
	Annual cost of delivering goods and services would not increase.	Annual cost of delivering goods and services would not increase.	Annual cost of delivering goods and services would increase by $4.3M by 2021.
	Boater spending would be maintained through 2021.	Boater spending would be maintained through 2021.	Boater spending would decrease by $4.5M per year by 2021.
	No increase in casualty loss	Minimal increase in casualty loss	Increased Casualty Losses (up to $2.7 M by 2021)
	No increased employment loss	No increased employment loss	Increased loss of employment (up to 93 jobs lost annually by 2021)
	Negligible (< 0.07%) offshore economic loss in current dollar value.	Negligible (< 0.12%) offshore economic loss in current dollar value.	No economic loss to fisheries.
	Negligible loss to onshore economy from fisheries losses (0.04%).	Negligible loss to onshore economy from fisheries losses (0.06%).	No economic loss to onshore economy from fisheries losses.
	No environmental justice impact.	No environmental justice impact.	No environmental justice impact.
	Transportation cost for dredged material disposal at ocean site = $6 to $22/CY.	Transportation cost for dredged material disposal at ocean site = $6 to $22/CY.	Transportation cost for dredged material disposal at upland site = $50 to $104/CY.

Table ES-3. Summary of Cumulative Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	**Site W**	**No Action**
Cumulative Impacts (*§ 228.6(a)(7)*)	**Impact**	**No Impact**	**Impact**
	Site has not been used for dredged material disposal; site represents natural conditions in Rhode Island Sound; sediment quality is good and contaminant concentrations are low; benthic community is well-developed and diverse; no significant fish, shellfish, or lobster resources.	Site is presently disturbed by disposal of dredged material found acceptable for ocean disposal through the MPRSA dredged material testing requirements.	Additional areas selected for disposal after 69B selection expires would be disturbed during disposal, with recovery following.
	Designation would increase area in Rhode Island Sound disturbed by dredged material disposal.[1]	Designation would not increase areas disturbed by dredged material disposal.[2]	No change from present condition.
	No long-term cumulative impacts expected.	No long-term cumulative impacts expected.	No long-term cumulative environmental impacts expected.
	Not expected to have additive impacts relative to identifiable future impacts to the region.	Not expected to have additive impacts relative to identifiable future impacts to the region.	Not expected to have additive impacts relative to identifiable future impacts to the region.
	Casualty impacts reduced.	Casualty impacts reduced.	Potential casualty and associated environmental impacts.
	Onshore economic impact alleviated.	Onshore economic impact alleviated.	Compounded onshore economic impact.

[1]This impact is defined as increasing the total area of seafloor subject to disruption if this alternative were selected.
[2]This impact characterization is defined as restricting the area of potential disruption due to previous, recent use of the site for disposal of dredged material found acceptable for ocean disposal.

Conclusion

The site screening process led to the identification of two alternative sites for further evaluation with respect to MPRSA site selection criteria. Evaluation of the two sites and the No Action Alternative determined that there would be only minimal short-term, long-term, or cumulative adverse impacts to the marine environment from the designation of either Site E or Site W. Of these two alternative sites, Site W (Figure ES-3), to be known as the Rhode Island Sound Disposal Site, is preferred for the reasons discussed above and summarized in Table ES-2 and Table ES-3.

Environmental considerations, including a lower likelihood of post-deposition transport of dredged material and a greater likelihood of meeting water quality requirements outside the boundaries of the site following disposal events, give slight preference to Site W over Site E.

The location of Site W would be expected to have minimal adverse environmental effects from disposal operations, including cumulative impacts, when compared with designation of Site E. In addition, Site W is currently used as a dredged material disposal site (Site 69B) selected under MPRSA Section 103. EPA regulations (40 CFR 228.5(e)) state that it is generally preferable to designate disposal sites in areas that have been used in the past, rather than to locate sites in new, undisturbed areas. Management practices have been established at the active disposal site (Site 69B) that will minimize the potential for adverse impacts associated with disposal of dredged material from the Providence River and Harbor Maintenance Dredging Project. Monitoring conducted to date seems to support the success of those management practices. Similar practices would be used for the preferred alternative site.

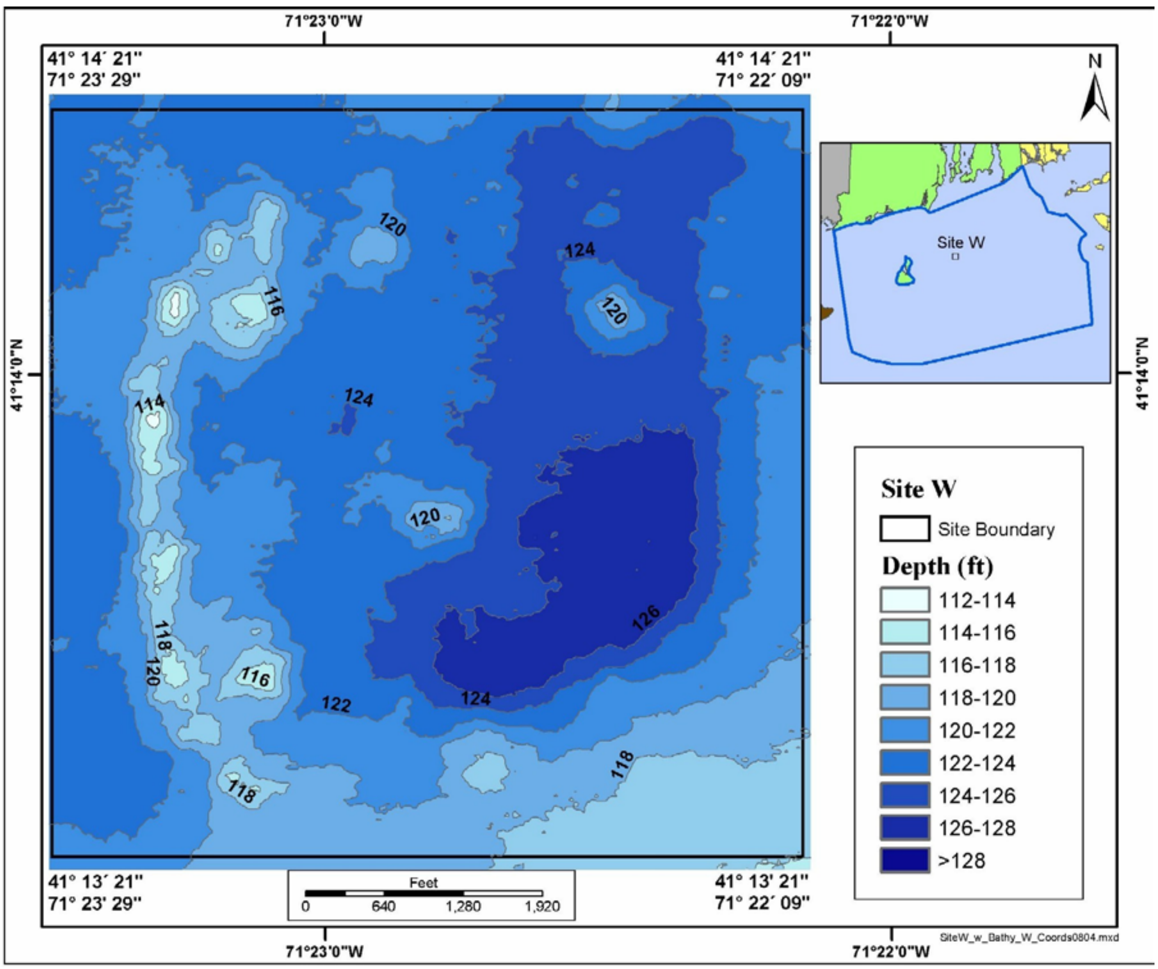

Figure ES-3. Location and Bathymetry of Site W (to be known as the Rhode Island Sound Disposal Site) as of May 2004.

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ACRONYMS AND KEYWORDS

ACEC	area of critical environmental concern
ACS	American Cetacean Society
Ag	silver
As	arsenic
AWOIS	Automated Wreck and Obstruction Information System
BA	Biological Assessment
Be	beryllium
C	Celsius
Cd	cadmium
CEQ	Council on Environmental Quality
CETAP	Cetacean and Turtle Assessment Program
CI	Coastal Institute
CL	carapace length
cm	centimeter
cm/s	centimeters per second
CMC	Criteria Maximum Concentration
CO_2	carbon dioxide
Corps	U.S. Army Corps of Engineers
CPUE	Catch-per-Unit-Effort
Cr	chromium
CRMC	Coastal Resources Management Council
Cu	copper
CWA	Clean Water Act (a.k.a. Federal Water Pollution Control Act)
CWS	Canadian Wildlife Service
CY	cubic yard
CZM	Coastal Zone Management
DAMOS	Disposal Area Monitoring System
DL	detection limit
DO	dissolved oxygen
DDT	dichlorodiphenyl-trichloroethane
DFW	Department of Fish and Wildlife
DMRP	Dredged Material Research Program
EA	Environmental Assessment
EDC	Economic Development Corporation
EFH	Essential Fish Habitat
EIS	environmental impact statement
ER-L	Effects Range-Low
ER-M	Effects Range-Median
EPA	Environmental Protection Agency

ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute, Inc.
F	Fahrenheit
FDA	Food and Drug Administration
FONSI	Findings of No Significant Impact
ft	feet
ft^3/s	cubic feet per second
FWS	[U.S.] Fish and Wildlife Service (Department of the Interior)
FVP	Field Verification Program
g	gram
g/L	grams per liter
GDP	Gross Domestic Product
GIS	Geographic Information System
GSP	Gross State Product
H′	Shannon-Wiener diversity
Hg	mercury
hrs	hours
IBA	important bird area
IPO_4	inorganic phosphate
IWC	International Whaling Commission
kg	kilogram
kg/m^2	kilograms per square meter
km	kilometer
lbs	pounds
LC_{50}	lethal concentration required to kill 50% of organisms
LNG	liquid natural gas
LPC	limiting permissible concentration
LTFATE	Long Term Fate Model
m	meter
M	million
m^2	square meter
m^3	cubic meter
MA	Massachusetts
MA BUAR	Massachusetts Board of Underwater Archaeological Resources
MAFWS	Massachusetts Fish and Wildlife Service
MARMAP	Marine Resources Monitoring, Assessment, and Prediction
MBDS	Massachusetts Bay Disposal Site
MDL	maximum detection limit

MDMF	Massachusetts Division of Marine Fisheries
MEDMR	Maine Department of Marine Resources
mg/L	milligram per liter
MHC	Massachusetts Historical Commission
min	minute
MIT	Massachusetts Institute of Technology
mL	milliliter
mm	millimeter
µm	micrometer
µM	micromole
MLW	Mean Low Water
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act of 1972
MPRSA	Marine Protection, Research, and Sanctuaries Act of 1972
NAAQS	National Ambient Air Quality Standards
NAVSTA	Naval Station Newport
ND	not detected
NDBC	National Data Buoy Center
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NH_3	ammonia
NHPA	National Historic Preservation Act
Ni	nickel
NLDS	New London Disposal Site
NM	not measured
NMFS	National Marine Fisheries Service
nmi	nautical mile
nmi^2	square nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_X	nitrate and nitrite
NPS	National Park Service
NRC	National Research Council
NTU	nephelometric turbitdy units
NUWC	Naval Undersea Warfare Center
O_3	ozone
OSI	Organism-Sediment Index
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PCB	polychlorinated biphenyls
pct	percent

ppb	parts per billion (i.e., μg/kg, μg/L)
ppm	parts per million (i.e., μg/g, mg/kg, mg/L)
pptr	parts per trillion
PSU	practical salinity unit
RDS	Rockland Disposal Site
RI	Rhode Island
RICRMC	Rhode Island Coastal Resources Management Council
RIDEM	Rhode Island Department of Environmental Management
RIDFW	Rhode Island Division of Fish and Wildlife
RIDOA	Rhode Island Department of Administration
RIDOT	Rhode Island Department of Transportation
RIEDC	Rhode Island Economic Development Corporation
RIHPHC	Rhode Island Historic Preservation and Heritage Commission
RIPA	Rhode Island Port Authority
RIR	Rhode Island Region
RIRPP	Rhode Island Resource Protection Project
RISDS	Rhode Island Sound Disposal Site (also known as Site W)
ROD	Record of Decision
RPD	redox potential discontinuity
SDE	Spatial Database Engine
Se	selenium
sec	seconds
SIC	Standard Identification Classification
SIP	State Implementation Plan
Site 16	Brenton Reef
Site 18	Brenton-A
Site 69A	Jamestown Bridge Reef
Site 69B	Separation Zone Site
SMMP	Site Management and Monitoring Plan
SPI	sediment profile imaging
STFATE	Short Term Fate Model
STSSN	Sea Turtle Stranding and Salvage Network
TCPU	transportation, communications, and public utilities
TEWG	Turtle Expert Working Group
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TSS	total suspended solids
URI	University of Rhode Island
URI-GSO	University of Rhode Island, Graduate School of Oceanography
U.S.	United States

UXO	unexploded ordnance
VTR	vessel trip report
WCRM	Warren C. Riess Marine, Inc.
WRDA92	Water Resources Development Act of 1992 (Public Law 102-580)
yr	year
ZSF	zone of siting feasibility
Zn	zinc

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ORGANIZATION OF THE FINAL EIS

This Final EIS is organized by major sections and subsections, including an Executive Summary, table of contents, appendices, and a Final Site Management and Monitoring Plan (SMMP). It is intended to guide the reader through the information, questions, issues, and considerations that were evaluated in the decision-making process conducted for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. The various sections of the EIS are briefly described below to assist the reader in understanding the document and the decision-making process.

SECTION 1.0 PURPOSE AND NEED FOR THE ACTION

Section 1.0 introduces and describes the proposed action, presents a history of disposal in the Rhode Island Region (RIR), and discusses agency activities related to the RIR, the legislative history of the Clean Water Act (CWA) and Marine Protection, Research, and Sanctuaries Act (MSPRA), regulatory requirements for site use, and the scoping and public involvement process. This background history and information lays the foundation for the subsequent discussion of the purpose of and need for the proposed project. The purpose explains the basis for the designation of one or more dredged material ocean disposal sites; it is followed by a discussion of the identified dredging, navigation, safety, and economic needs for an ocean disposal site.

SECTION 2.0 ALTERNATIVES

Section 2.0 provides a detailed discussion of the screening process used to identify reasonable ocean disposal alternatives. It also discusses alternatives that were considered but eliminated from detailed study and explains why they were eliminated.

SECTION 3.0 AFFECTED ENVIRONMENT

Section 3.0 describes the existing natural, physical, and socioeconomic environment of the Zone of Siting Feasibility (ZSF) and, where applicable, of the RIR. It presents a comprehensive discussion of environmental baseline resources obtained through an extensive literature search and from available environmental studies and analyses; additional information was collected and developed as part of the investigation and at working group meetings. The affected environment is the foundation upon which alternatives are developed and environmental consequences of the alternatives are evaluated. Physical features discussed include geological setting, meteorology, physical oceanography, sediment characteristics and transport, and water quality. Biological resources addressed include plankton community; benthic invertebrates; fish; shellfish; marine and coastal birds; marine mammals and reptiles; rare, threatened, and endangered species; species of special concern; and contaminants in organisms. The socioeconomic environment addresses commercial and recreational fisheries, shipping, military usage, mineral and energy development, recreational activities, natural and cultural features of historical importance, other legitimate uses, and areas of special concern.

SECTION 4.0 ENVIRONMENTAL CONSEQUENCES

Section 4.0 identifies and discusses in detail the environmental consequences that could occur under the two ocean disposal alternatives evaluated and under the no action alternative, including socioeconomic impacts, and evaluates and compares direct, indirect, and cumulative impacts. This section provides information on and justification of the choice of the preferred alternative

SECTION 5.0 FEASIBILITY OF SURVEILLANCE AND MONITORING

Section 5.0 presents the six requirements for ocean disposal site management plans included in the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Section 102(c)(3) and references the Final Site Management and Monitoring Plan (SMMP) accompanying this Final EIS.

SECTION 6.0 AGENCY COORDINATION AND COMPLIANCE

Section 6.0 summarizes the agency coordination and environmental compliance conducted throughout the development of this project. This section documents the coordination activities undertaken by the EPA and the Corps with Federal, state, and local agencies, from the request for identification of cooperating agencies through the identification of the preferred alternative. Additionally, a summary of the Biological Assessment (BA), Essential Fish Habitat (EFH), and Coastal Zone Management (CZM) consistency determination is presented.

SECTION 7.0 PUBLIC INVOLVEMENT

Section 7.0 discusses scoping activities and the continuous public involvement conducted throughout the project, including Working Group and public information meetings, LISTSERV communication, Corps and Working Group websites, and public hearings.

SECTION 8.0 LIST OF PREPARERS

Section 8.0 lists all Federal and state agency personnel, together with the consultants, who were responsible for conducting the environmental studies, technical basis reports, public involvement, and coordination for the preparation of this Final EIS.

SECTION 9.0 REFERENCES

Section 9.0 lists all references used during this study and documentation of this project.

SECTION 10.0 LIST OF EIS DISTRIBUTION TO AGENCIES, ORGANIZATIONS, AND INDIVIDUALS

Section 10.0 provides a complete Final EIS distribution list of all Federal and state government agencies having jurisdictional responsibility, expertise, or interest in this project and all interested parties or persons who requested the opportunity to review and comment on this Final EIS.

APPENDICES

Appendices include (1) additional data not presented in the text of the EIS but which support evaluations, (2) all pertinent correspondence, (3) the RIR SMMP, and (4) the response to comments received on the Draft EIS.

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1.0 PURPOSE AND NEED

1.1 INTRODUCTION

Maintenance of adequate navigation depth in the states' marine terminals, port facilities, and private marinas is vital to the economies of Rhode Island and southeast Massachusetts (referred to as the Rhode Island Region). Commercial shipping and recreational boating industries throughout the Rhode Island Region (RIR) rely on the continued viability of these facilities. To ensure continued use, economic viability, and safety of the region's navigation channels and navigation-dependant facilities, periodic dredging must be performed to remove accumulated sediment. Maintenance dredging in the RIR has become both difficult and costly due to the absence of a designated long-term ocean disposal site in the region. In an effort to ease the burden, the Governor of Rhode Island requested (September 21, 2000) (Appendix B) that the U.S. Environmental Protection Agency (EPA), in cooperation with the U.S. Army Corps of Engineers (Corps), consider the designation of a long-term dredged material disposal site in Rhode Island Sound (pursuant with the Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. §§ 1401 *et seq.*). In response to this request EPA Region 1 and the Corps New England District initiated an evaluation to determine if there was a need to designate one or more long-term ocean dredged material disposal sites as part of the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project in waters offshore of Rhode Island or offshore of southeastern Massachusetts, referred to herein as the Rhode Island Region (RIR). This evaluation is being conducted pursuant to the Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. Section 1401 *et seq*. One or more of the proposed potential dredged material disposal sites would be used to dispose of material dredged from harbors and navigation areas in Rhode Island and southeastern Massachusetts. The area that was initially included in project scoping meetings with the public is illustrated in Figure 1-1.

In the letter requesting EPA and the Corps' consideration of designating a long-term disposal site, the Governor cited difficulties that navigational facilities were experiencing due to a backlog of maintenance dredging activities. This backlog stemmed from a lack of environmentally acceptable and cost-effective disposal options available to the navigation community. While other disposal options, including upland disposal, must be considered as part of the permit process, the number of upland disposal sites was limited and, when available, was an expensive alternative (Corps, 2001) that curtailed the number of facilities that could perform maintenance activities. For this reason, the Governor requested that EPA initiate the necessary efforts to identify and designate a long-term dredged material disposal site that could be used for navigation projects in the State of Rhode Island. This effort required a comprehensive assessment of all current and future dredging needs, identification of all the potential disposal sites, and an assessment of potential impacts associated with the designation of a permanent disposal site. A Notice of Intent (NOI) regarding the preparation of an environmental impact statement (EIS) to consider the designation of one or more long-term ocean dredged material disposal sites in the RIR was published in the *Federal Register* on April 6, 2001.

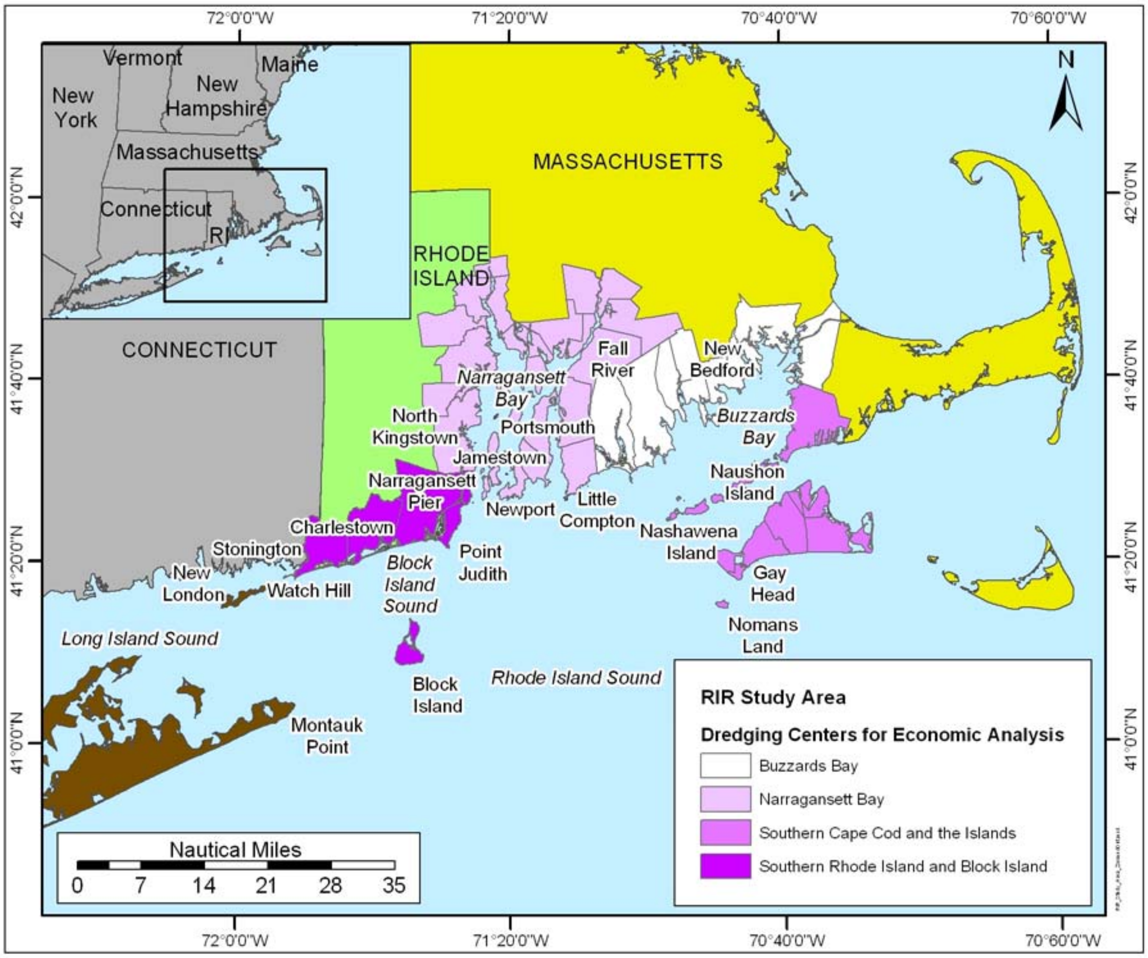

Figure 1-1. Rhode Island Region Study Area.

This Final EIS has been prepared in accordance with the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4321 *et seq.*, to evaluate the potential environmental impacts associated with (1) the proposed action (designating one or more potential dredged material disposal sites in the RIR) and (2) a no action alternative. While EPA is not legally required to subject its disposal site designation process under MPRSA to environmental review under NEPA, EPA is preparing this EIS in compliance with EPA's "Statement of Policy for Voluntary Preparation of National Environmental Policy Act (NEPA) Documents": 63 Fed. Reg. 58045 – 58047. EPA has for many years voluntarily prepared NEPA reviews for its dredged material disposal site designations under the MPRSA, and this action continues in that vein (63 Fed. Reg. 58046). EPA has explained that although "voluntary preparation of these [NEPA] documents in no way legally subjects the Agency to NEPA's requirements," EPA will nevertheless "follow, as appropriate, the procedures set out at 40 CFR Part 6, Subparts A through D (which can be found on EPA's website at www.epa.gov/oeca/ofa)." The EIS has also been prepared in compliance with NEPA-implementing regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508).

The publication of this Final EIS provides an opportunity for Federal agencies; state, local, and tribal agencies; special interest groups; and the public to comment on the RIR EIS. After the issuance of the Final EIS, EPA will issue a Final Rulemaking that states what alternative was selected, if any; identifies all alternatives considered; and states whether all practical means to avoid or minimize environmental harm have been adopted (40 CFR Section 1505.2).

1.2 PURPOSE OF AND NEED FOR THE ACTION

The purpose of this EIS is to evaluate whether EPA should designate one or more long-term ocean sites in the RIR. The designation of one or more such sites could allow for the disposal of material dredged from marine terminals, port facilities, and private marinas which preserve shipping, provide increased navigation safety and effectiveness, and ensure the continued use, economic viability, and safety of Federal navigational channels and private navigation-dependent facilities. Periodic dredging must be performed to remove accumulated sediment (shoals) deposited as a result of natural processes so that appropriate depths for the safe and efficient use of commercial shipping and recreational boating operations are maintained. In addition, increases in the sizes of commercial vessels (which require deeper channels to avoid tide-induced delays or the need for lightering) and increases in the number of recreational water craft have created a need for improvement dredging. Improvement dredging typically consists of either deepening or expanding existing channels; developing new channels, marinas, or anchorage areas; or a combination of all of these improvements.

The lack of a designated long-term ocean disposal site in the RIR has made maintenance dredging of shoals in many marinas, berths, and channels in Rhode Island and southeastern Massachusetts a difficult and costly task. It has also limited the ability of those facilities to either expand to meet a growing need or to provide deeper channels or berths to meet the commercial waterborne industry's movement toward deeper draft vessels. Accumulated sediments must be dredged periodically to ensure the safety of the vessels navigating harbor channels and anchorages. It has been found that shoaling has adversely affected shipping in the project area, a sector that contributes significantly to the Rhode Island and southeastern Massachusetts economies (Corps, 2001). Shoaling can also cause channel restrictions, which result in added time and cost to shippers bringing goods into and out of the ports; cause tidal delays; require lightering (the process of transferring cargo from larger to smaller vessels to reduce draft); or require the use of smaller, less efficient and more costly ships. In addition, vessels may scrape bottom or become grounded if navigation depths are not adequately maintained, potentially causing a hazardous situation to vessel or crew or resulting in damages to the vessel and the discharge of cargo, such as petroleum, into the aquatic habitat.

Maintaining proper navigation depths is also important for the recreational industry in the region. Marinas in the RIR are closely dependent on tourism, recreational fishing, and boating (Corps, 2001). Due to a lack of viable disposal alternatives, many marinas have gone decades without significant dredging. As a result, marinas have shoaled over the years to the point where the total number of slips that can accommodate large boats has been reduced, and large numbers of slips have been lost entirely. Rhode Island marinas lose approximately $25 million a year due to the inability to dredge their facilities (Corps, 2001).

Large amounts of dredged material are generated from maintenance dredging of navigation channels (to improve navigability), marinas and port facilities, and from improvement dredging. Dredging needs surveys conducted in 1984 (West *et al.*, 1985) and in 2002 (Corps, 2002) for the Rhode Island and southeastern Massachusetts region examined past dredging activities, quantities, dredging cycles, and disposal methods. Future dredging/disposal needs were estimated based on the review of historic information and on information collected as part of a questionnaire sent to navigation facilities in Rhode Island and southeastern Massachusetts. Material that was most likely to be used for beach nourishment or other beneficial uses was not included in final volume projections. The 1984 survey projected future volumes of dredged material requiring disposal for both Rhode Island and Massachusetts to be 8.77 million cubic yards (MCY) over the period 1985 – 1995. The 2002 survey (Corps, 2002) found that only 2.4 MCY was actually dredged between 1983 and 2002, most of which was used for beach nourishment. The remaining volumes were most likely not dredged due to the lack of a designated ocean disposal site. The Corps survey estimates that nearly 9 MCY[1] of dredged material will be generated over the next 20 years (Table 1-1), excluding the Quonset Point/Davisville Project and material projected to be used for beach nourishment. This estimate also does not include the 2003 Providence River and Harbor Maintenance Project disposal at Site 69B (Separation Zone Site) that began in early 2003, or recent proposals to create liquid natural gas (LNG) terminals in the Fall River area. Figure 1-2 shows the projected 20-year volumes of dredged material from Rhode Island and southeastern Massachusetts by municipality.

Table 1-1. Summary of Total Federal and Non-Federal Dredging Needs and Future Quantities of Dredged Material for the Rhode Island and Southeastern Massachusetts Region by 2021.

	Facilities Surveyed	Responses Received	2002-2006 (CY)	2007-2011 (CY)	2012-2016 (CY)	2017-2021 (CY)	20-year Total (CY)
Federal Projects[1]	NA	NA	1,303,700	1,468,200	63,200	880,750	3,715,850
Non-Federal Facilities[2]	450	178	3,357,044	681,150	563,800	453,585	5,055,579
Totals[3]	NA	NA	**4,660,744**	**2,149,350**	**627,000**	**1,334,335**	**8,771,429**

NA Not applicable.

CY cubic yards.

[1] The total volume for the Federal Navigation Projects does not include projects that will beneficially use dredged material, such as beach nourishment. This totals 919,500 CY. Additionally, the New Bedford/Fairhaven Harbor Project, which totals 1,783,500 CY, is not included because the Corps has already established that the material is unsuitable for offshore disposal.

[2] The total volume estimate does not include known surveyed non-Federal facilities that will incorporate beneficial use of dredged material, such as beach nourishment. This is estimated at 1,200,000 CY.

[3] Quonset Point/Davisville is excluded because the dredging associated with the proposed container port, between 8 and 14 MCY, is not a Federal project and its realization is not known at this time.

[1] Since this information was developed, one potential project identified in the survey has been permitted to dredge and dispose of material in conjunction with the Providence River and Harbor Maintenance Dredging Project. This reduces the estimated total volume to 8,736,429 CY. Moreover, previously unidentified projects have come forward, which may increase this estimate.

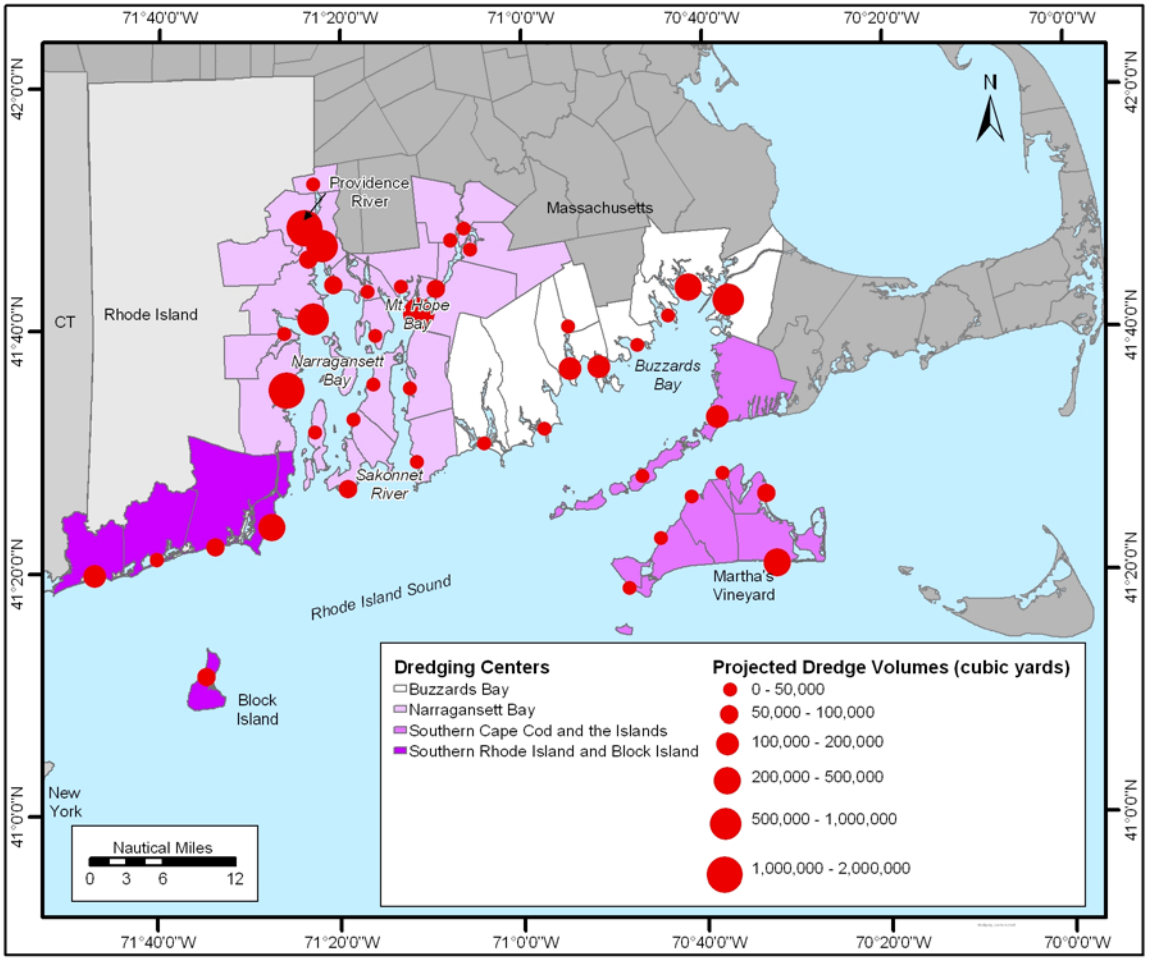

Figure 1-2. RIR Long-Term Dredged Material Disposal Site Evaluation Project – Dredging Needs Study – Projected 20-year Volumes of Dredged Material by Municipality.

The designation of one or more dredged material ocean disposal sites in the RIR would provide an alternative disposal option for the region's dredged material. Maintaining the existing channels and periodically improving the region's waterways are important for sustaining the economic and recreational value of a safe and efficient water transportation resource. The ability to support marinas and port facilities by providing an environmentally sensitive, practicable dredged material disposal alternative is important for current and future needs of this region.

1.3 LAWS AND REGULATIONS GOVERNING RIR OCEAN DISPOSAL SITES

The primary authorities that apply to the disposal of dredged material in U.S. waters are the MPRSA of 1972 and the Clean Water Act (CWA) of 1972. The jurisdiction of MPRSA and CWA overlaps within the territorial sea, which is defined as the open water within the states' 3-mile Territorial Limit. Where jurisdiction overlaps, CWA takes precedence where dredged material is used as fill, such as beach nourishment, while MPRSA takes precedence for the disposal of dredged material. The majority of the offshore waters of the RIR lie seaward of the territorial sea baseline and thus are subject to MPRSA.

These acts, in concert with the Rivers and Harbors Act of 1899 and the Water Resources Development Act of 1992 (WRDA92), implement the Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (known as the London Dumping Convention, an international treaty that guides the disposal of all materials in the marine environment). These statutes and the regulations pertinent to the designation of one or more ocean disposal sites in the RIR are summarized in the following sections.

1.3.1 Marine Protection, Research and Sanctuaries Act (MPRSA)

Any disposal occurring seaward of the territorial sea baseline is subject to the authority of the MPRSA. Congress enacted the MPRSA of 1972 to address and control the disposal of materials in ocean waters. Regulations implementing MPRSA were promulgated by EPA and are codified at 40 CFR Parts 220-228 (referred to as the Ocean Dumping Regulations). Title I of MPRSA authorized the EPA and the Corps to regulate disposal in U.S. ocean waters. EPA and the Corps share responsibility for managing dredged material. EPA is also responsible for reviewing and permitting any proposals to dump anything other than dredged material into ocean waters (33 U.S.C. Section 1412(a) and (b)).

The MPRSA regulates dredged material disposal only in waters seaward of the territorial sea baseline (with the exception of Long Island Sound), which are referred to as “ocean waters” under statute U.S.C. Section 1402 (b). These waters include the 3-mile band extending seaward of the baseline, which is referred to as the “territorial sea,” and beyond. Under the authority of MPRSA Section 102, EPA is responsible for designating ocean sites for disposal of dredged material. Goals of the EPA site designation process include limiting impacts to the environment, providing for efficient management and monitoring operations, and, where appropriate, supporting multiple users (e.g., the Corps, a local port authority, and private applicants). EPA and the Corps work cooperatively to designate, monitor, and manage sites and to evaluate dredged material permits and projects.

EPA is to designate sites and time periods for disposal, and can restrict site use, as necessary to “mitigate adverse impact on the environment to the greatest extent practicable” (33 U.S.C. Section 1412(c)). WRDA92 made a number of significant changes to MPRSA that affect the management of ocean dredged material disposal sites. Section 506 of the WRDA92, which amended the MPRSA, requires the EPA and the Corps to prepare a Site Management and Monitoring Plan (SMMP) for each designated disposal site and specifies that after January 1, 1995, no site shall receive a final designation unless an SMMP has been developed. The SMMP must include a baseline assessment of conditions at the site; a program for monitoring the site; special management conditions or practices to be implemented at the site to protect the environment; consideration of the quantity of material to be disposed of; the presence, nature, and bioavailability of the contaminants in the material; consideration of the anticipated use of the site over the long term; and a schedule for review and revision of the plan (33 U.S.C. Section 1412(c)(3)). A designated disposal site may not be used until the SMMP has been developed for the ocean disposal site (33 U.S.C. Section 1412(c)(4)). A Final SMMP has been prepared for the ocean disposal site identified as the preferred alternative in this Final EIS and is included as an appendix. Site management integrates permitting, enforcement, monitoring, and data interpretation to continually evaluate the appropriateness of ocean disposal in relation to MPRSA and the criteria.

EPA designation of an ocean disposal site does not authorize or result in the disposal of any particular material at the site. Designation only makes a site available for disposal, and disposal at a designated site is only one of a number of disposal options that are evaluated for proposed dredging projects.

The MPRSA prohibits the disposal of dredged materials into water under its jurisdiction unless conducted in compliance with a permit issued by the Corps under Section 103 of the MPRSA or authorization under the Corps Civil Works Program (33 U.S.C. Section 1411 (a) and Section 1413 (a)). Corps dredged material disposal permits and authorizations are issued under MPRSA Section 103 and may include conditions deemed necessary by the Corps related to the type of material to be disposed of, time of disposal, and other matters (33 U.S.C. Section 1413 and Section 1414(a)). The dredged material disposal permitting process requires consideration of a range of disposal alternatives, including beneficial reuse and upland treatment and disposal.

The Corps issues a permit, or approves a dredging project under its civil works authority, only if it has determined that dredged material disposal "will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities" (33 U.S.C. Section 1413(a)). The Corps makes MPRSA Section 103 determinations by the standards set forth in EPA regulations (33 U.S.C. Section 1413(b)). EPA has promulgated its ocean disposal regulations pursuant to MPRSA Section 102(a) (33 U.S.C. Section 1412(a), at 40 CFR Parts 220 to 229). Corps permit determinations and civil works approvals are also subject to any applicable requirements of other laws (e.g., the Endangered Species Act (ESA), the Coastal Zone Management Act [CZM], etc.). In addition, Corps authorizations under MPRSA are subject to EPA review and concurrence, and EPA may either veto or add conditions to the permit or civil works approval (33 U.S.C. Section 1413(c) and 1414(a)). The Corps does not issue permits under MPRSA for Corps dredged material disposal projects under its civil works authority; rather, it authorizes its own disposal projects by applying the same substantive and procedural requirements "in lieu of" the permit procedures (33 U.S.C. Section 1413(e)). As such, Corps authorizations for Corps projects are subject to the same EPA review and concurrence process described above.

The Corps and EPA are required to review and evaluate permit applications for proposed dredged material disposal using criteria established by EPA under Section 102 of MPRSA. Factors to be considered by EPA in developing the permit review criteria include:

- The need for the proposed disposal
- The effect of the disposal on human health and welfare; fisheries resources, plankton, fish, shellfish, wildlife, shorelines, and beaches; and marine ecosystems

- The effect of disposal on the transfer, concentration, and dispersion of such material, and the potential changes in marine ecosystem productivity and population dynamics
- The persistence and permanence of the effects of the disposal
- The effect of disposing of particular volumes and concentrations of such materials
- Appropriate locations and methods of disposal or recycling, including land-based alternatives
- The effect on alternate uses of oceans

1.3.2 Clean Water Act (CWA), Section 404

Section 404 of the CWA (33 U.S.C. Section 1344) governs the disposal of fill, including dredged materials, in waters of the United States within the 3-mile territorial sea. This applies to discharges landward of the baseline of the territorial sea and in instances seaward of the baseline when the intent is to fill or nourish beaches. The Section 404 permit program is implemented by the Corps and covers the discharge or placement of dredged and fill material into inland waters of the United States. The proposed action is to designate one or more ocean dredged material disposal sites and does not involve inland waters, as defined; therefore, the Clean Water Act does not apply to this proposed action.

1.4 HISTORY OF DISPOSAL IN THE RHODE ISLAND REGION

Dredging and disposal operations have been documented in the RIR since the 1920s; however, until the 1970s, disposal activities occurred with less regulatory oversight and record-keeping. Since the 1970s, little dredging has occurred in Rhode Island and southeastern Massachusetts due to the lack of an open water disposal site. Prior to 2003, the Providence River and Harbor Navigation Project was the last large Federal dredging project that utilized offshore disposal. This project was constructed in the late 1960s to early 1970s (Corps, 2001), and the dredged material from this project was deposited at a location known as Brenton Reef. Until selection of Site 69B, as part of the recent Providence River and Harbor Maintenance Dredging Project (Corps, 2001), dredging in Rhode Island and southeastern Massachusetts has been limited primarily to the Cape Cod Canal and locations in southeastern Massachusetts where dredged material, for the most part, can be used for beneficial purposes or disposed of elsewhere. Section 1.4.1 documents disposal activities that have occurred to date, focusing mainly on an area called the zone of siting feasibility (ZSF) (the reasonable and practical area within which dredged material sites could be located off the shores of Rhode Island and southeastern Massachusetts).

1.4.1 Documented Disposal from 1920s to Present

Dredging activities were conducted from the 1920s through the 1950s mainly as part of navigation projects or bridge construction work in the Mount Hope Bay and Tiverton, Rhode Island, areas in the upper reaches of Narragansett Bay. Materials from these projects were placed at various locations in Narragansett Bay, Rhode Island.

In the late 1960s, the best documented disposal of dredged material in the waters of Rhode Island Sound took place at a location known commonly as the Brenton Reef Disposal Site (Saila *et al.,* 1969), more recently called Site 16 (Corps, 2001) (Figure 1-3). Dredged material placed at the Brenton Reef Site originated primarily from the Providence River and Harbor Navigation Project (Corps, 2001). The project, constructed by the Corps, involved the deepening of the Providence River navigation channel from Narragansett Bay to Providence, Rhode Island, from 35 to 40 feet (ft). This was the first time that dredged material from Narragansett Bay was deposited offshore rather than within the estuary (Saila *et al.*, 1971). In addition to Providence River material, several smaller projects from the Mount Hope Bay approach channels and berthing area of the New England Power Company's Brayton Point Plant (Corps, 1972), and Point Judith, Rhode Island (Pratt *et al.*, 1973), were placed at the Brenton Reef Site. All disposal at the site ended in 1976.

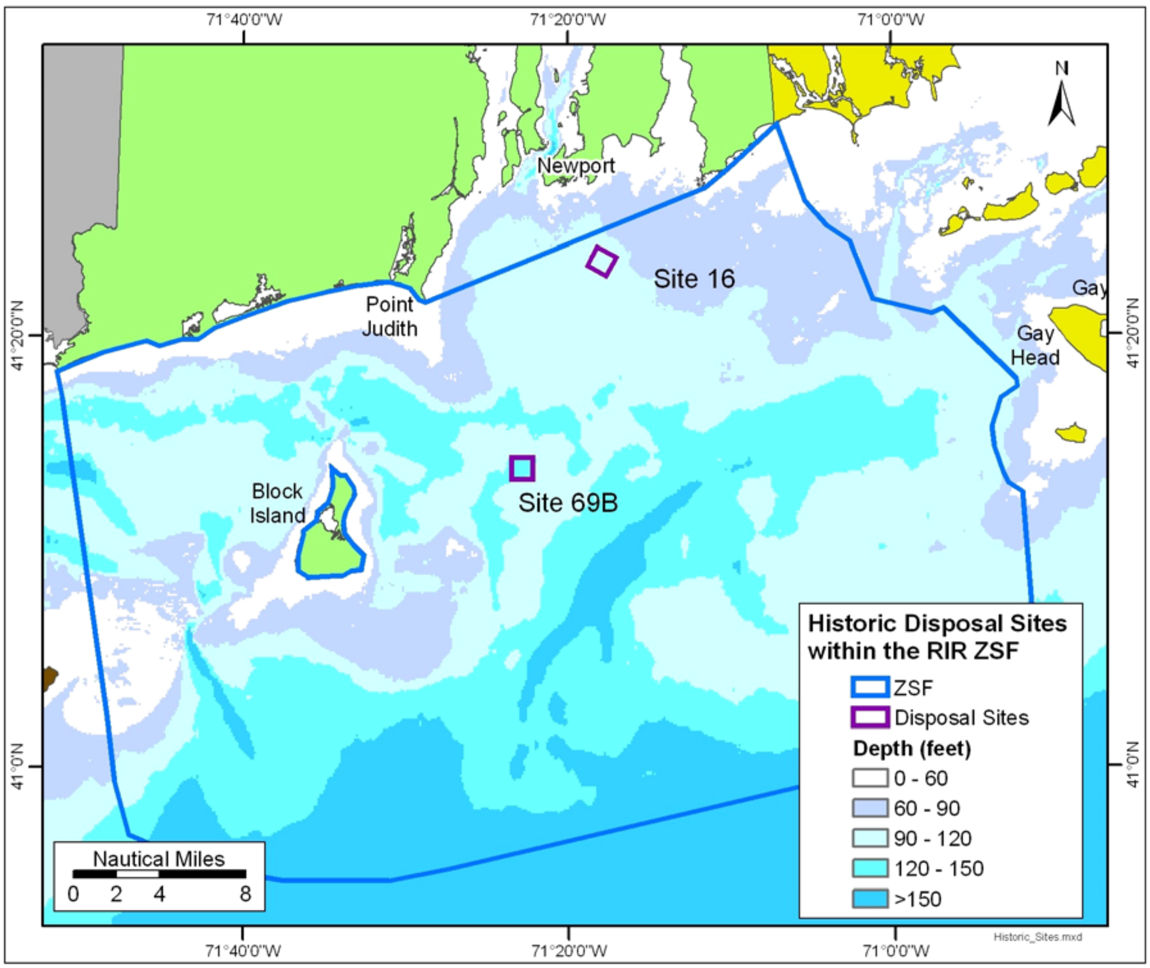

Figure 1-3. Location of Historic Disposal Sites in the ZSF.

With the adoption of the MPRSA legislation in 1972 (see Section 1.3.1 for more details on MPRSA), disposal in the ocean became more closely regulated and disposal was permitted only at either selected or designated sites (Section 1.5 explains the difference between selected and designated sites). An attempt to designate a regional disposal site (Corps, 1982) and to dredge the Fall River navigation channel in Massachusetts was made in the early 1980s but failed due to the inability to identify an acceptable disposal site (Corps, 2001). With no selected or designated site in the waters off Rhode Island and southeastern Massachusetts, little dredging has occurred over the past 25 years in Rhode Island and southeastern Massachusetts (Corps, 2001).

Recently, the need to dredge the Providence River became vital to the continued use of the Providence Berthing areas and led to selection and approval of a disposal site at a location known as Site 69B (Separation Zone Site), selected under the MPRSA site selection criteria (Figure 1-3). The Record of Decision (ROD) for the Providence River and Harbor Maintenance Dredging Project was signed on March 18, 2002, and disposal of dredged material began in April 2003. As a selected site, disposal will be allowed until April 2008 with the potential for an additional 5-year disposal period. Dredged material being disposed of at Site 69B consists primarily of material removed as a result of maintenance activities in the Providence River and determined to be suitable for ocean disposal under national and regional testing guidance (EPA and Corps, 1991; EPA and Corps, 2004). The sources, types, and quantities of material placed at Site 16 and at Site 69B are discussed in the following section.

1.4.2 Sources, Types, and Quantities of Material Disposed of in the ZSF

Table 1-2 summarizes the volumes and sources of dredged material disposed of or permitted for disposal within the ZSF and the disposal site location from 1967 through 2008 (projected).

Table 1-2. Disposal of Dredged Material Within the ZSF.

Disposal Site Location	Year(s) of Use	Volume/Type of Material	Source of Material
Site 16	1968 to 1971	~ 9 MCY[a] Dredged material[b]	Providence River and Harbor Navigation Project
Site 16	1970 to 1976	320,000 CY[a] Dredged material[b]	New England Power Co. Brayton Point
Site 16	1970 to 1976	30,000 CY[a] Dredged material[b]	Point Judith, RI
Site 69B	2003 to 2008[c]	5.05 MCY (authorized) Dredged material	2003 Providence River and Harbor Maintenance Dredging Project
Site 69B	2003 to 2008[c]	0.55 MCY Dredged material	Private maintenance projects adjacent to Providence River and Harbor Maintenance Dredging Project

[a] Pratt, S.D. *et al.,* 1973.
[b] Material was dredged prior to current testing requirements.
[c] The site can be reselected for another 5-year cycle.

The former Brenton Reef Disposal Site (Site 16) is located 4.6 nautical miles (nmi) from Brenton Reef Light in Rhode Island Sound and occupies 1 square nautical mile (nmi^2), centered at latitude 41°23’25” N and longitude 71°17’58” W (Figure 1-3). The material placed at this site was dredged prior to the extensive testing currently required to determine a material’s acceptability for ocean disposal and had relatively high levels of metals and organic compounds (Saila *et al.*, 1971). During the later years of operation, the potential for impacts from the contaminants in the sediment were mitigated by placing sediments with higher contaminant levels in the site first, then covering these with cleaner material. The areas dredged included Providence Harbor, a series of reaches extending about 2 nmi down the Providence River, and a 2-nmi long approach channel in upper Narragansett Bay (Saila *et al.*, 1971). Smaller amounts of dredged material were deposited at Site 16 between 1970 and 1976 (Table 1-2) (Pratt *et al.*, 1973).

Site 69B is located approximately 6.5 nmi east of Block Island and centered at latitude 41°13'51" N and longitude 71°22'49" W (Corps, 2001) (Figure 1-3). The 1-nmi^2 site is situated in a topographical depression that has a maximum depth of 130 ft. This site has been selected for disposal of approximately 5.05 MCY of dredged material from the Providence River and Harbor Maintenance Dredging Project and 550,000 CY of dredged material from private maintenance projects adjacent to the Federal maintenance activities. The authorization for dredged material disposal from that project at Site 69B expires in 2008. Other projects may opt to use this site for disposal during this ongoing authorization period if the dredged material is determined to be suitable for ocean disposal. After the current 5-year authorization period expires, the site may be used for dredged material disposal for an additional 5-year period if it meets the MPRSA Section 103 site selection criteria. Material determined to be unacceptable for ocean disposal cannot be disposed of in the site.

1.5 AGENCY ACTIVITIES RELATED TO DREDGING/DISPOSAL IN THE RHODE ISLAND REGION

In February 1993, the Governor of the State of Rhode Island established a Dredging Task Force (formally called the Interagency Task Force to Preserve Shipping in Narragansett Bay) to identify issues, develop a statewide plan for dredging, and ensure the plan's implementation. The Task Force included representatives from the Rhode Island Departments of Environmental Management (RIDEM), Transportation (RIDOT), and Administration (RIDOA), the Rhode Island Coastal Resources Management Council (RICRMC), the Rhode Island Port Authority (RIPA), the Rhode Island Economic Development Corporation (RIEDC), the Port of Providence, and the Governor's Policy Office. Advisory members of the Task Force included representatives from the Corps, the U.S. Coast Guard, and the offices of the congressional delegation of Rhode Island.

The Task Force met frequently between February and June of 1993 and completed a dredging plan, which laid out specific steps to be taken to implement anticipated dredging projects. The Task Force recommended prioritizing efforts and identified maintenance dredging of the Federal Navigation Channel in the Providence River as its top priority.

The priority was based on surveys of channel water depth and channel width that had occurred since the last dredging was completed in 1970. The surveys revealed that shoaling (accumulation of sediment) had reduced the controlling depths in sections of the channel to 30 ft below Mean Lower Low Water (MLLW). Because of the sedimentation and resultant navigation safety hazards, traffic in the channel was restricted to one-way traffic, and vessel drafts were restricted to 35 ft below MLLW. Vessels with drafts in excess of the channel depths incurred delays, were lightered (cargos transferred from larger to smaller vessels with shallower drafts), or were light-loaded to reduce draft. To eliminate the existing safety hazards associated with the shoaling in the channel and allow the resumption of two-way traffic, the State of Rhode Island requested that the Corps perform maintenance dredging to restore the Providence Navigation Channel to its authorized depths.

On April 29, 1994, the Corps published an NOI to prepare a Draft EIS for the proposed Providence River and Harbor Maintenance Dredging Project. This was the beginning of the process to identify issues, design the maintenance project, and identify a disposal location for the dredged material so that maintenance dredging could be initiated and Providence River authorized depths could be restored. Following the regulatory processes in Section 404 of the CWA (the CWA is applicable in "State" waters but not in "ocean disposal" sites) and Section 103 of the MPRSA and in accordance with the NEPA process, Draft and Final EIS documents were issued and reviewed. A ROD was issued by the Corps with approval by EPA on March 18, 2002, pursuant to its authority under MPRSA Section 103, identifying Site 69B as the selected alternative for disposal of dredged material from the Providence River and Harbor Maintenance Dredging Project.

Providence River and Harbor Maintenance Dredging Project

The Federal Navigation Channel of the Port of Providence constitutes the principal commercial waterway in Rhode Island. The Corps first initiated a Federal navigation channel and harbor in the Providence River, Rhode Island, in the 19th century with the construction of a 9-ft-deep channel. Subsequent improvements were made at various periods, including the last major dredging and disposal completed in 1970 and several smaller projects completed by 1976. The project consists of a 16.8-mile-long channel that begins near the head of Providence Harbor and follows the Providence River on a southerly course to deep water near Prudence Island. The upper 2.5 miles comprise the main harbor of the Port of Providence. The channel is generally 600 ft wide, except for a length between Fields Point (near the Providence-Cranston city line) and Fox Point, where it has varying widths of up to 1,700 ft. The channel has an authorized depth of 40 ft below Mean Lower Low Water (MLLW).

The Federal Providence River and Harbor Navigation Project was implemented to provide navigation efficiency and safety for deep draft vessel traffic using the channel. This deep draft traffic consists mainly of tankers, barges, and general cargo vessels, typically with drafts in excess of 39 ft fully loaded.

Under MPRSA, a selected site can be used by other permit applicants only if each applicant identifies the site as the proposed disposal location after a disposal alternative analysis. A selected site itself can be used for disposal for no more than two 5-year periods. Thus, Site 69B can be used by other projects only if the project selects the site and the selection and disposal permit is approved. In contrast, a designated site is available for use by applicants as long as they follow the Corps permitting process and it is determined, after an evaluation of disposal alternatives, that the designated site is the most appropriate location for disposal of dredged material.

Regardless of whether the site is selected or designated, the evaluation and decision-making process must follow pertinent regulatory guidelines. Each process is comprehensive and thorough, and requires a substantial degree of investigation generated by the investment of time and funding. The Governor of Rhode Island requested that EPA identify and designate a long-term dredged material disposal site that could be used for navigation projects in the State of Rhode Island. The availability of a designated long-term site would minimize the potential for dredging delays and allow responsible governmental agencies to focus on the development of a long-term dredged material management plan for the region. The availability of an EPA-designated site also would provide a predictable long-term alternative for disposal in the RIR and eliminate the need to re-evaluate the viability of the disposal site each time a project seeks to use it. In addition, the site designation process evaluates the cumulative impacts of placing dredged material from the RIR at the proposed site. In contrast, the site selection process requires project-specific and individual action review of the environmental consequences at the disposal site associated with its use. An EPA-designated site must also have an SMMP (a selected site is not required to have an SMMP). An SMMP lays out a program to effectively manage and monitor dredged material placed at the site. Moreover, the EPA designation process evaluates dredging needs over long planning horizons, while the site selection process evaluates each proposed dredging project on a project-specific basis.

1.6 REGULATORY REQUIREMENTS FOR SITE USE

The Corps, as the lead Federal agency for all permit actions dealing with ocean disposal of dredged material, works cooperatively with Federal and state regulatory and resource agencies throughout the permitting process, which is designed to ensure that disposal will not unduly degrade or endanger the marine environment and will not adversely affect human health, the marine environment, or other ocean uses. The application for a dredging permit initiates the permitting process. During the process, the Corps solicits comments from the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (FWS), EPA, and state regulatory agencies to ensure that the project conforms to applicable state water quality standards (if within the state's territorial waters) and is consistent with the CZM. In accordance with the EPA Ocean Dumping Regulations, national guidance is provided to applicants in the Ocean Testing Manual *Evaluation of Dredged Material Proposed for Ocean Disposal* (EPA and Corps, 1991), which defines the procedures for evaluating potential impacts associated with ocean disposal of dredged material. The Regional Implementation Manual for EPA Region 1 and the New England District of the Corps (EPA and Corps, 2004) implements the national guidance.

Throughout the permitting process, the Corps and EPA work with applicants to determine (1) appropriate disposal options and locations, and (2) the suitability of their dredged material for ocean disposal. Every permit application must thoroughly examine the need for ocean disposal and consider all alternatives, including beneficial use, upland disposal, and treatment technologies. Material may be permitted for ocean disposal only if there is no practicable alternative location or if there are methods of disposal or reuse available that would have less adverse environmental impact on the aquatic environment.

Ultimately, the decision to deny, approve, or place restrictions on a permit must meet the regulatory requirement that the action causes no "unacceptable adverse impact". As a result, Federal and state agencies cooperatively set permit conditions by considering the range of potential impacts and the environmental, economic, social, and political conditions associated with the proposed activities (dredging, transport, and disposal).

Enforcement of the MPRSA and its accompanying regulations is a joint responsibility of EPA and the Corps. The Corps may revoke disposal permits or suspend them for a specified period of time if any of the conditions of the permit are violated. Additionally, disposal of dredged material into the ocean without a permit or authorization is a violation of MPRSA. EPA is responsible for assessing the civil liability of the violator; known violations of permit conditions may be punished by imposing fines up to $50,000 or imprisonment up to 5 years, or both, for each event. Enforcement is an important site management tool because it ensures that the requirements set out in the disposal permit are complied with and that no unanticipated impacts occur resulting in adverse consequences.

1.7 PUBLIC INVOLVEMENT

In accordance with the requirements of NEPA, as amended (41 U.S.C. Section 4321-4347) and CEQ regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508), formal scoping and public involvement activities are required for Federal projects requiring an EIS. The scope of an EIS consists of the range of actions, alternatives, and impacts that are examined for a proposed action. NEPA requires initiating an early and open process with the public regarding a proposed action for which an EIS is prepared. This process is called scoping. The purpose of scoping is to inform and obtain input, including issues of concern, from private citizens, citizen groups, public interest groups, organizations, businesses, and Federal and state agencies and Tribes, and to involve them in the decision-making process.

Scoping is achieved by holding public meetings where the proposed project is presented and comments and questions are solicited, reviewed, and responded to, either at the meetings or in the NEPA documentation. This input is used by the agencies to provide guidance in identifying areas that are of particular concern to the public or that require additional information. This process ensures that the EIS addresses pertinent issues regarding the proposed project and can facilitate the acceptance of the project should it be implemented.

EPA and the Corps initiated scoping activities at the onset of this project to identify agency and public issues and concerns regarding the proposed action. In response to the issues and concerns identified through the scoping meetings, EPA and the Corps developed an extensive public involvement program to be conducted throughout the life of the project to ensure public awareness and obtain continuous public input. This program included public meetings, special working group meetings facilitated by the Coastal Institute (CI) of the University of Rhode Island (URI), an EPA and Corps e-mail address to receive and respond to project questions and comments, a project website to provide project information, and separate meetings to solicit input from stakeholders and from Federal, state, and local agencies. Sections 1.7.1 through 1.7.4 summarize the scoping activities and future opportunities for public input. Section 7.0, Public

Involvement, provides a comprehensive discussion of all public involvement activities undertaken during the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project.

1.7.1 Public Scoping Meetings

EPA and the Corps conducted two formal scoping meetings for this project. The first was held on May 17, 2001, at White's of Westport, in Westport, Massachusetts. The meeting was attended by representatives of the EPA and the Corps and by 13 stakeholders, who were either private citizens or representatives from the marine trade organization, a marine operator, and the Harbor Master of Westport. The second meeting was held on May 22, 2001, at the Lighthouse Inn in Narragansett, Rhode Island. Representatives from the EPA and the Corps and approximately 35 stakeholders were present at that meeting. Attendees included fishermen, lobstermen, members of environmental groups such as "Save the Bay," city council members, representatives for then-Governor Lincoln Almond and Senator Lincoln Chafee, Rhode Island legislative representatives, and members of the RICRMC. Public comments received at both meetings reflected the following concerns:

- The need for adequate data regarding fish and lobster habitats in Rhode Island Sound
- The economic impacts of the project
- Alternatives to disposal in Rhode Island Sound
- Confusion or misconception about the purpose of the project

At the Westport meeting, a representative from the maritime association also indicated a "need" for an ocean disposal site.

Based on the concerns and issues identified by the attendees at these two meetings, the EPA and the Corps agreed to perform the following tasks during the project development process:

- Conduct a comprehensive review of available data pertaining to the RIR
- Collect any existing data on biological resources (shellfish, lobsters, finfish, and habitat)
- Collect information from fishermen about the areas where they fish and lobster
- Continue public outreach
- Identify relevant information from the Providence River and Harbor Maintenance Dredging project
- Forecast future dredged material disposal needs for the region
- Define methods to address economic issues
- Collect physical, chemical, and biological data from potential disposal sites

1.7.2 Intra-Agency Meeting

An intra-agency meeting was convened between the EPA, Corps, and NMFS on November 14, 2001. This meeting focused on the "V-notch program" that was being facilitated by staff at NMFS's Narragansett Laboratory in association with the State of Rhode Island. The goals of this program were to ascertain the abundance and health of lobsters in the region in the wake of a 1996 oil spill that occurred in southern Rhode Island known as the *North Cape* oil spill. Data collected from this program were identified as being potentially useful to the RIR EIS. It was determined that NMFS would provide V-notch program data, including number of legal lobsters, and the number of V-notched lobsters with eggs for each area studied.

1.7.3 Meetings with Fishermen and Lobstermen

In response to concerns and issues raised at the public scoping meeting, the EPA and the Corps held meetings with Rhode Island Sound fishermen on August 28, 2001, on November 14, 2001, and on January 8, 2002. The August meeting was held at RIDEM in Wakefield, Rhode Island; the November and January meetings took place at the NMFS's Narragansett Laboratory in Narragansett, Rhode Island. A meeting was also held in January 2003 at the Coastal Institute. Neither the Corps nor EPA attended that meeting. The same concerns discussed in Section 1.7.1, Public Scoping Meetings, were discussed at the meetings, in addition to the following issues:

- Location of significant fisheries
- Relationship of (or confusion over) the Providence River project and the RIR project
- Public participation process for the RIR EIS
- Economic impact to fishing industry from the RIR project
- Data needs
- Alternatives to be examined in the RIR EIS.

1.7.4 Future Public Involvement Opportunities

In accordance with the NEPA process, the public has the opportunity for comment throughout the EIS process through public information meetings, working group sessions, verbal and written communication avenues with EPA and the Corps, and public comment periods on the Draft and Final EIS documents. This Final EIS and the accompanying Final SMMP are published together to provide an opportunity for public review and comment. Comments may be provided in writing (by mail, facsimile, or electronic mail).
A minimum 30-day public comment period is provided once a Notice of Availability of the Final EIS is published in the *Federal Register*.

Additionally, EPA conducted public hearings for interested parties to submit comments on June 15, 2004 at the Lighthouse Inn of Galilee in Narragansett, RI. The dates for the public

EPA Wants Your Input on the Draft EIS

EPA requests and encourages comments on the Final EIS for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Comments may be submitted:

By mail to:
Olga Guza
U.S. EPA New England, Region 1
One Congress Street, Suite 1100
Mail Code CWQ
Boston, MA 02114-2023

By facsimile to: (617) 918-1505

By electronic mail to:
R1_RISEIS@EPAMAIL.EPA.GOV

comment period and the locations, dates, and times of the public hearings were published in the *Federal Register*, in public notices, and in press releases; this information was also mailed to individuals and agencies identified on the EIS mailing list. Comments received were addressed in this Final EIS.

1.7.5 EPA Rulemaking Process

At the completion of the evaluation process, a draft of the proposed rulemaking was published in the *Federal Register* for public comment on April 30, 2004. Following issuance of this Final EIS, EPA will publish a formal rulemaking, no earlier than 30 days after the Notice of Availability of the Final EIS is published in the *Federal Register*.

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2.0 ALTERNATIVES

This section describes the process used to identify potential areas acceptable for locating an ocean dredged material disposal site in the Rhode Island Region (RIR) and provides an overview of the alternatives evaluated throughout the environmental impact statement (EIS) process, including the No Action Alternative. The No Action Alternative would be to abstain from designating an ocean site for dredged material disposal within the RIR.

The activities and impacts analyzed in this EIS focus exclusively on ocean disposal; however, during the overall EIS process, alternatives to ocean disposal were considered in accordance with the National Environmental Policy Act (NEPA). These included beneficial uses of the dredged material, upland alternatives, and treatment technologies. Section 2.1 briefly describes these alternatives. This EIS determined that none of these alternatives could provide the necessary holding capacity or would meet the long-term regional dredged material disposal management objectives for the RIR. A number of other local or regional studies, including the Long Island Sound EIS (EPA, 2004), Boston Harbor EIS (Corps, 1995), and the Final EIS for the Providence River and Harbor Maintenance Dredging Project (Corps, 2001), reached the same conclusion. Therefore, those disposal options were not evaluated in detail in Sections 3.0 and 4.0. The detailed evaluation focuses on identifying sites that would be acceptable for receiving dredged material deemed suitable for ocean disposal as defined by the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Ocean Dumping Regulations and implemented under the requirements of the Ocean Testing Manual (EPA and Corps, 1991) and the Regional Implementation Manual (EPA and Corps, 2004).

This Final EIS analyzes the potential environmental impacts associated with the No Action Alternative and two alternative ocean dredged material disposal sites (Site E and Site W in Figure 2-1), which were identified as potential candidates following a site screening process (Corps, 2003a). The screening process considered sites within the zone of siting feasibility (ZSF), the reasonable and practical area within which dredged material sites could be located off the shores of Rhode Island and southeastern Massachusetts.

2.1 ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED STUDY

This Final EIS focuses on the possible designation of ocean dredged material disposal sites under MPRSA Section 102. Because other disposal alternatives such as beneficial use, treatment of dredged material, and containment will not meet the long-term regional needs, they are not analyzed in detail. Each of these disposal alternatives is briefly described below and will be analyzed in subsequent NEPA documents prepared for specific proposed dredging projects.

- ***Upland and Beneficial Use*** – Options may include use of dredged material at upland sites (e.g., landfill cover and brownfields) and along shore sites (beach, dune, and wetland restoration). The ability to use dredged material in this way depends on the physical and chemical characteristics of the material.

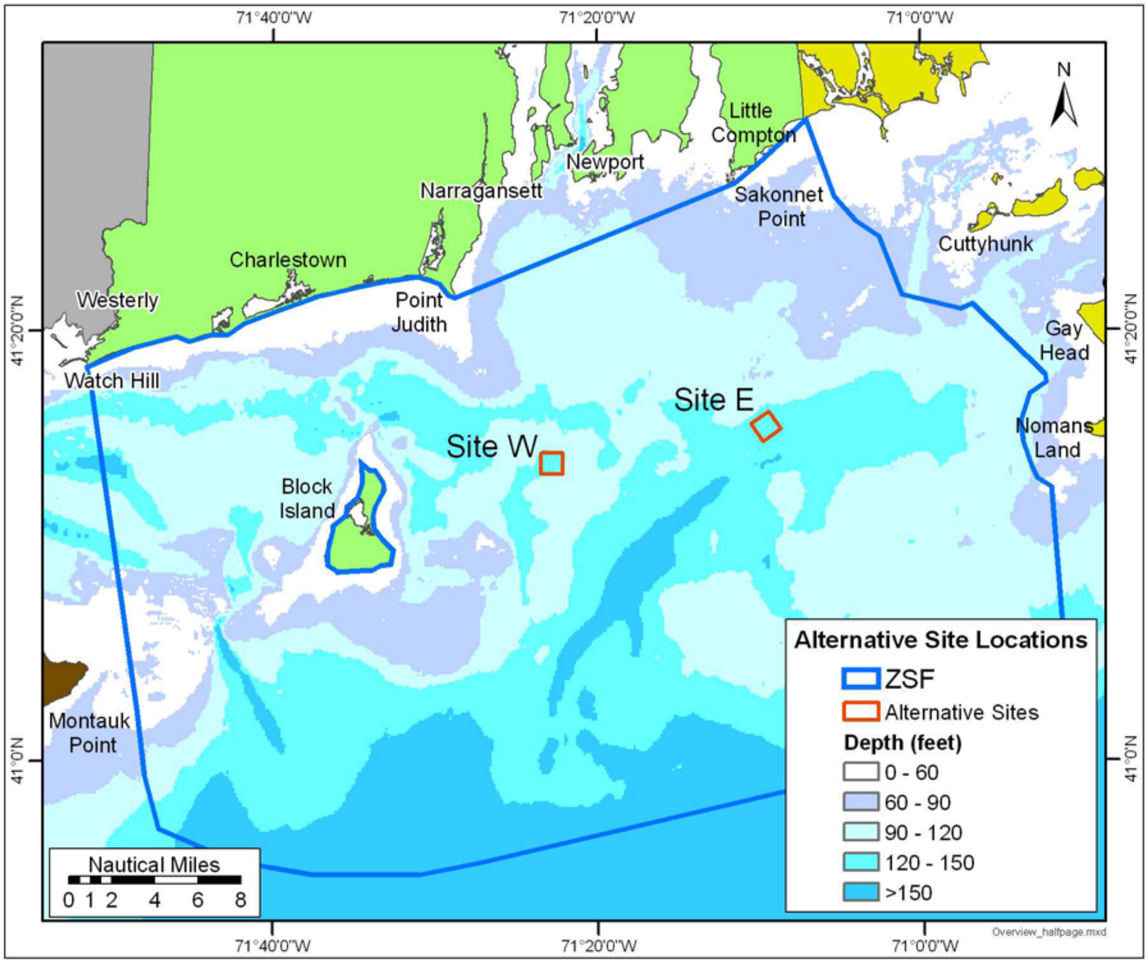


Figure 2-1. Alternative Ocean Dredged Material Disposal Sites Evaluated in this Final EIS.

- ***Treatment*** – Treatment alternatives for dredged material can involve separation (removing contaminants from the sediments for further treatment or confinement), reduction (removing the uncontaminated fraction of the sediments to reduce the volume that must be treated or contained); stabilization (fixing the contaminants into the sediment matrix to reduce the possibility of exchange with biological components of the ecosystem); and destruction (destroying the contaminants to render them harmless, such as with thermal treatment).
- ***Containment*** – This option is commonly used for disposal of dredged material found to be unacceptable for open water disposal, primarily because of contaminants in the dredged material. Examples include development of in-channel disposal sites, excavation of borrow pits, creation of islands, and use of disposal facilities in barren or industrialized land.

Relative to the RIR, several specific dredged material management options were evaluated in detail in the Providence River and Harbor Maintenance Dredging Project Final EIS (Corps, 2001). That EIS found that alternative treatment technologies for marine sediments were unproven at operational scales and that few have been commercially demonstrated or are available for the purpose of treating dredged material. Dewatering treatment technologies have been used to some extent, however, after dewatering, large amounts of material must be transported elsewhere for disposal at an extremely high cost. For these reasons, these processes have not been implemented routinely in the region and therefore, these dredged material management options were found unfeasible for the volume and rate of material generated by large dredging projects.

As for upland disposal, the Providence River and Harbor Maintenance Dredging Project Final EIS found that placing material in the aquatic environment avoids land use and traffic impacts and costs substantially less than non-aquatic alternatives. It also found that disposing of large volumes of the material at landfill sites would result in the unacceptable loss of capacity and lifespan of the landfills evaluated.

The Providence River and Harbor Maintenance Dredging Project Final EIS also found that using the dredged material for habitat creation/restoration, while possible in limited situations, was not a viable option for that project because costs would be high and the number of sites with sufficient capacity to hold material was limited. The current dredging needs study (Corps, 2002a) found that most of the ~ 2.4 MCY of material that was dredged in the region in the past 20 years was used for beach nourishment. Estimates of dredging needs in the next 20 years include almost 1.2 MCY for beach nourishment and almost 9 MCY of material that may not be suitable for beneficial use. Based on the Providence River EIS evaluation and the large amount of additional material projected for dredging in the region, beneficial use is not a viable option as a long-term solution to dredged material disposal in the RIR.

Containment options were found viable, and in certain cases excavated material could be used for beneficial uses, thus requiring project-specific evaluation of alternatives at the permitting stage. These findings and conclusions remain valid today.

2.2 IDENTIFICATION OF OCEAN ALTERNATIVE SITES

The process of defining the alternatives evaluated in this Final EIS consisted of the following steps:

- Defining the region's dredging needs (Corps, 2002a) to identify the potential volume of dredged material that could require ocean disposal to assist in identifying site volume requirements
- Identifying a ZSF (Corps, 2002b) – the reasonable and practical area within which a dredged material site could be located (see Figure 2-1)
- Reviewing possible alternatives
- Identifying specific locations for further evaluation

These activities were performed in coordination with Federal and state cooperating agencies and the project's Working Group.

A dredging needs study was conducted to determine the current dredging needs and project volumes of dredged material in the Rhode Island and southeastern Massachusetts region over a 20-year period (Corps, 2002a). The results of this study indicate that between 2002 and 2021, the Rhode Island and southeastern Massachusetts region has the potential to generate more than 9 million (M) cubic yards (CY) of dredged material that will require relocation to a disposal location. Based on the results of the dredging needs analysis, the study area was divided into four dredging centers, or geographical areas, that share a logical point of origin for dredged material. The dredging centers defined for the Rhode Island and southeastern Massachusetts region are Southern Rhode Island and Block Island, Narragansett Bay, Buzzards Bay, and Southern Cape Cod and the Islands (Figure 1-1 in Section 1.0).

The geographic boundaries of the ZSF were determined based on the results of the following:

- The dredging needs study (Corps, 2002a)
- Ocean disposal site designation guidelines prepared by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers, New England District (Corps) (1986)
- Evaluation of a set of criteria applicable to delineating the ZSF (Corps, 2002b). These criteria included political boundaries, navigation restrictions (such as safety issues, etc.), type of disposal plant, cost of transporting dredged material, and distance to the continental shelf.

The ZSF defined for this evaluation encompasses Rhode Island Sound, Block Island Sound, and the area of the continental shelf south to a distance approximately 30 nautical miles (nmi) from the mouth of Narragansett Bay. The ZSF covers an area of 1,100 nmi^2 and reflects the maximum distance offshore that is practical for transporting dredged material to a potential disposal site using long-haul bottom dump barges. A detailed description of the location of the ZSF is provided in Section 3.1.

2.2.1 Site Screening Process

Once the ZSF was established, a two-tiered screening process was conducted using MPRSA site identification criteria. This process involved reviewing and evaluating available biological, chemical, and physical data and considering other uses of the ocean within the ZSF. Tier 1 screening ruled out areas where disposal could not occur. Tier 2 screening identified areas where disposal was still possible. Additional information was then evaluated in the acceptable areas to identify potential disposal alternative sites. The screening process narrowed the area within the ZSF that was potentially suitable to receive acceptable dredged material to two areas, each covering approximately 1 nmi^2. This section summarizes the screening process; a comprehensive description of the process can be found in the Alternative Site Screening Report (Corps, 2003a).

The MPRSA lists five general and 11 specific criteria required for evaluating and designating ocean disposal sites (40 CFR 228.5 and 40 CFR 228.6, respectively) (Table 2-1). EPA, in consultation with other Federal and state agencies, used these criteria to perform initial screening of areas within the ZSF and identify areas that should be excluded when formulating the location of alternative disposal sites.

A Working Group of regional stakeholders was also established to identify additional evaluation factors that should be considered in the initial screening process (Petruny-Parker *et al*., 2003). The Coastal Institute (CI) at the University of Rhode Island (URI) served as facilitators of the Working Group, which consisted of public resource users as well as stakeholders, science and policy advisors from URI, and staff from several Federal, state, and local agencies. A summary of meetings with the Working Group is presented in Section 7.2.

The Working Group developed a list of evaluation factors it considered important for identifying acceptable alternative sites and identified information and data needed to apply the evaluation criteria. The major issues identified by the Working Group included:

- Potential impacts to fisheries (commercial and recreational)
- Potential impacts to non-commercial species
- Potential conflicts with recreational areas
- Potential conflicts with commerce/military activities
- Possible remedial use
- Economic factors
- Hydrodynamic factors

EPA and the Corps used these evaluation factors and the site designation criteria to develop a series of geospatial screening layers that depict each of the Working Group's concerns and the MPRSA siting criteria. To support the screening, three levels of quantitative values specific to each screening layer were developed (Corps, 2003a). These three levels were prepared after relevant available data for each screening layer were examined and were used to quantitatively categorize (1) areas that should be excluded from consideration (Level 1), (2) areas that could be excluded or included (Level 2), and (3) areas that could be included (Level 3). The individual layers are based on the ocean disposal site designation criteria and were prioritized into two tiers to facilitate the screening process. Tier 1 layers were exclusionary layers used to identify *broad areas* within the ZSF that were not acceptable for locating an ocean disposal site designated under the MPRSA (Tier 1 screening). Tier 2 layers were used to identify *the broad areas* remaining after Tier 1 screening for which further analysis and screening would occur in delineating the location of alternative sites for further evaluation in the Final EIS.

Data from current and historical studies were assembled and mapped graphically as Geographic Information System (GIS) data layers using Environmental Systems Research Institute, Inc. (ESRI) ArcGIS Desktop software (i.e., ArcView) to address each screening criterion.

Table 2-1. MPRSA Criteria for the Evaluation and Designation of Ocean Dredged Material Disposal Sites (40 CFR 228.5 and 228.6).

MPRSA Section	MPRSA Regulation
228.5(a)	The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.
228.5(b)	Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.
228.5(c)	If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in §§ 228.5 through 228.6, the use of such sites will be terminated as soon as suitable alternate disposal sites can be designated.
228.5(d)	The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.
228.5(e)	EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.
228.6(a)	In the selection of disposal sites, in addition to other necessary or appropriate factors determined by the Administrator, the following factors will be considered:
(1)	Geographical position, depth of water, bottom topography and distance from coast;
(2)	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases;
(3)	Location in relation to beaches and other amenity areas;
(4)	Types and quantities of wastes proposed to be disposed of, and proposed methods of release, including methods of packing the waste, if any;
(5)	Feasibility of surveillance and monitoring;
(6)	Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any;
(7)	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects);
(8)	Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the ocean;
(9)	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys;
(10)	Potentiality for the development or recruitment of nuisance species in the disposal site;
(11)	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.

Tier 1 Screening

Tier 1 screening identified areas within the ZSF that were not acceptable for locating an ocean disposal site under the MPRSA, focusing the area to be considered for Tier 2 screening. The southern geographic boundary of the ZSF previously excluded areas beyond the continental shelf (MPRSA Section 228.5[e]) and was based on a travel distance of approximately 20 nmi south of the southernmost dredging center of Block Island, Rhode Island (Corps, 2002b). Long-distance haul traveling beyond the 20 nmi distance creates additional risks such as greater use of fossil fuels and increased air emissions, greater casualty loss, greater potential for endangered species encounters (i.e., risk of whale strikes), and potential risks from traveling in the open ocean and wave conditions. The ZSF study determined this transport distance to be reasonable based on environmental concerns, safety, practicality, and operational efficiency within an 8-hour workday using disposal practices typical in the New England area. In addition, areas of high dispersion (erosion) potential and of clearly conflicting uses were excluded from further consideration during the Tier 1 screening. Areas of conflicting uses included:

- Anchorages
- Reserves and science areas
- Beaches and amenities
- Conservation areas (sanctuaries, wildlife refuges, national seashores, parks, fish havens, artificial reefs)
- Active ordnance and military use
- Active utilities (pipelines, cable areas, etc.)
- Historic or culturally important shipwrecks

Figure 2-2 shows the areas that were eliminated as unacceptable for an ocean disposal site during Tier 1 screening.

The potential erosion and transport of sediment in the ZSF during typical storm events was modeled using physical parameters, such as wind, waves, and sediment type (grain size and cohesiveness) information (Corps, 2003a). The modeled estimates for potential sediment erosion were then compared to depth. This comparison predicted that sediments were not likely to be resuspended at depths below 170 feet (ft), but that occasional erosion and frequent sediment transport occurred at depths shallower than 105 ft. The interagency group decided to exclude areas of the ZSF where depths were less than 115 ft, the minimal depth for locating a disposal site based on high potential sediment erosion (105 ft) and the theoretical mound height (a 10-ft mound created from the disposal of more than 8 MCY over 20 years).

The interagency group recommended that the modeling results also be considered as an exclusionary layer. The areas predicted to have a high potential for erosion were excluded; those with a moderate potential for erosion (gray in Figure 2-2) were initially considered but were excluded after this evaluation. The areas of high potential sediment erodability in the northwest corner of the ZSF also coincided with areas of strong tidal currents, which were considered as further justification for excluding that area during this screening. The areas of the ZSF shown in

Figure 2-2 that are not black (excluded) or gray (potential for impact) were carried forward to the Tier 2 evaluation.

Tier 2 Screening

The objective of the Tier 2 screening was to further evaluate the areas determined during Tier 1 to be potentially acceptable and, if possible, identify actual alternative disposal sites for further evaluation in this Final EIS. The Tier 2 screening criteria were categorized quantitatively into three levels, as described for Tier 1 (Corps, 2003a) and included:

- Fish and shellfish resources (finfish, lobster, and shellfish)
- Navigation
- Diving areas
- Unexploded ordnances (UXOs)
- Economics (cost of transport)
- Tidal ellipses
- Grain size distributions
- Historic and current disposal sites

The southern boundary of the ZSF was set at approximately 20 nmi from the dredging center on Block Island by considering all the potential dredging locations (Corps, 2002b). Further review of the information in the ZSF report identified that only the centers on Block Island and Gay Head caused the boundary to be located approximately 30 nmi offshore. Examination of cost tables for typical barge operations determined that a more appropriate economic distance from most harbors in Rhode Island and southeastern Massachusetts was approximately 20 nmi from the coast. This was found to be reasonable for the greatest haul distance in upper Narragansett Bay. Transfer distances of greater than 20 nmi offshore were considered less favorable from a cost perspective. Uncertainty regarding the environmental consequences of disposal of dredged material in areas beyond 20 nmi offshore was an issue as well. The interagency group decided that the area of the ZSF greater than 20 nmi from the coast would be removed from further consideration.

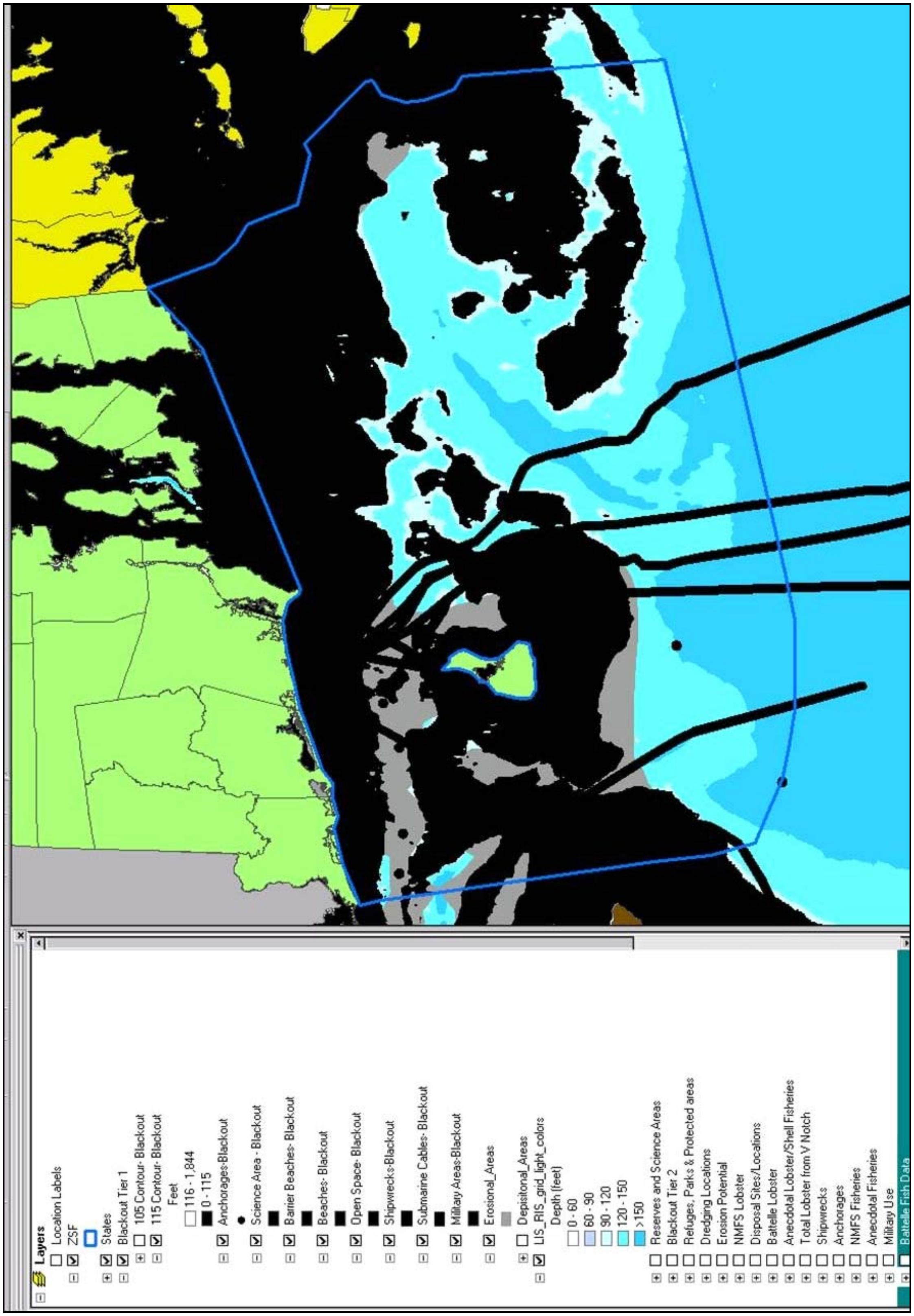


Figure 2-2. Tier 1 Screening Summary.

Figure 2-3 shows the areas that were found acceptable for location of a potential ocean disposal site if only Tier 2 screening information were used to identify candidate sites. Areas that were important fish and shellfish habitats, those used for navigation and diving, those containing UXOs, and those that were beyond an economically effective distance from the coastal dredging centers were all removed from consideration during Tier 2 screening.

Combined Tiered Screening Results

The areas removed from further consideration by both the Tier 1 and Tier 2 screening are shown in Figure 2-4 as black or gray. Of the areas that remained after screening, the area to the southwest of Block Island, Rhode Island, was excluded from consideration based on information that the bathymetric trough in that region has high currents, is used as a migratory route for lobster, and is in close proximity to other significant fisheries in this area. The area in the southeastern portion of the ZSF was also considered unacceptable due to its close proximity to highly productive shellfish beds. The area adjacent to the western boundary of the ZSF was excluded due to the strong tidal currents and high potential sediment erodability found in the northwestern corner of the ZSF.

Of the areas potentially acceptable for locating an ocean dredged material disposal site (red polygons in Figure 2-4), only two (Area E and Area W, shown on Figure 2-5) were recommended for further analysis and consideration in this Final EIS at a September 8, 2003, interagency meeting (Section 6.0 discusses all interagency meetings and coordination). The area defined as Area W encompasses Site 69B, which was selected in 2001 and became an active dredged material disposal site in April 2003 for dredged material found suitable for ocean disposal from the Providence River and Harbor Maintenance Dredging Project and nearby areas (Corps, 2001). The boundaries of Area W are set in the east and west by a navigational channel buffer zone, in the south by depth restrictions, and to the north by anecdotal reports that it is a finfish trawling zone. The area defined as Area E is located about 9 nmi east of Area W in 120 to 150 ft of water. The boundaries of Area E are set in the northwest by a navigational channel buffer zone on the inbound lane to Buzzards Bay, in the northeast by depth restrictions (erosion potential), and in the south by an identified finfish trawling zone.

It was not feasible to further refine specific potential locations of alternative disposal sites for evaluation in these areas at the end of the Tier 2 screening due to the lack of comparative data for the eastern area. The interagency group recommended that additional data be collected and that further evaluations be conducted on these areas to more fully define the sites for evaluation in this Final EIS. Moreover, the screening indicated that the western area (Area W) needed further data collection due to the overlap of the present Site 69B with the 0.5-nmi buffer area applied to the inbound navigation lane to Narragansett Bay.

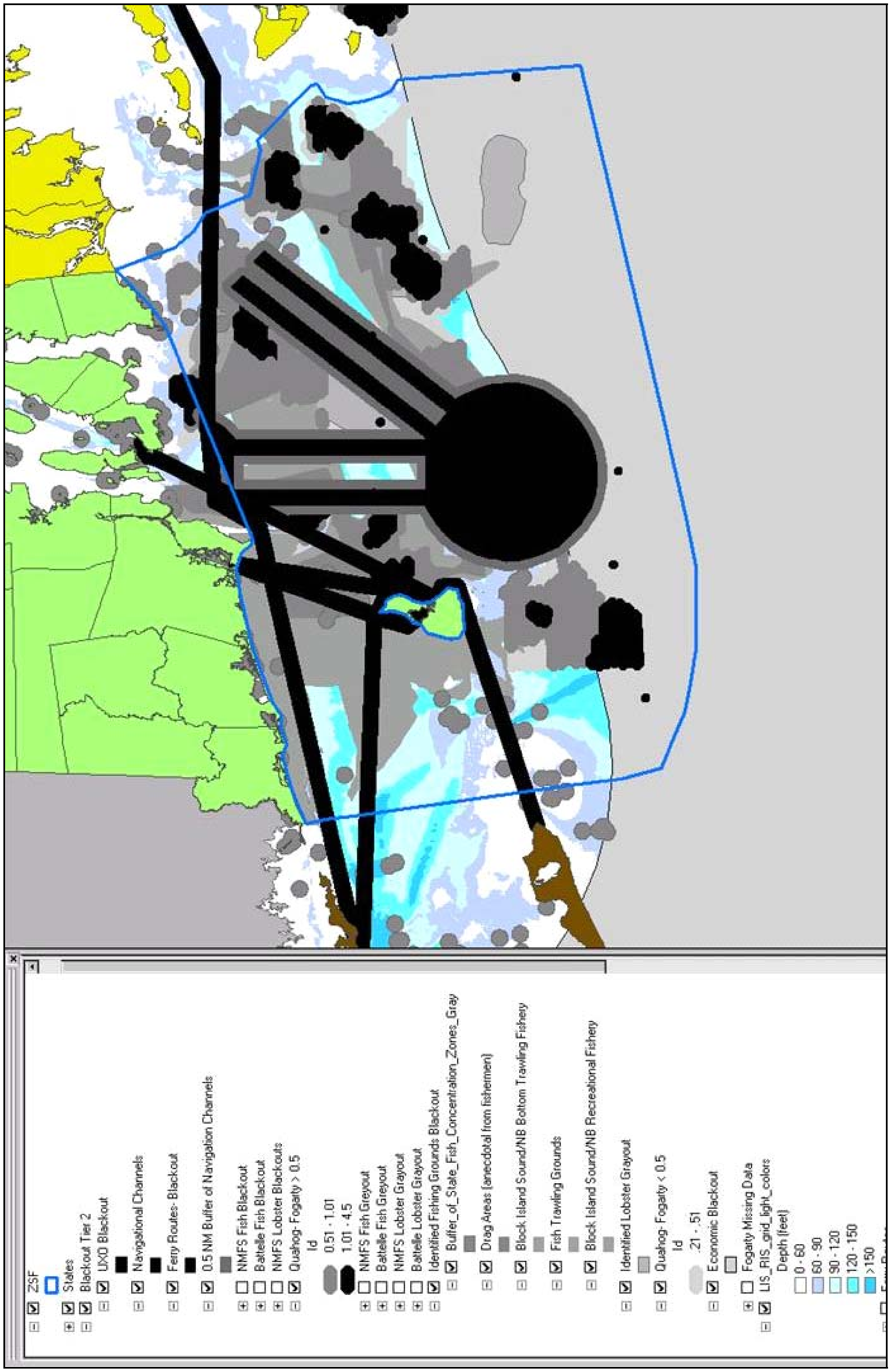
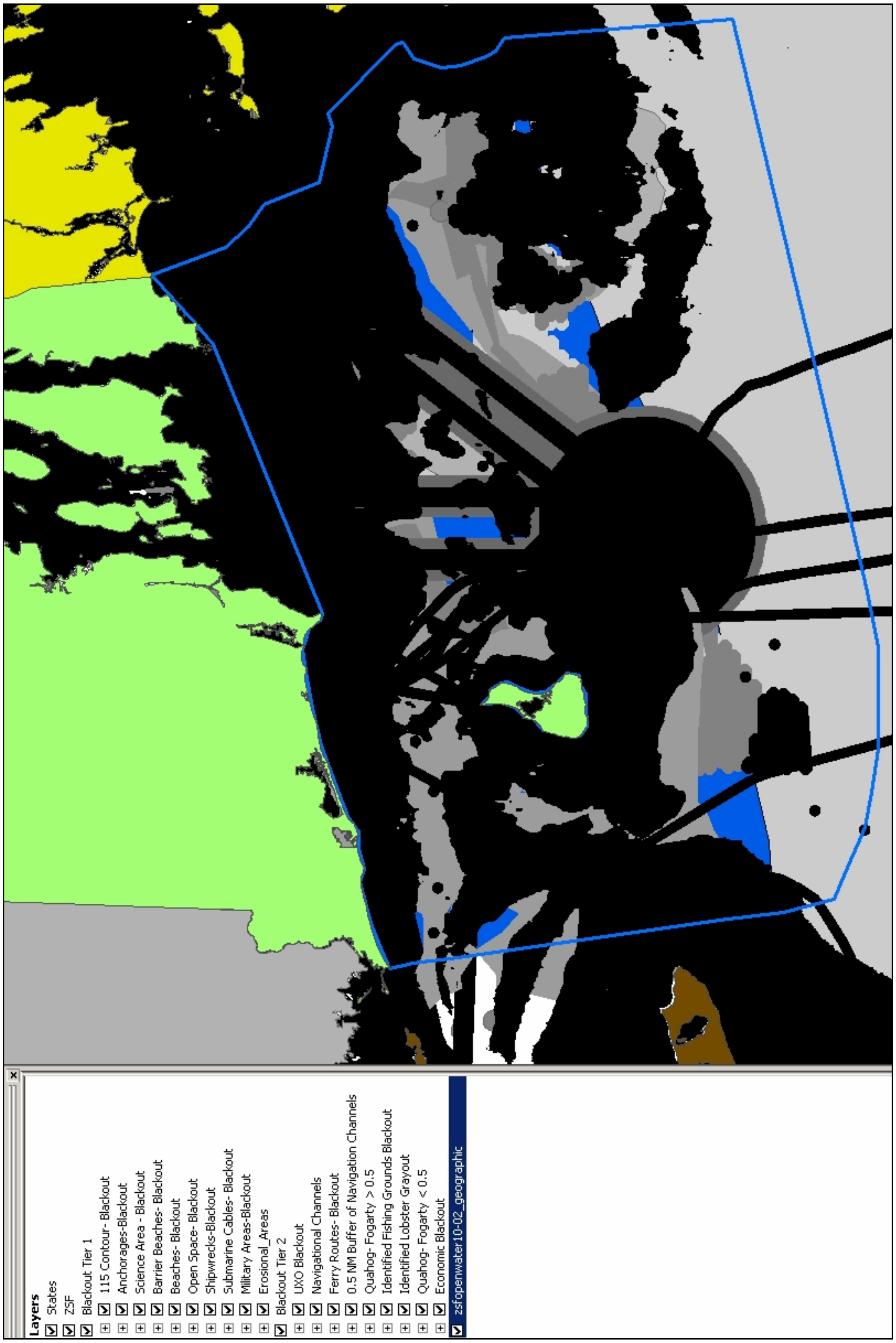


Figure 2-3. Tier 2 Screening Summary.



Note: Blue areas are areas recommended for further analysis and consideration after the site screening process

Figure 2-4. Tier 1 and Tier 2 Screening Results.

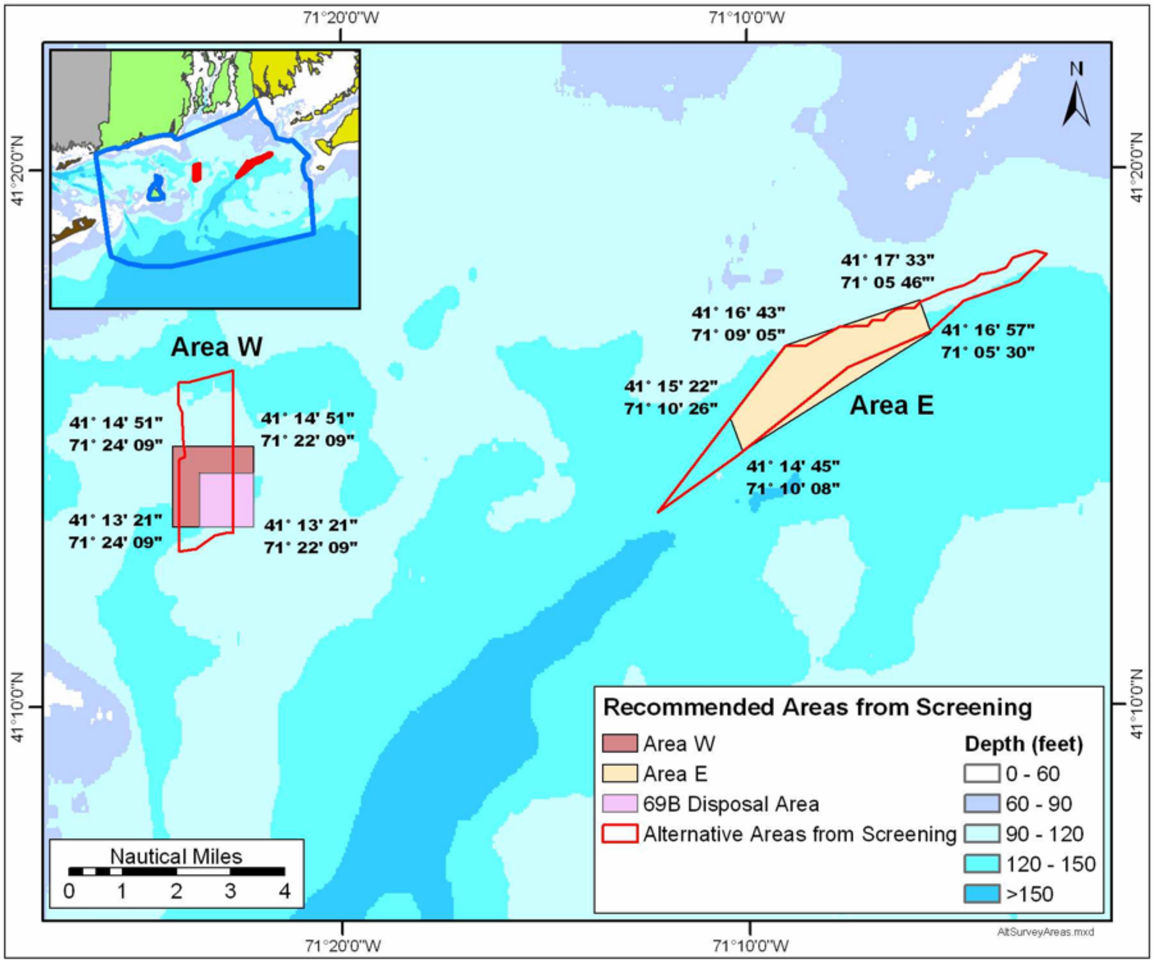


Figure 2-5. Recommended Areas (Areas E and W) Resulting from the Screening Process.

2.2.2 Identification of Alternative Sites

Additional data collection needs identified for the western and northern portions of Area W and for the entire Area E included:

- Detailed bathymetry
- Habitat and bottom type (using side-scan sonar)
- Archaeology (using a magnetometer)
- Habitat, sediment type, benthic community (using sediment profile imaging [SPI])
- Sediment chemistry
  - Grain size/total organic carbon (TOC)
  - Selected metals and organics
- Benthic infauna (benthic community)
- Finfish trawls (fish community)

- Lobster abundance and distribution (using pots/traps)
- Ocean quahog and mahogany clam abundance and distribution (using clam dredges)

A series of field surveys were completed in the summer of 2003 to satisfy the identified data gaps in Areas E and W (Corps, 2003b; Corps, 2003c; Corps, 2003d; Corps, 2003e; Corps, 2003f; Corps, 2003g). The data from these surveys were mapped graphically as GIS data layers using ESRI Arcview and were used to identify 1-nmi^2 alternative sites within each of the alternative areas.

Area E Evaluation

Field data were collected for Area E from a survey area of approximately 4 nmi^2 within the widest portion of the area, since the northeast and southwest corners of this area were not large enough to accommodate a 1-nmi^2 disposal site (see Figure 2-5). Side-scan sonar images and sediment characteristics derived from rapid sediment imagery using SPI indicated that Area E consists of a number of different habitat types, with coarse to medium sand in the southwest portion of the area, silty-fine sand along the southern border of the area, and significant expressions of rocks and boulders in the northern and eastern portions of the area. The rough, rocky bottom type present in the northeastern portion of Area E restricted the sampling efforts for finfish and quahog to the southern part of the area. The number of finfish collected from Area E and locations just to the south was generally low. Slightly larger numbers of finfish were collected from the northeastern trawl locations than from the trawls located in the southwestern portion of the area. These data are consistent with the anecdotal information regarding finfish trawl activities that occur immediately to the south of Area E and were used to set the southern boundary of this area.

Lobsters were more abundant during the sampling at stations located in the northeast part of the area. This is consistent with the preferred habitat of lobsters (i.e., mixed bottom type including significant surface expressions) (Cobb and Phillips, 1980). Throughout Area E, unvented[1] pots contained more lobsters than vented pots, indicating that sub-legal sized lobsters are present in this area. Ocean quahog densities were generally low in Area E, with higher densities found in the southwest portion of the area, corresponding to the presence of coarse to medium sand in accordance with the preferred substrate identified by Fogarty (1979, 1981). Few to no ocean quahogs were found in the areas of siltier and finer sands near the southern border of the area. These results are consistent with the field studies conducted by Fogarty (1979, 1981) that demonstrated (1) ocean quahog biomass is generally low in the vicinity of Area E, and (2) ocean quahogs prefer sediments with high amounts of medium sand and shell fragments. Fogarty also found that ocean quahog densities were lowest in high silt/clay or coarse sand-gravel sediment.

It was determined that rocky bottom types within Area E should be avoided to the extent feasible due to their ability to provide suitable habitat for a number of biological resources. The eastern

[1] As required by law, all lobster pots are required to have an opening (approximately 2 inches by 5 inches) in the "parlor" area of the pot to the outside to allow undersize lobsters to escape. In the unvented pots, the escape vents are closed up using a mesh screen to prevent the juvenile lobsters from escaping.

portion of the area was also excluded from consideration due to the significant lobster and finfish resources present.

Using the results of the summer 2003 field studies, three locations, each covering approximately 1 nmi^2, were considered as possible alternative sites within Area E (Figure 2-6). The northernmost location (Location 1 in Figure 2-6) was excluded because the site overlapped with finfish resources to the south and significantly overlapped hard-bottom high-relief habitat to the northeast. The middle location (Location 2 in Figure 2-6) was removed from consideration because it also overlapped with finfish resources to the south and hard-bottom habitat. The southwesternmost location (Location 3 in Figure 2-6) avoided areas of considerable lobster and finfish resources and minimized inclusion of the high-relief areas while maximally staying within the initial screening boundaries. The amount of overlap on the finfish trawl areas to the south was minimal, and the site extended slightly into the shipping lane buffer zone to the north. While the site was located in an area where ocean quahogs were found, the measured densities are low compared to other areas of the ZSF (see Section 3.11).

Based on the data and evaluation, it was recommended that the southwesternmost area within Area E (Location 3 in Figure 2-6) should be included as an alternative called Site E in this Final EIS. The interagency group reviewed the process for locating this alternative site and concurred with the recommended location of Site E, while noting the presence of some lobster habitat within the area.

Area W Evaluation

Additional field data were collected within a survey area of approximately 1.5 nmi^2 to the north and west of the current Site 69B (see Figure 2-5). Additional data collection from within Site 69B was not needed due to the availability of previous information gathered during the Site 69B site selection process and in previous field efforts as conducted in preparation of this Final EIS.

Side-scan and SPI data indicated that the sediment bottom type in Area W consists primarily of uniform fine sands with very little expressions of high relief (rocks, boulders, etc.) in the western portion. Higher relief was found in the northern portion of the area. A large number of trawling scars were visible in the side-scan images collected from the western portion of Area W. The number of finfish collected from Area W was generally low (and consistent with the numbers collected from Area E at this time). Slightly larger numbers of finfish were collected from the western portion of Area W than from the northern portion. Lobsters were more abundant at stations located in the northern part of the area, consistent with the preferred habitat of lobsters (i.e., mixed bottom type including significant surface expressions) (Cobb and Phillips, 1980). Unvented pots generally contained more lobsters than vented pots, indicating that sub-legal sized lobsters are present in this area. Quahog densities were generally low in Area W, with densities fairly consistent throughout the area. These results are consistent with recent and historic ocean quahog studies conducted in the immediate area (Corps, 1998; Corps, 2003b; Fogarty, 1979; Fogarty, 1981).

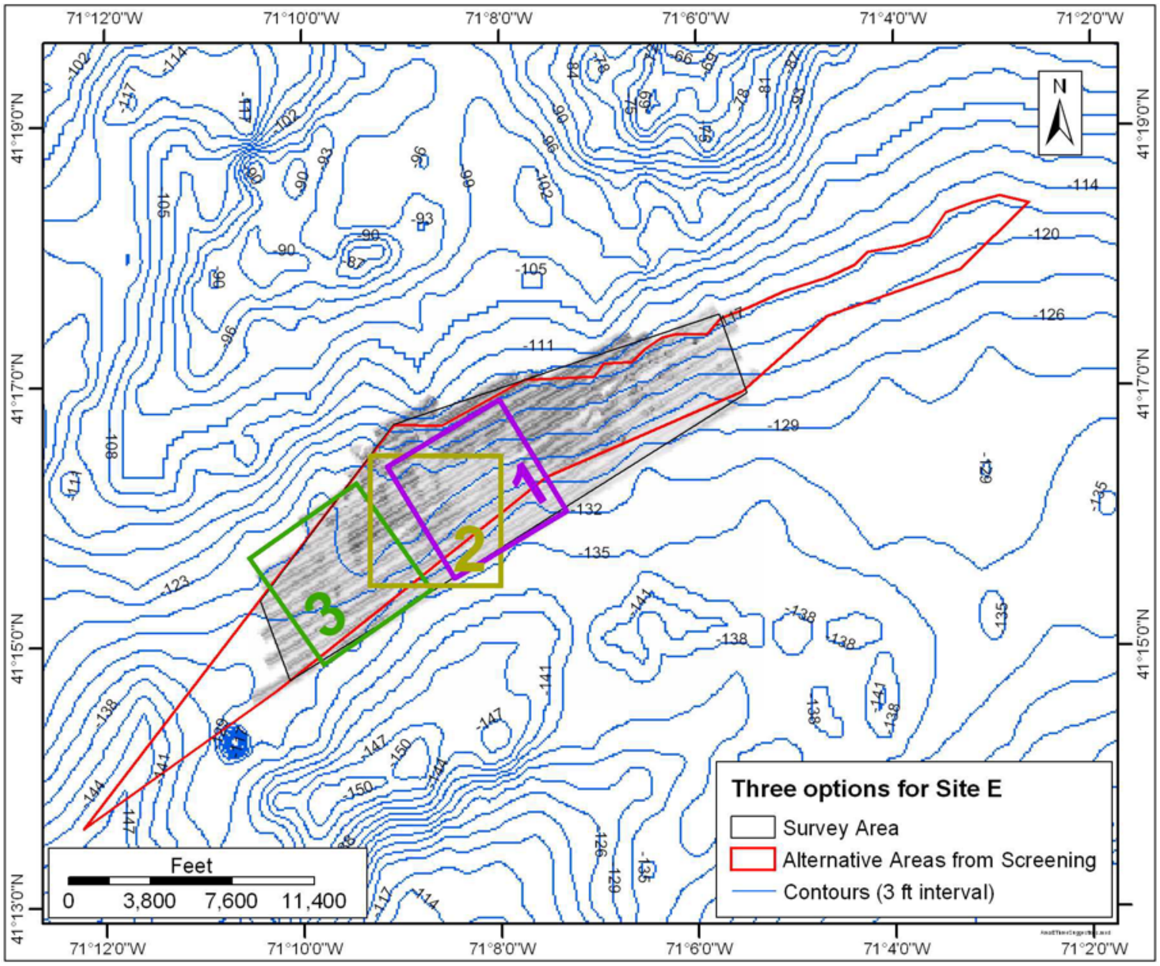
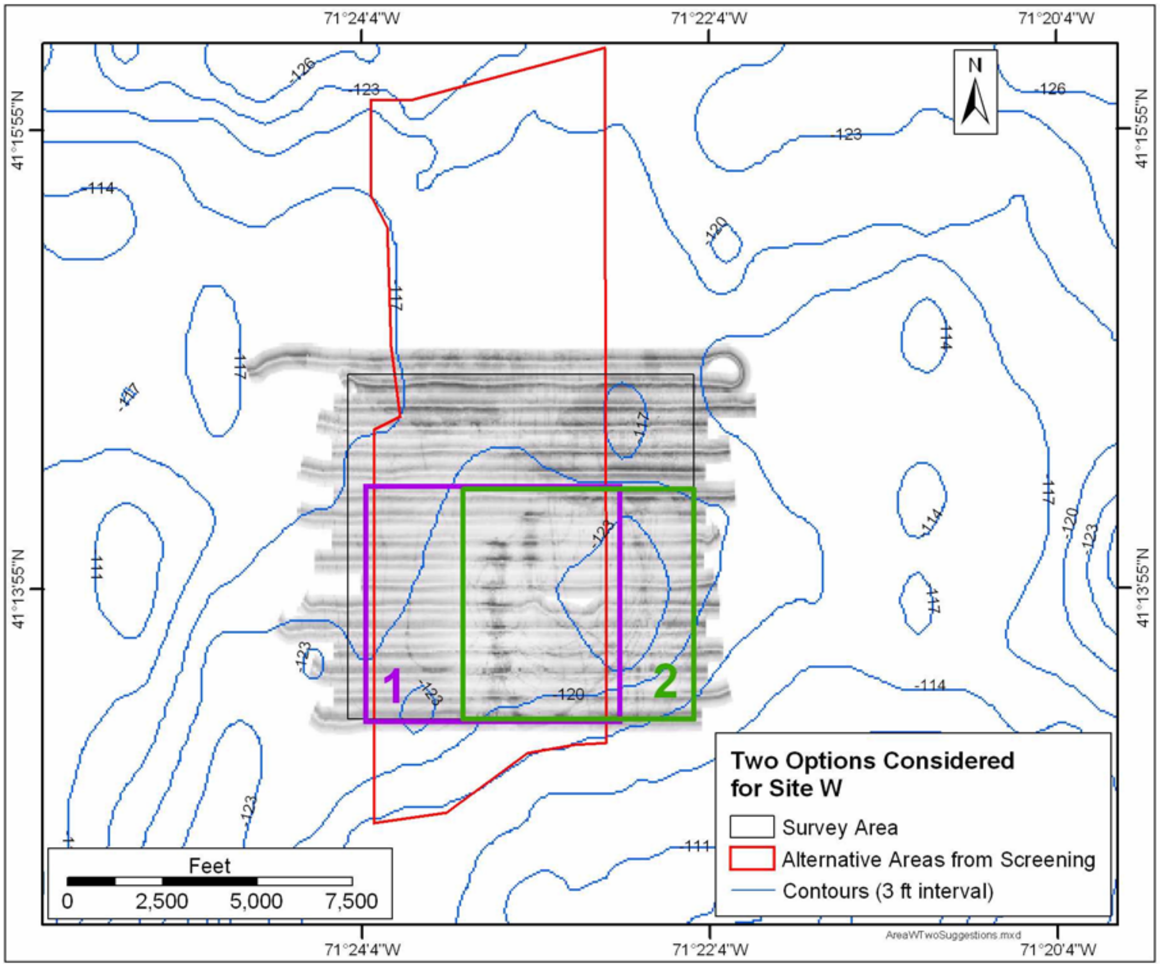


Figure 2-6. Location and Bottom Type of Three Potential Alternative Sites within Area E.

It was determined that the rocky bottom types within the northern portion of Area W should be avoided because they provide suitable habitat for a number of biological resources. Using the results of the summer 2003 field studies, two locations, each covering approximately 1 nmi^2, were considered in the remaining area as potential alternative sites within Area W (Figure 2-7). The western location (Location 1 in Figure 2-7) encompassed an area containing consistently low abundances of finfish, lobster, and ocean quahog and avoided the hard-bottom habitat to the north. It was also within the boundaries of the two navigational channel buffers on either side of the site. However, this site overlapped with an area that is heavily trawled based on the presence of numerous trawls scars in the western portion of this area observed in the field information collected. The site becomes progressively shallower to the west, with approximately half of the site shallower than 120 ft. Therefore, this site was excluded from consideration.



Note: Location 2 corresponds to the currently selected Site 69B.

Figure 2-7. Location and Bottom Type of Two Potential Alternative Sites within Area W.

The eastern location (Location 2 in Figure 2-7) also avoided the hard-bottom high-relief habitat to the north and the finfish trawling area to the west. The ocean quahog resources found within this site were generally low and are consistent with those in the western portion of the site (Corps, 1998; Corps, 2003b). The site was centered on a topographic low with depths ranging from 120 to 130 ft. This site corresponded to an active ocean disposal site (Site 69B) where dredged material disposal is occurring for the Providence River and Harbor Maintenance Dredging Project and nearby areas[2]. Disposal activities started at this site in April 2003. The grey area within Figure 2-7 represents side-scan sonar data depicting bottom types and elevations as of September 2003. The dark areas represent the mounds of dredged material deposited and the lines are the result of the disposal activity.

[2] Note: MPRSA criterion 228.5(e) recommends designating new ocean disposal sites at existing or historic disposal sites where feasible.

This evaluation recommended the eastern location (Location 2) within Area W for further evaluation as an alternative called Site W in this Final EIS. The interagency group reviewed the process for locating this alternative site and concurred with the recommended location of Site W.

2.3 ALTERNATIVES EVALUATED

This section describes the No Action Alternative and the general setting of each alternative site (Site E and Site W) identified by the screening process and evaluated in this Final EIS.

2.3.1 No Action Alternative

NEPA requires that an EIS evaluate the "No Action Alternative" (40 CFR 1502.14[d]). In cases involving Federal decisions on proposals for projects, "no action" means the proposed activity would not take place. Under this Final EIS, the No Action Alternative would be to abstain from designating a permanent ocean site for dredged material disposal within the RIR. Evaluation of the No Action Alternative involves assessing the environmental and socioeconomic effects that would result if the proposed action (i.e., designation of an ocean disposal site) did not take place. These effects are assessed and compared with the impacts of the other alternatives.

2.3.2 Site E

Site E is a 1-nmi square with its center located at 41˚ 15' 36"N and 71˚ 09' 36"W (NAD 83) (Figure 2-8). The site is located 15 nmi southeast from Point Judith, Rhode Island and 17.7 nmi northeast of Block Island, Rhode Island, in water depths from 123 to 135 ft. Site E is located on a gently sloping plane that deepens to the south and east.

The native sediments at the site are predominantly medium to fine sands, with some finer-grained sediments (i.e., silt) along the southeastern boundary (Corps, 2003c). An area of mixed sediment types is present in the northeastern quadrant of the site.

2.3.3 Site W

Site W is a 1-nmi square with its center located at 41˚ 13'51"N and 71˚ 22'49"W (NAD 83) (Figure 2-9). The site is located approximately 9 nmi south of Point Judith and roughly 6.5 nmi due east of Block Island. Site W is located over a topographic depression, where the maximum water depth is about 130 ft. Water depths of the surrounding area are between 113 and 118 ft to the north, east, and south of the surveyed area. The southeastern portion of the site shoals more rapidly than the northern and western areas.

Native surface sediments in and around Site W are predominantly fine and very fine sands, containing varying proportions of finer-grained sediment fractions (i.e., silts and clays) (Corps, 2002c). Sediments in and near the northeast corner of the site have relatively high gravel content, and the area is dominated by sands and hard gravel bottom. Fine to medium sands and gravel are found near the southeast corner of the site, but the bottom type is changing due to active disposal from the Providence River and Harbor Maintenance Dredging Project. The material from the Providence River and Harbor Maintenance Dredging Project is mainly consolidated clay, silt, and fine sands.

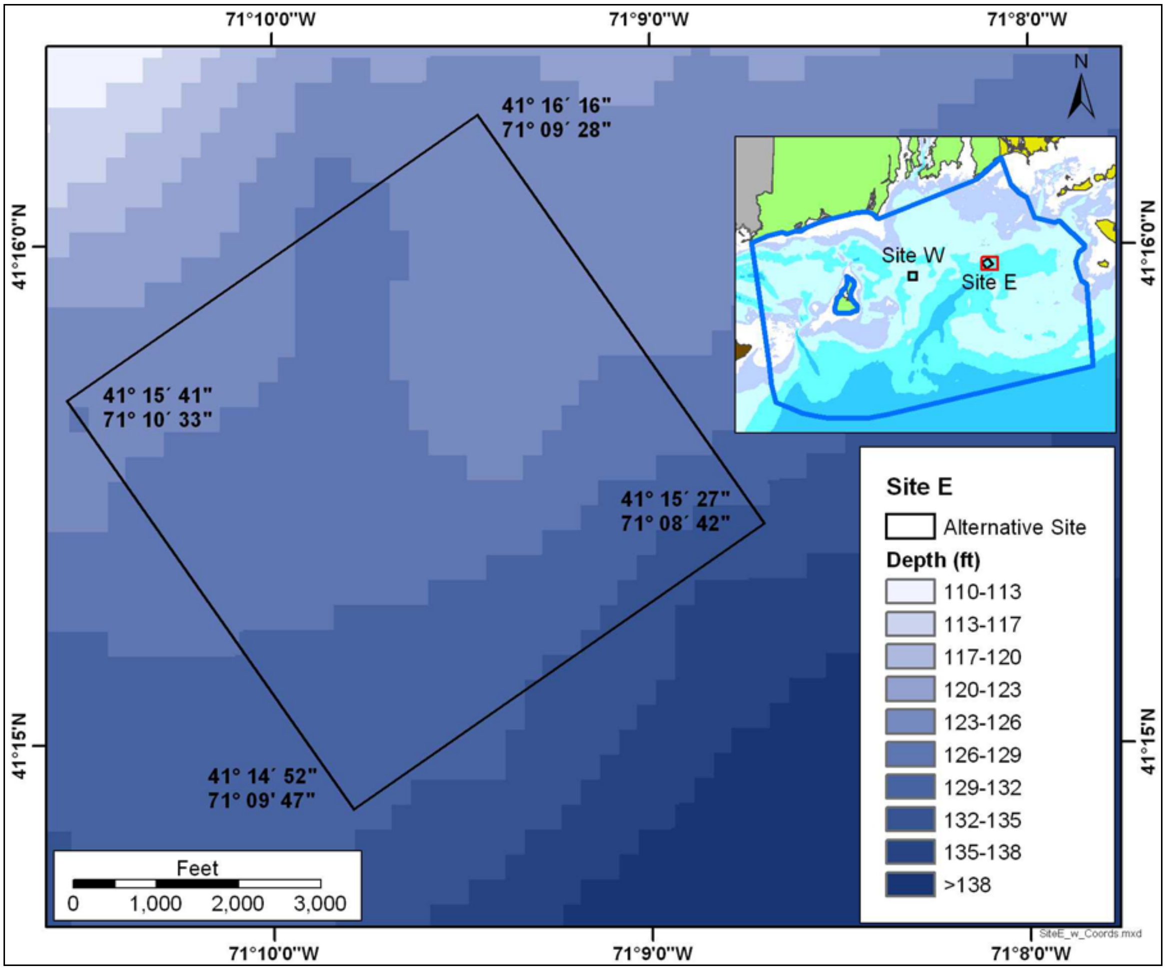


Figure 2-8. Location of Site E.

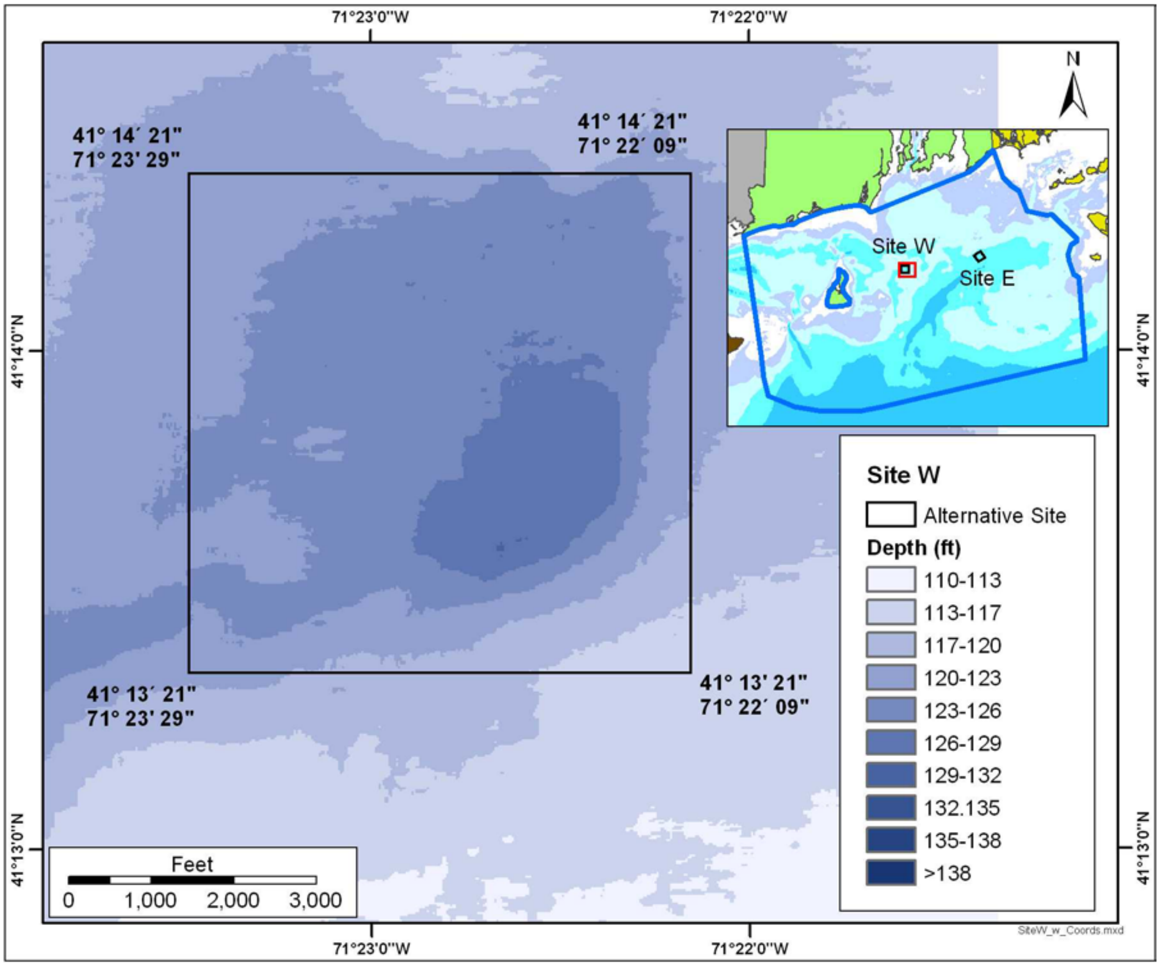


Figure 2-9. Location of Site W.

3.0 AFFECTED ENVIRONMENT

This section describes, both qualitatively and quantitatively, the existing physical, chemical, biological, and socioeconomic environment of the Rhode Island Region (RIR). The baseline information presented in this section is used in Section 4.0, Environmental Consequences, to evaluate the environmental impacts of the disposal alternatives presented in Section 2.0, Alternatives.

The natural resources of the affected environment are described in relation to the zone of siting feasibility (ZSF) (Figure 3-1), the vicinity of the two alternative disposal sites identified by the screening process, and the area in which environmental impacts could occur. The socioeconomic setting, however, extends beyond the ZSF; it encompasses areas within the states of Rhode Island and southeastern Massachusetts that are likely to be economically affected by the designation or lack of designation of a long-term ocean dredged material disposal site.

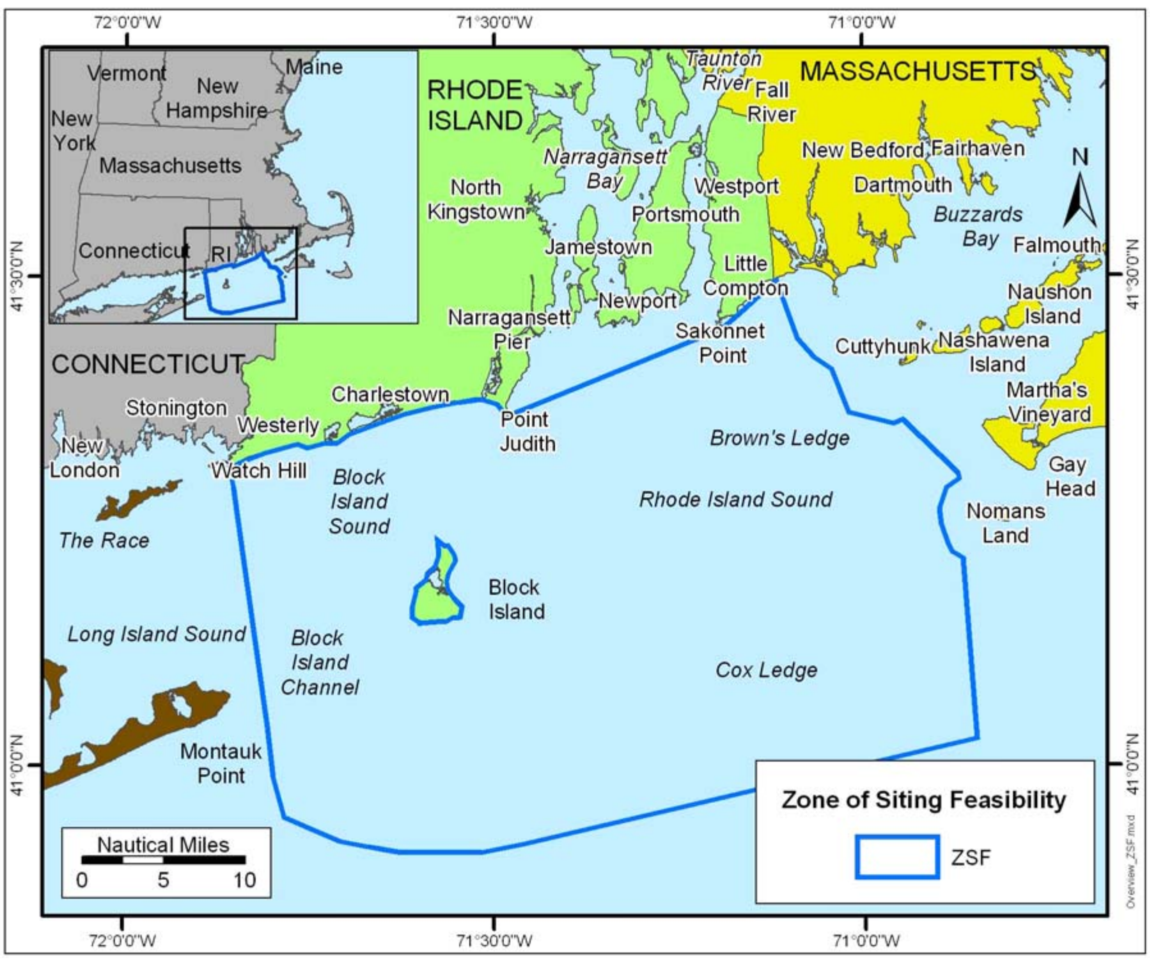


Figure 3-1. General Location of the RIR and the ZSF.

Historical data collected from within the ZSF since the 1970s (Appendix A-1), as well as more recent data collected in support of the Providence River and Harbor Maintenance Dredging Project Environmental Impact Statement (EIS) (Corps, 2001a) and this Final EIS, are used to describe the environmental setting of the RIR.

Sampling in support of this Final EIS was initially conducted on areas in and around the four potential open-water disposal sites identified and evaluated in detail in the Providence River and Harbor Maintenance Dredging Project EIS (Figure 3-2). These locations include:

- Site 16 (Brenton Reef) – a former dredged material disposal site
- Site 18 (Brenton-A)
- Site 69A (Jamestown Bridge Reef)
- Site 69B (Separation Zone Site) – selected dredged material disposal site for the Providence River and Harbor Maintenance Dredging Project

Data collected at these four locations in 2001 and 2002, along with historical data, were utilized in the RIR site screening process (Section 2.2.1) to identify potentially acceptable locations for an ocean dredged material disposal site and are used in this section of the Final EIS to characterize the general environmental setting of the RIR ZSF.

Additional sampling specific to the two alternative areas identified during the RIR site screening process (Figure 3-2) were conducted in 2003. These data are used in this section to characterize the environmental setting of the two alternative sites being evaluated in this Final EIS (Site E and Site W).

3.1 LOCATION OF THE RIR [40 CFR SECTION 228.6(a)(1)]

The RIR is located on the inner continental shelf of the northwest Atlantic Ocean, adjacent to the states of Rhode Island, Massachusetts, Connecticut, and New York (see Figure 3-1). The RIR is the area that is likely to be economically affected by the designation or lack of designation of a long-term dredged material ocean disposal site. The RIR extends from approximately Fairhaven in southeastern Massachusetts westward to the Rhode Island-Connecticut state line.

The boundaries of the ZSF were determined based on an evaluation of the present and future dredging needs in the RIR (Corps, 2002a), combined with a number of factors such as the economics and logistics of dredged material transport (Corps, 2002b). The northern boundary of the ZSF was set at the Territorial Sea Baseline Limits of Rhode Island (see Figure 3-1). The western limit is based on the southerly projection of the state line between Rhode Island and Connecticut and excludes the Long Island Sound region. Dredged material needs and disposal locations for Long Island Sound are currently being evaluated and will be the subject of forthcoming U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (Corps) evaluations. The southern boundary is based on a travel distance of approximately 20 nautical miles (nmi) from the southernmost dredging location on Block Island. This distance is considered feasible under the Marine Protection, Research, and Sanctuaries Act of 1972

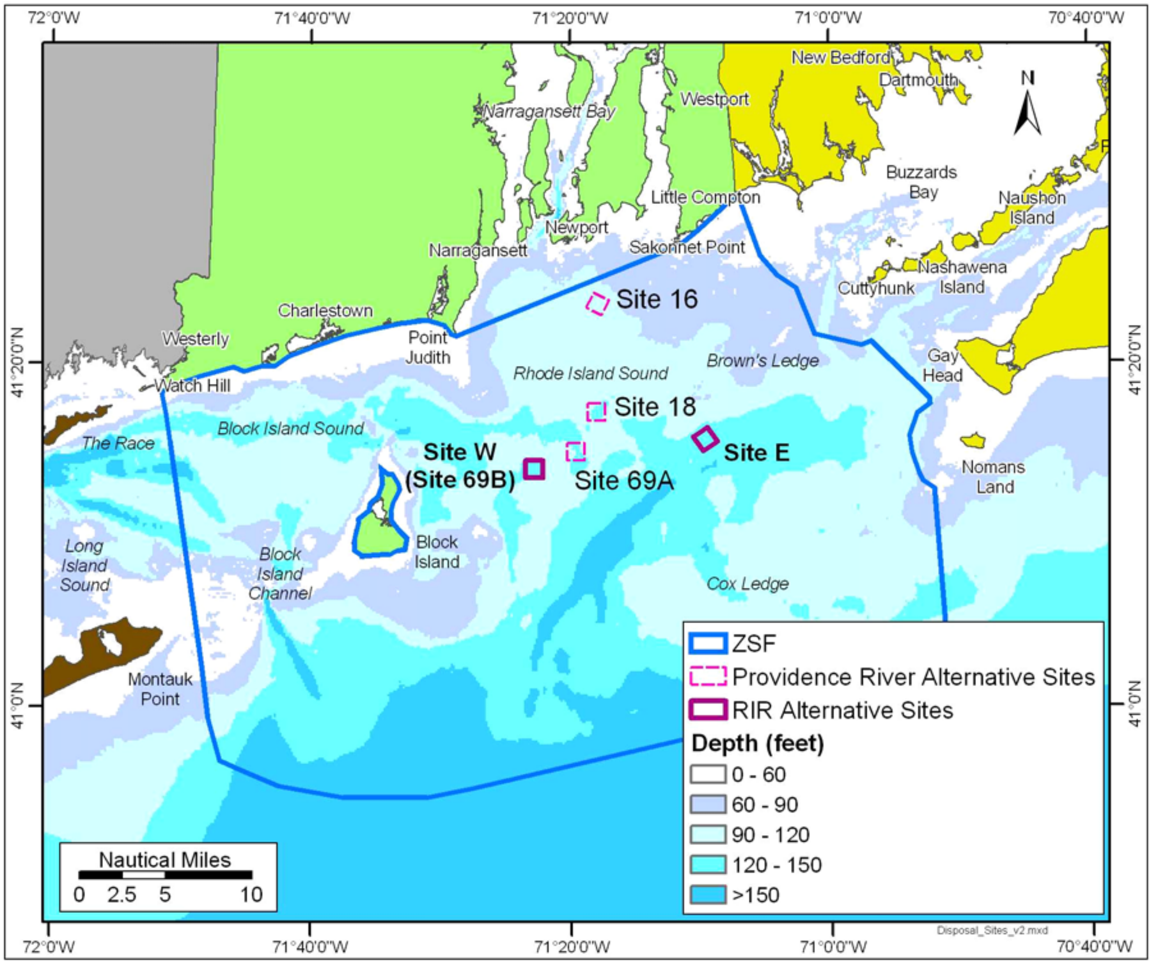


Figure 3-2. Open-Water Alternative Sites Previously Evaluated in the Providence River and Harbor Maintenance Dredging Project EIS and Currently Evaluated in the RIR EIS.

(MPRSA) criteria and is a reasonable transport distance within an 8-hour workday considering costs, safety, practicality, and efficiency. The eastern boundary of the ZSF extends south from the Rhode Island/Massachusetts state line to a point where it intersects the 3-mile territorial limit of Massachusetts west of the Naushon and Nashawena Islands. The eastern limit then follows the 3-mile territorial sea limit to a point south of Nomans Land, and then extends south approximately 17.4 nmi until it intersects the seaward boundary of the ZSF. The ZSF encompasses Rhode Island Sound, Block Island Sound, and the area of the continental shelf south to a distance of 30 nmi from the mouth of Narragansett Bay (see Figure 3-1).

3.2 GEOLOGICAL SETTING [40 CFR SECTION 228.6(a)(1)]

3.2.1 Rhode Island Region ZSF

The ZSF encompasses Rhode Island Sound, Block Island Sound, and the area of the continental shelf south out to a distance of 30 nmi from the mouth of Narragansett Bay (Figure 3-1). Rhode

Island Sound is generally considered the body of water bounded by Narragansett Bay on the north, Buzzards Bay and Vineyard Sound on the east, Block Island Sound on the west, and on the south, by a line connecting Martha's Vineyard to Block Island. While partly protected from storm winds and waves from the east and west by Martha's Vineyard and Block Island, it is otherwise exposed to harsh weather in the northwest Atlantic Ocean from the south, and represents largely an open continental shelf environment. Block Island Sound, on the other hand, is relatively protected from storm forces by Block Island and the northeasternmost point of Long Island (Orient Point). Block Island Sound is the water mass that provides the eastern approach to Long Island Sound through the Race, a narrow strait that connects the two bodies of water. It is bounded on the west by a chain of islands that stretches between Watch Hill, Rhode Island, and Orient Point, Long Island, New York. While the Sound is protected from storm waves by the presence of Block Island and Orient Point, it experiences strong tidal currents that flow in and out of Long Island Sound.

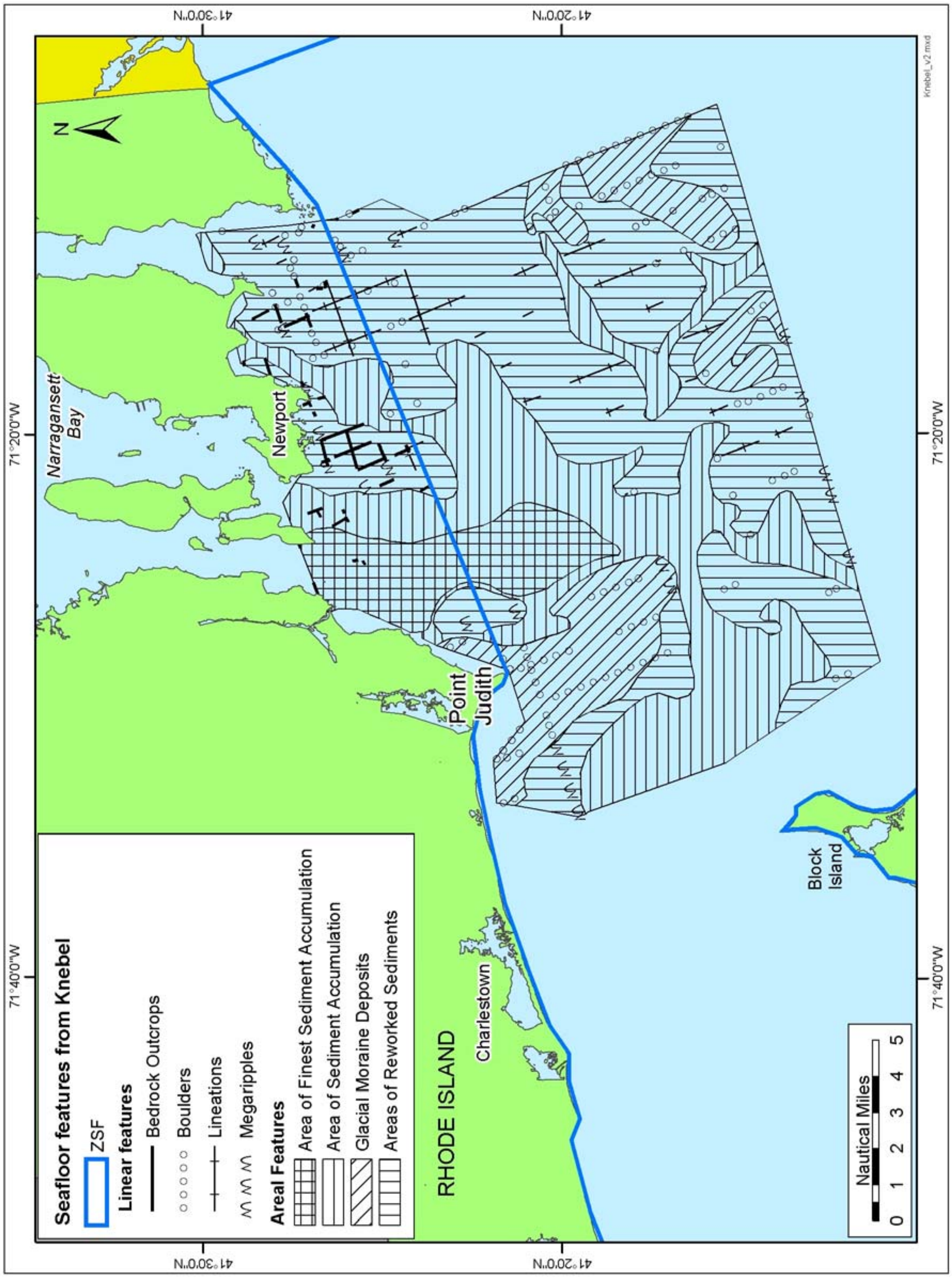
General Bathymetry

The bathymetry (depth) of the ZSF is shown in Figure 2-1. Depths in the ZSF range to approximately 200 feet (ft). The bottom topography in Rhode Island Sound has been shaped by glacial action and is characterized by irregular and discontinuous ridges, knolls, and depressions. Deep, linear depressions in the seafloor are found southeast and southwest of Block Island. A discontinuous ridge trends southeast from Point Judith for about 6 nmi, then trends east and northeast into an area of hummocky relief (Knebel *et al.*, 1982). This ridge is a deposit of material left by a glacial ice sheet (i.e., morainal deposit) during the Pleistocene (McMaster, 1960). Similarly, a bathymetric ridge (high) is located between Block Island and Montauk Point, New York. It was cut by a river channel that was submerged by rising sea level at the end of the most recent glacial retreat.

Sedimentary Environments

Sedimentary environments in the ZSF have been inferred based on grain size analysis of surface sediment samples and collection of geophysical data (Savard, 1966; Danbom, 1975; Knebel *et al.*, 1982). Knebel *et al.* (1982) identified four types of sedimentary environments in the area south of Narragansett Bay and northeast of Block Island (Figure 3-3):

- Physical reworking of sediments is represented by tonal patches and lineations found as broad areas of sand with scattered and intermingled deposits of gravel. Changes in texture on this sand sheet environment indicated that the sand and gravel are continually reworked and sorted by hydrodynamic forces. Additional areas where physical reworking of the seafloor is found are located in the northeast part of Rhode Island Sound and are characterized by bedrock with no evidence of sedimentary cover. These areas represent either erosion or non-deposition of sediment environments.
- Sand, gravel, and boulders found on top of the glacial moraine that trends southeast from Point Judith appeared to be lag deposits from marine erosion as sea level rose over the moraine and winnowed away the finer-grained material.
- Featureless patterns indicating sediment accumulation (deposition) are scattered throughout the Rhode Island Sound area.



Source: Knebel *et al*., 1982

Figure 3-3. Sedimentary Environments in Rhode Island Sound.

- The finest (siltiest) sediment material is found accumulated south of Narragansett Bay in an apparent depositional area. This accumulation of silt appears to represent recent deposition of fine-grained sediment transported out of the bay (McMaster, 1960).

Danbom (1975) mapped the grain size distribution in a portion of eastern Block Island Sound based on seismic reflectivity. This area was primarily underlain by sand of various types, with an overburden deposit of silt found northwest of Block Island. These sands appear to represent reworked glacial and post-glacial deposits (Savard, 1966). A more detailed discussion of the sedimentary environment is contained in Section 3.5, Sediment Characteristics.

Modeling results of the erosional/depositional processes at work in the ZSF (described in detail in Section 3.6) suggest that portions of Rhode Island Sound, which are exposed to wind and waves from the south, may not be depositional at depths less than 120 ft (36 meters [m]). This is generally consistent with grain size characterization and analysis.

3.2.2 Site E

A geophysical survey was performed between July 16 and July 30, 2003 to provide a broad-scale physical characterization of two areas of the seafloor, including Sites E and W and areas contiguous to those sites (Corps, 2003a). The survey included side-scan sonar recordings of the seafloor. Sediment grab samples were used to identify bottom sediment grain size and type and to assist in mapping areas of different sediment composition evident in the side-scan results. Bathymetric measurements were also made to develop accurate bathymetric maps of the areas.

Bathymetry

Site E is located 15 nmi west-southwest of Gay Head, in the northeast portion of the large topographic depression that runs northeast to southwest through the central portion of Rhode Island Sound (Figure 2-8). The bathymetry of Site E depicts a gradually sloping bottom from northwest toward the southeast falling away from a bathymetric ridge present just to the north of the site. Water depths in Site E range from 125 ft along the northwest boundary to 133 ft along the southeast. The bottom slope is fairly uniform except for a very slight depression (just 3 to 4 ft) present in the north-central portion of the site.

Sedimentary Environments

A mosaic of side-scan sonar images from the July 2003 survey is presented in Figure 3-4. Those images, along with grab samples from the area (Figure 3-5), determined that Site E is made up of somewhat variable sediment types, including coarse sand, medium sand, and silty-sand with occasional pebbles, gravel, rocks, and shells. The data also indicate that small-scale patchiness in sediment type is present in some areas. For instance, two grab samples taken in close proximity to each other just outside the northeast boundary of the site had very different sediment types (till and gravel in one and medium sand in the other). Grab samples collected in the south-central part of the site found silty-sand, suggesting a low-energy near-bottom regime (i.e., little erosion). Sand waves, which generally indicate a very energetic bottom environment, were observed in the side-scan images in the eastern corner of Site E. The side-scan images suggest that the finest bottom material is to be found in the south-central and southwest portions of the site, but no grab samples were collected in that area. In general, most of the shallower

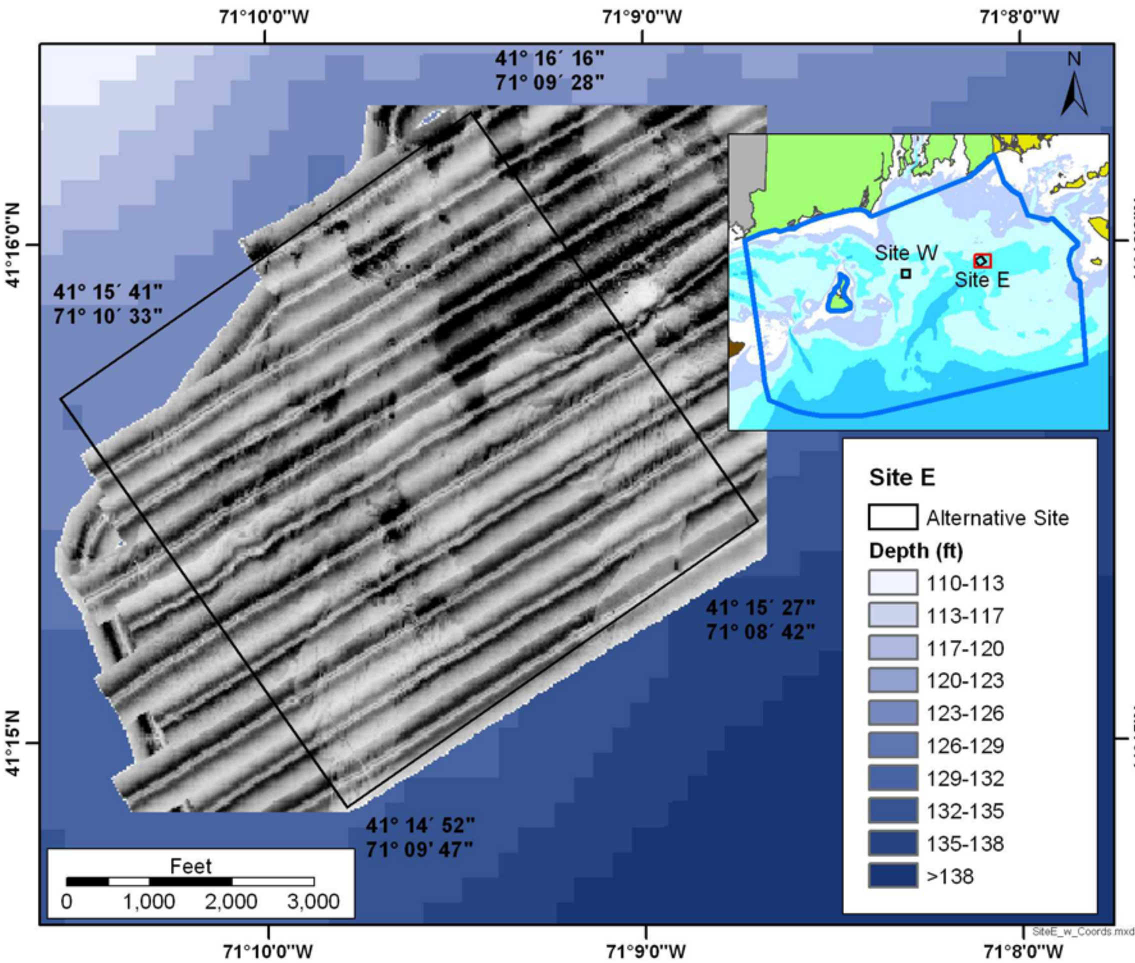
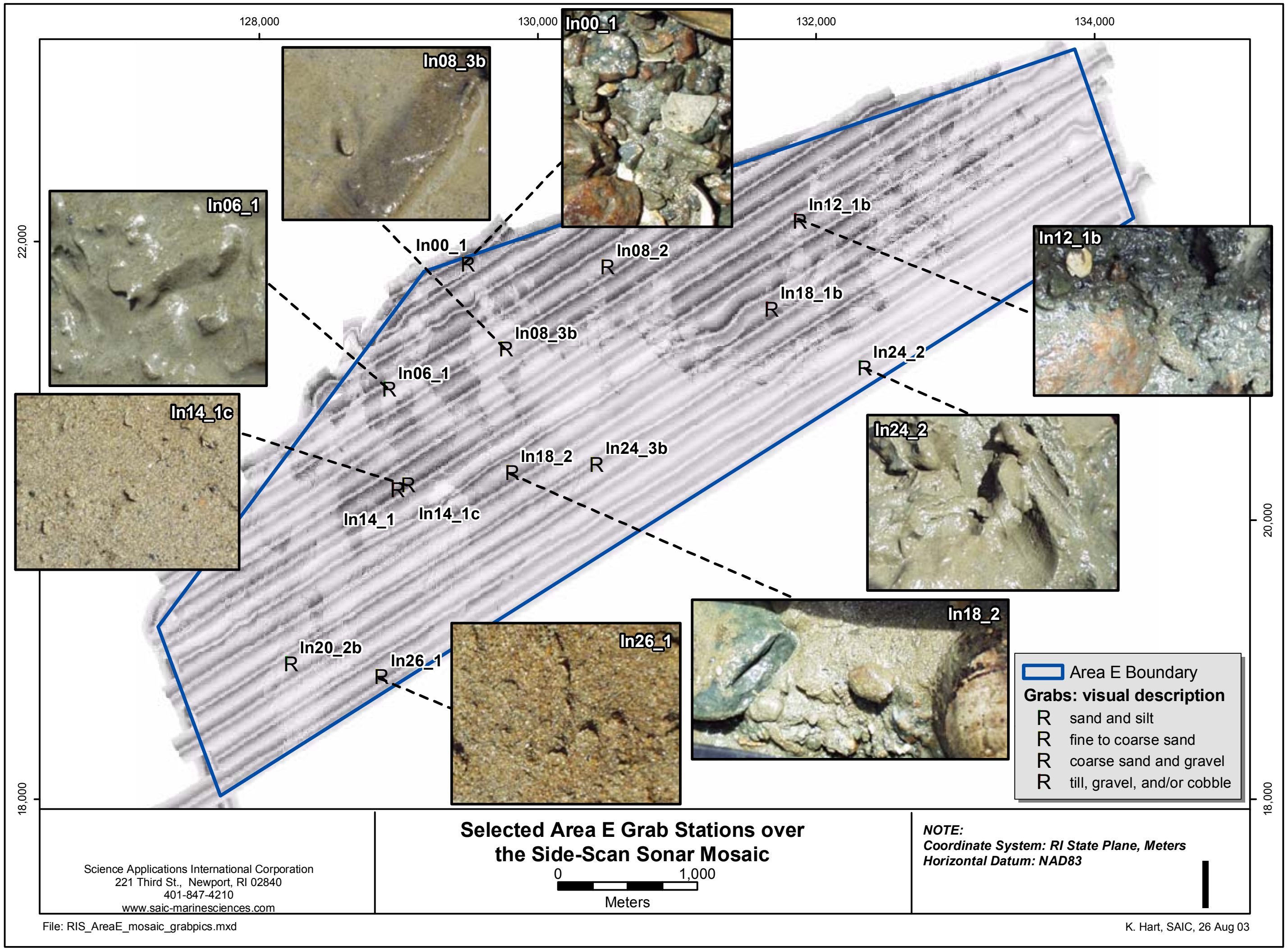


Figure 3-4. Side-Scan Sonar Mosaic Image of Site E Developed from Side-Scan Data Acquired in July 2003.

water depths in Site E corresponded to coarser-grained, glacial-deposit sediment. Similarly, the deeper areas corresponded well with the lower-reflectance, softer sediment identified in the side-scan sonar mosaic as darker in color and depositional in character.



Source: Corps, 2003a

Figure 3-5. Photos of Selected Grab Sample Stations Shown Over Side-Scan Sonar Mosaic Image of Area E.

3.2.3 Site W

Bathymetry

Site W is located on the northern tip of a topographic depression, roughly 7.5 nmi due east of Block Island (see Figure 2-9). The bathymetry of Site W and the surrounding area is presented in Figure 2-9. Site W encompasses a topographic depression with water depths around the boundary of the site generally around 120 ft and depths within the depression roughly 130 ft. The depression is centered about the southeast-central portion of Site W. The water depth in Site W ranges from a minimum of 116 ft in the southeast corner to a maximum of 132 ft in the depression. The site is currently receiving dredged material from the Providence River and Harbor Maintenance Dredging Project. Dredged material from that project has decreased the depth in the western portion of the site to approximately 112 ft along a roughly north-south ridge, as of May 2004. This has been done in an effort to create an artificial containment cell by augmenting the natural relief around the topographic depression. Changes in bathymetry within the site are expected until completion of the Providence River dredging project.

Sedimentary Environments

Side-scan and bathymetry data were collected in Site W as part of the July 2003 geophysical survey described in Section 3.2.2 (Figure 3-6) and again in September 2003 (Corps, 2004a). Multi-beam imagery (high-resolution bathymetry) was also collected over the site and the surrounding area by the Corps in February 2003 and September 2003. Underwater video and sediment-profile imaging were also performed in October 2003 (Corps, 2004a). These data indicate that the seafloor within Site W is made of sediments of various types ranging from glacially derived cobbles to soft silty-sand. The sediments along the northern and eastern boundaries and in the southeast corner tend to be a mixture of fine sands; the northern area has some hard-bottom areas interspersed with this sediment type. These latter areas correspond to shallower depths. Very fine sand with ripples was observed at the southernmost stations within the site. The rippled sand corresponds to shallower depths and higher near-bottom energy regimes, which are less than the 120-ft depth contour. In the central portion of the site (the deeper areas), the sediments tend toward an unconsolidated soft bottom of very fine sand mixed with silt-clay, suggesting a depositional environment in the hollow. Sediment profile imaging data suggest that recent dredged material deposits (silty sand mottled with white clay) are widespread over the southeast central portions of Site W (Corps, 2004a). Outside of Site W, the sediments consist of coarse-grained glacial sediment made up of gravel and coarse sand to the north (shallower depths) and less consolidated sediment (sand and silt) to the southwest (deeper depths). Trawl scar marks were also evident in the softer seafloor areas within Site W and to the west of Site W in both 1999 and 2003 data.

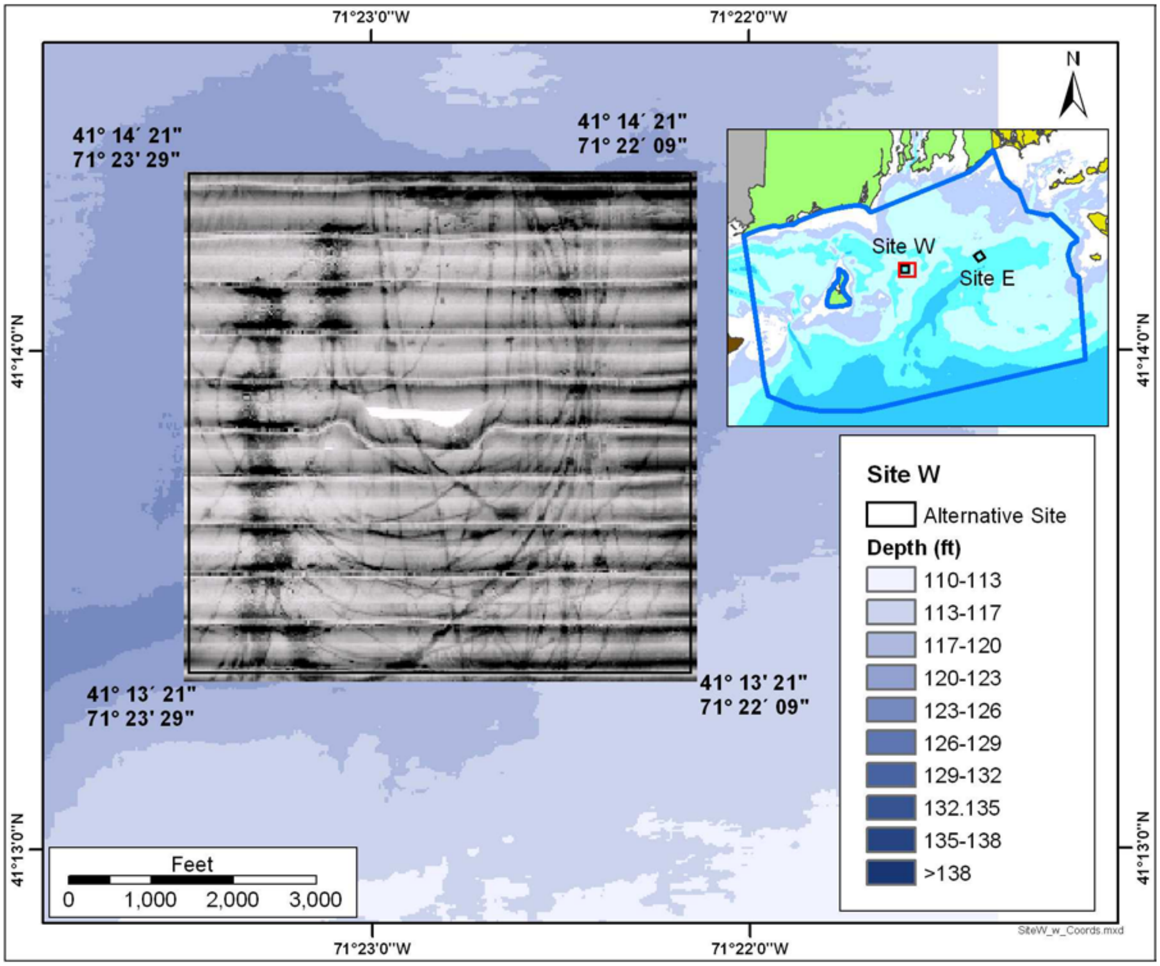


Figure 3-6. Side-Scan Sonar Mosaic Image of Site W Developed from Side-Scan Data Acquired in July 2003.

3.3 METEOROLOGY [40 CFR SECTION 228.6(a)(6)]

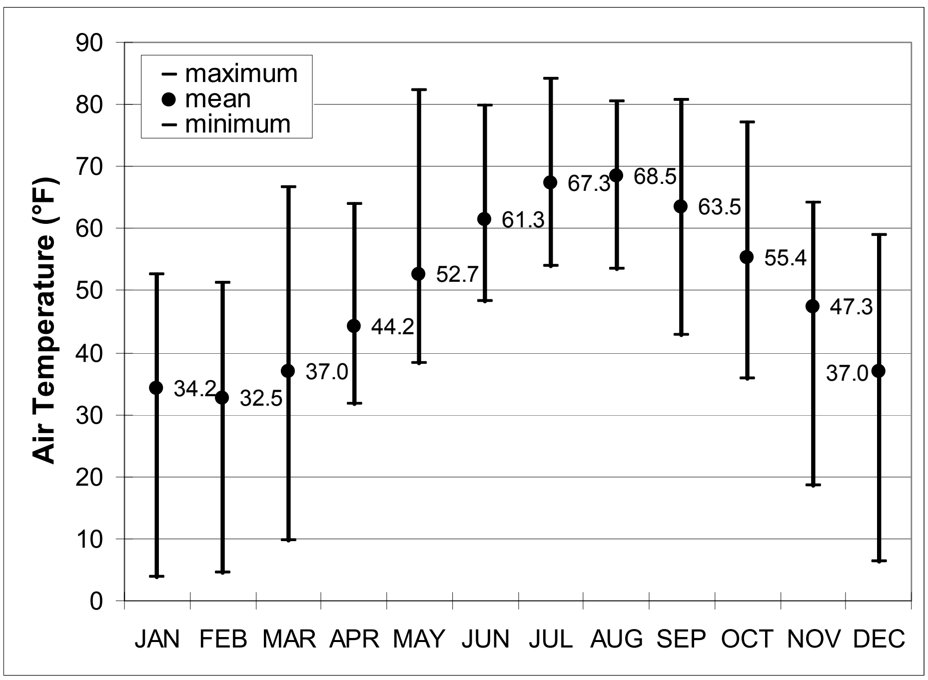
The atmosphere and ocean are a coupled system. Winds affect the circulation of the ocean and create waves; air temperature and cloud cover (solar radiation) control ocean warming and cooling; and rainfall (runoff) influences ocean salinity. Therefore, to better understand the marine processes at work, the climatology of the area, drawn from long-term historical records, is examined in this section.[1]

3.3.1 Rhode Island Region ZSF

Meteorological data and climatological statistics used to evaluate conditions in Rhode Island Sound and Block Island Sound were obtained from the National Oceanic and Atmospheric

[1] Climatology is the branch of meteorology that deals with long-term statistics (mean values, variances, probabilities of extreme values, etc.) of meteorological parameters in a given region.

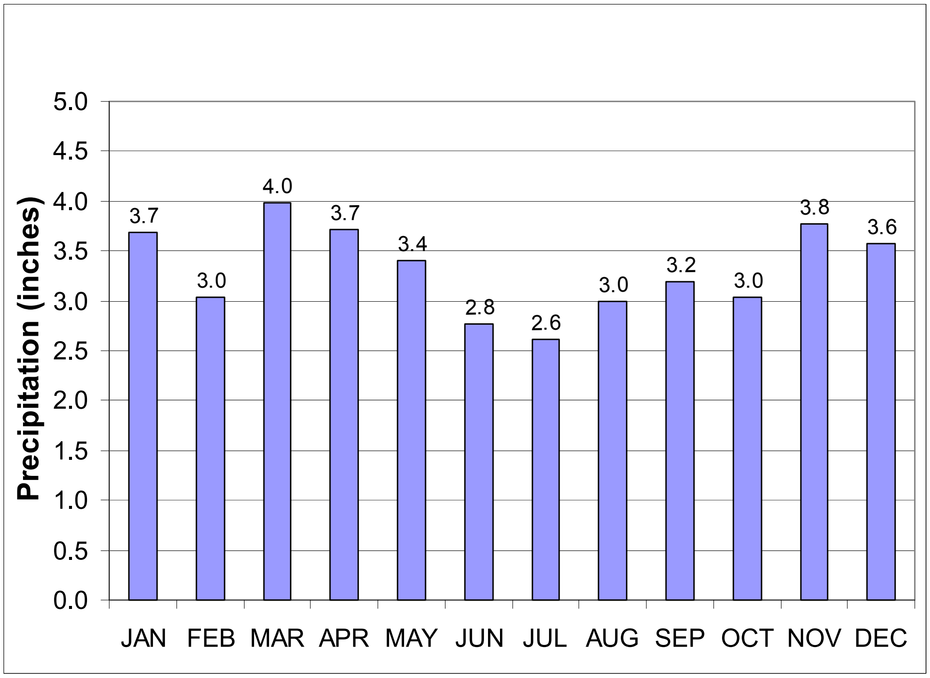
Administration (NOAA) (http://www.ndbc.noaa.gov/). The coastal maritime weather of the ZSF (including Rhode Island Sound and Block Island Sound) is characterized by a climate of extremes, typical of the northeast United States, with hot summers and cold, stormy winters. Offshore air temperatures measured at the Buzzards Bay Tower, located on the eastern edge of the ZSF, range from a mean monthly low temperature that occurs in February of 32.5 °F (degrees Fahrenheit) to a high that occurs in August of 68.5 °F (Figure 3-7); extremes in hourly measurements range from 3 °F to 84 °F. Weather conditions are more variable in the fall and winter, when storms produce strong winds and high seas. Weather conditions are generally more stable (less energetic) in the summer. In summer, the predominant winds blow from the southwest and are usually light, except for tropical storms and hurricanes, which normally occur in this area in August, September, or October. In winter, the predominant winds blow from the northwest.



Source: National Data Buoy Center (NDBC).
Note: Air temperature measured at 80 ft above mean sea level.

Figure 3-7. Mean Monthly Air Temperature (1985-1993) Recorded at the Buzzards Bay Tower C-MAN Station (41.40 ºN 71.03 ºW).

The area experiences considerable rainfall throughout the year, with a slight seasonal low in the summer months (Figure 3-8). Mean monthly precipitation ranges from about 2.6 to 4 inches. A relatively small quantity of freshwater runoff enters Narragansett Bay and Rhode Island Sound from the Providence and Taunton Rivers. However, freshwater runoff from the Connecticut (average discharge of 20,000 cubic feet per second [ft^3/s]), Thames, and Housatonic Rivers (total average discharge of 4,600 ft^3/s) makes its way, after considerable mixing in Long Island Sound, through the Race into Block Island Sound. This significant influx of freshwater affects the salinity distribution of Block Island Sound and the ZSF. It is estimated that the total annual



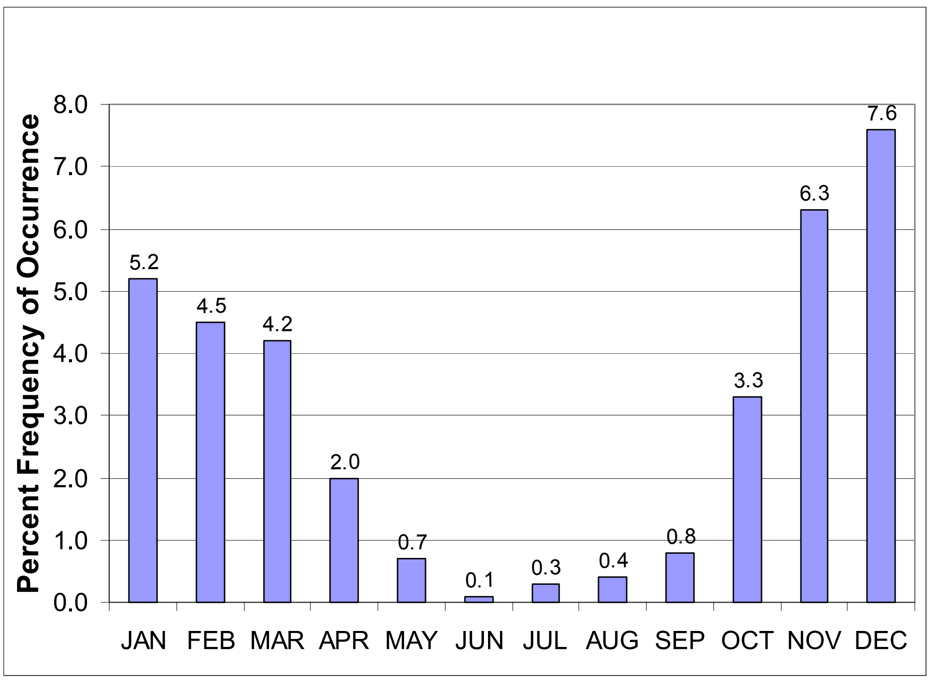
Source: National Weather Service.

Figure 3-8. Mean Monthly Precipitation (1971-2000) Measured at Block Island.

discharge of these three Connecticut rivers displaces a volume of water equal to one-third to one-half of the total volume of Block Island Sound. This freshwater is quickly dispersed by active circulation in Block Island Sound and into the adjacent water of Rhode Island Sound and the Atlantic Ocean. The discharge of the rivers that enter Long Island Sound peaks in April, with a mean flow of 45,000 ft^3/s, and is lowest in July, when the mean flow is only 7,100 ft^3/s. The mean monthly flow of these rivers may vary by as much as a factor of 10 from year to year.

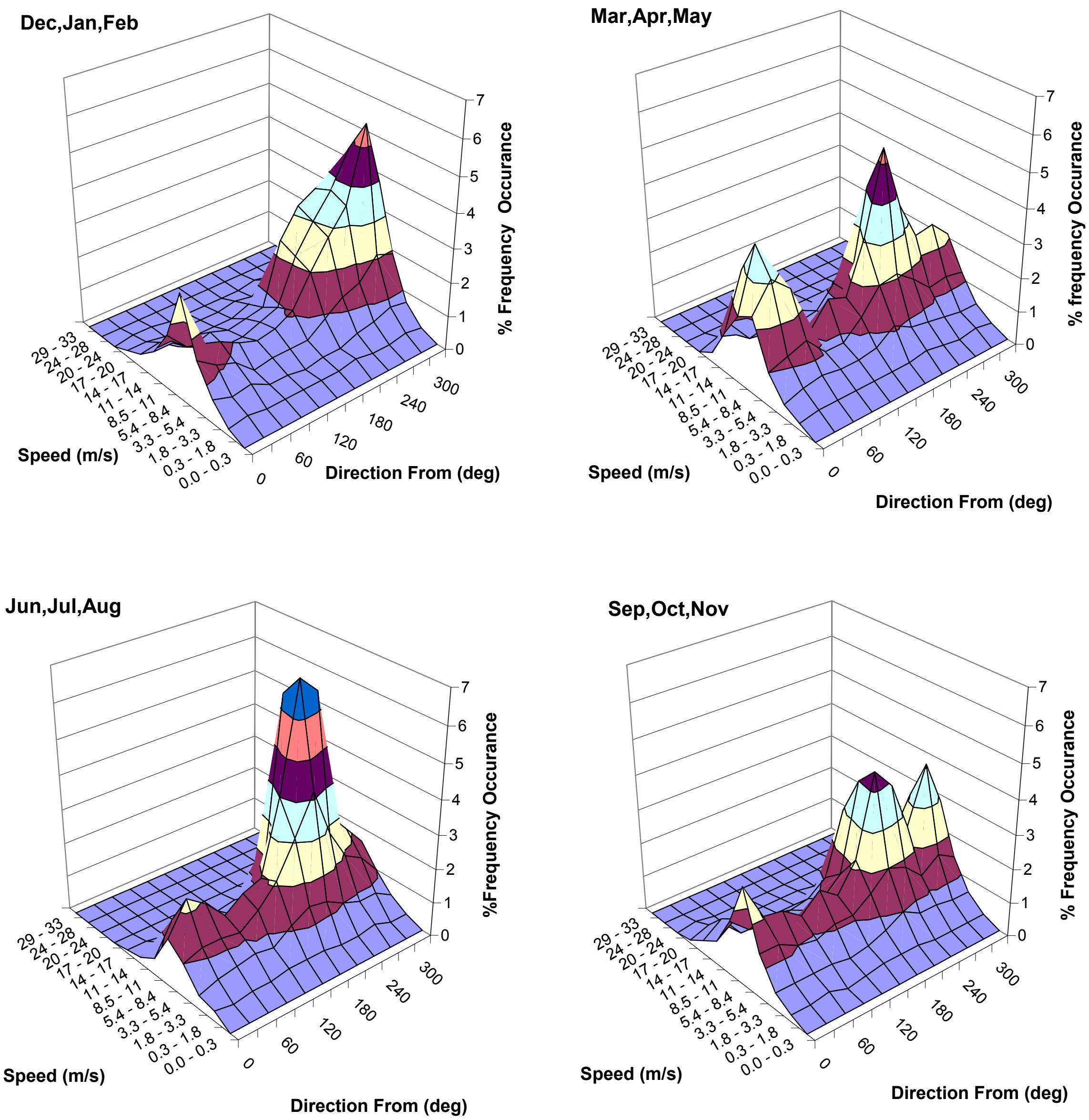
Winds in the area of Rhode Island Sound and Block Island Sound are an important influence on the ZSF environment, as they generate surface waves and affect water column mixing and currents in the area. Storm winds in the fall help to break down the water column thermal stratification, which results from solar heating during the summer months. Wind observations from the National Weather Service show that during winter, wind speeds average 16 to 17 knots over the open water. This can be twice that found on the coast. Seas of 10 ft or greater are likely 5 percent to 7 percent of the time in winter. While the average current flow over the continental shelf is toward the southwest at about 5 centimeters per second (cm/s) near the surface (Mayer *et al.*, 1979), energetic wind-driven transient current events, primarily during the winter months, significantly alter the mean flow pattern. Beardsley and Boicourt (1981) showed that fluctuations in current speed and direction caused by storm systems were occasionally sustained at a range of 40 to 50cm/s.

The National Data Buoy Center (NDBC) of NOAA maintains offshore meteorological buoys and platforms throughout coastal and offshore waters of the United States. The NDBC has maintained a meteorology and wave station on the Buzzards Bay Tower (outside the entrance to Buzzards Bay at 41.40°N 71.03°W) since 1985. Data from the station are presented for the period July 1985 through December 1993 in Figure 3-9 and Figure 3-10. Figure 3-9 shows the frequency with which winds greater than 30 knots occur during each month of the year. Wind speeds exceed 30 knots more than 5 percent of the time in November, December, and January, with the peak in December when wind speeds exceed 30 knots 7 percent of the time. Figure 3-10 presents four charts, one for each season of the year, in which the frequency of occurrence of winds at different speeds and directions are presented. Figure 3-10 shows that during winter, the predominant wind direction was out of the northwest, but winds from the southwest and northeast (nor'easters) were not uncommon. During March and April, winds are more southerly but can still be strong; March winds exceed 30 knots over 4 percent of the time. The summer chart in Figure 3-10 shows that during these months, winds from the southwest predominate.



Source: NDBC
Note: Wind measured at 81 ft above mean sea level.

Figure 3-9. Wind Speed Exceeding 30 Knots (1985-1993) Recorded at the Buzzards Bay Tower C-MAN Station (41.40 ºN 71.03 ºW).



Source: NDBC Data (1985 – 1993)
Note: Wind measured at 81 ft above mean sea level. Contours represent percent frequency of occurrence of wind speed (knots) and direction (from).

Figure 3-10. Average Wind Speed and Direction (by Season) Recorded at the Buzzards Bay Tower C-MAN Station (41.40 ºN 71.03 ºW).

3.3.2 Alternative Sites

No studies have been conducted at either alternative site to directly measure meteorological conditions; however, the climatology for the region is well understood. The marine climate across the open waters of the ZSF, and indeed across the open water of all of southern New England, is very consistent, as seen in the long-term record of meteorological parameters for the region. Given the broad-scale nature of storms, winds, rainfall, and cloud cover, the climatology at each alternative site can be assumed to be similar to that described for the open waters of the ZSF in general.

3.4 PHYSICAL OCEANOGRAPHY [40 CFR SECTIONS 228.6(a)(1) AND 228.6(a)(6)]

The transport, dispersion, and eventual fate of dredged material released into the marine environment depend upon both the physical characteristics of the dredged material and the structure and dynamics of the water column. Ocean currents directly affect the transport and dispersion of dredged material. Waves can resuspend bottom sediments and dredged material particles previously deposited on the seafloor. The density structure of the receiving water, relative to the density of the released dredged material, influences the length of time the dredged material remains in the water column. This section describes the physical oceanography (currents, waves, and density structure) of the ZSF and of Sites E and W.

Both alternative sites are located in the larger water mass of Rhode Island Sound and are influenced by the circulation patterns of the Atlantic Ocean. The characteristics of most of the physical oceanography parameters at each site are common to most of the area within the Sound. Some site-specific information was collected to verify this assumption. Both the general characterization and the site-specific information are presented in the following discussions.

3.4.1 Rhode Island Region ZSF

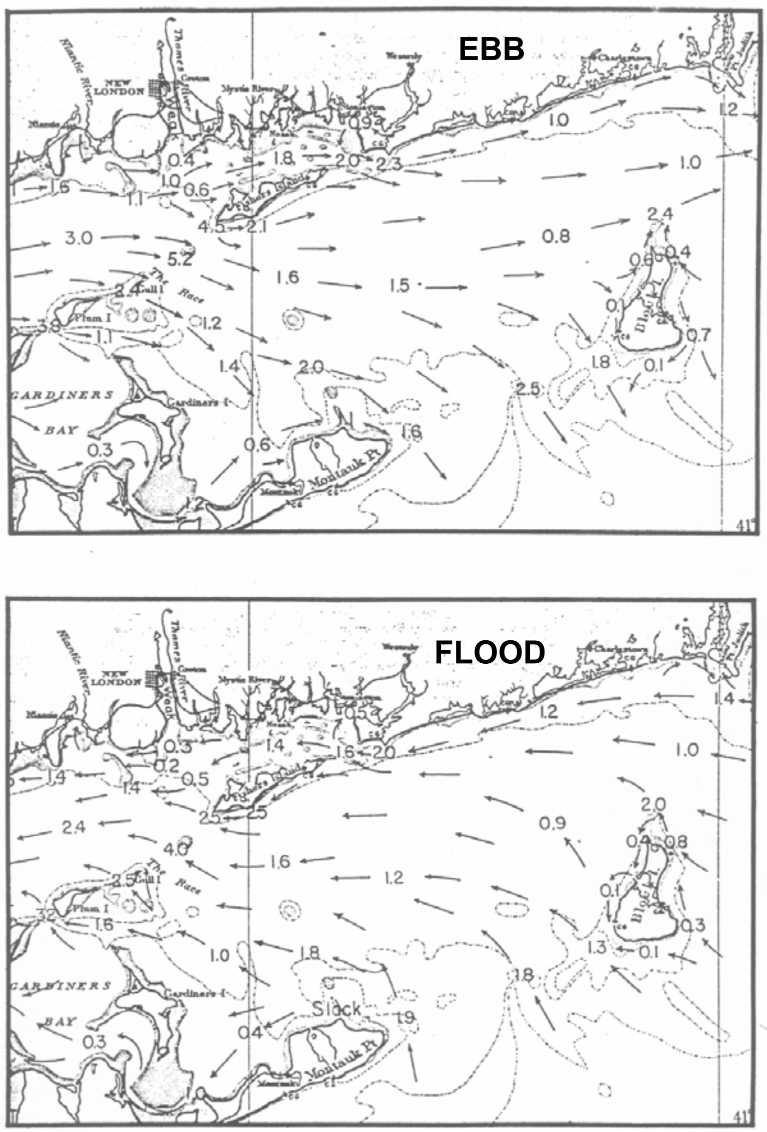
Currents

Circulation in Rhode Island and Block Island Sounds results largely from three influences, each working on different time scales: (1) a weak mean current, or mean drift, to the southwest (on the order of 5 cm/s); (2) occasional storm wind-driven currents, stronger in winter, with a time scale of 5 to 7 days (on the order of 25 cm/s); and (3) 12-hour tidal currents (ranging from 20 cm/s to 250 cm/s, depending on the location). These different processes produce the regional current structure, which is dominated by tides close to shore, but with more variability over a wider area of the RIR due to storm-driven currents in the deeper open waters.

Tides are dominated by a semi-diurnal lunar tidal component. Maximum surface tidal current speeds approach 250 cm/s in the Race, a narrow channel on the eastern end of Long Island Sound that connects Long Island Sound to Block Island Sound (Figure 3-11). These are some of the highest tidal currents on the east coast of the United States. The tidal flows decrease eastward from the Race, to about 125 cm/s in Block Island Channel and about 70 cm/s between Block Island and Point Judith. Ebb currents are generally stronger than flood currents in Block Island Sound. Maximum surface tidal currents throughout Rhode Island Sound are less than 50 cm/s, usually ranging between 25 and 50 cm/s.

Block Island Sound: Block Island Sound exhibits characteristics of an estuary, with weak mean eastward surface flow and weak westward bottom flow. This reflects the drift of surface waters out of and bottom water into Long Island Sound, which is driven by the estuarine circulation of Long Island Sound. The residual eastward flow at the surface, out of Long Island Sound into

Block Island Sound, has been measured at 6 cm/s. Riley (1948) and Hicks (1959) observed southwesterly drift of water along the coast in Rhode Island Sound, which enters Block Island Sound and passes out to the Atlantic Ocean through Block Island Channel. Beardsley and Boicourt (1981) showed that the mean current flows were southwestward along depth contours at an average rate of 6 to 8 cm/s at a series of stations south of the ZSF. The mean southwest drift of continental shelf water contributes to the exchange of water between Block Island Sound and the Atlantic Ocean. However, the mean southwest drift is small relative to the tidal current at any given point. The magnitude of currents generated by wind events occasionally rivals the tidal current in the central portion of Block Island Sound and again contributes to the net flow of water into and out of Block Island Sound.

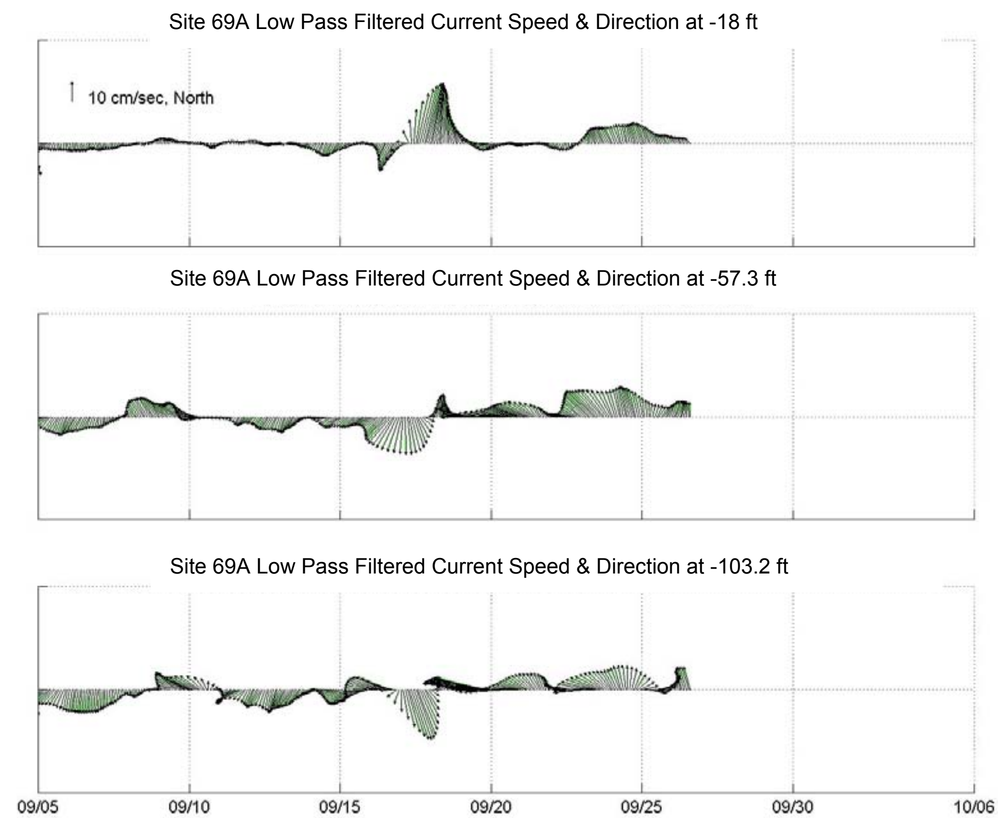


Source: NOAA Tidal Current Chart.

Figure 3-11. Maximum Ebb and Flood Tide Currents (Knots) Throughout Block Island Sound.

Rhode Island Sound: Rhode Island Sound and the outer portion of the ZSF experience much weaker tidal currents than Block Island Sound, with surface currents generally between 25 and 50 cm/s. The long-term mean (or net) southwest drift can also be seen here.

Superimposed on the regular ebb and flood motions of the tides and the weak southwest mean drift are fluctuations in current speed and direction caused by storm events. Wind-driven flows can be most important to the sediment transport climate, as the majority of sediment transport occurs during storms when wind stress is highest and wave heights are their largest. Beardsley and Boicourt (1981) documented that the mean southwestward circulation on the continental shelf throughout the New York Bight is dramatically altered by weather events. Southwestward flow is greatly enhanced by winter storms, when winds are from the northeast. They reported (1981) that strong winter storms could produce along-coast currents from 20 to 50 cm/s in the mid-shelf region. This is consistent with short-term current measurements made at three stations in Rhode Island Sound in September 1999 during Hurricane Floyd. Non-tidal current velocities recorded at Site 69A reached 20 to 30 cm/s during the passage of the hurricane, with surface currents directed onshore and bottom currents directed offshore (Figure 3-12). Hurricane Floyd's winds were strong but of short duration. Longer wind stress events, such as nor'easters, tend to generate even stronger flows.



Source: Corps, 2001b.

Figure 3-12. Current Speed and Direction (Tide Removed) Recorded at Site 69A in Rhode Island Sound (September 1999).

Density Structure

Temperature stratification of the water column varies seasonally in Block Island Sound, Rhode Island Sound, and the waters of the inner continental shelf of the ZSF. The warming of the area surface waters begins in April; by June, strong thermal stratification develops. Summer sea surface temperatures throughout the ZSF are typically 18 °C (degrees Celsius) to 20 °C, while temperatures remain at 5 °C to 8 °C below a strong thermocline typically found at approximately 25 m (Williams, 1969) in the late summer. In August or early September, the combined effect of decreasing heat flux and increased mixing by storms causes the breakdown of thermal stratification, and the water column returns to a thermally well-mixed state. In winter, temperature and salinity gradients are horizontal, and temperature and salinity increase with distance offshore. The boundary effects of the Gulf Stream become apparent about 80 nmi southeast of Block Island, and warm core rings shed by the Gulf Stream have been observed over the inner continental shelf south of the ZSF. The hydrographic structure (temperature, salinity, and density) of the waters of the ZSF is discussed in further detail in Section 3.7.1.

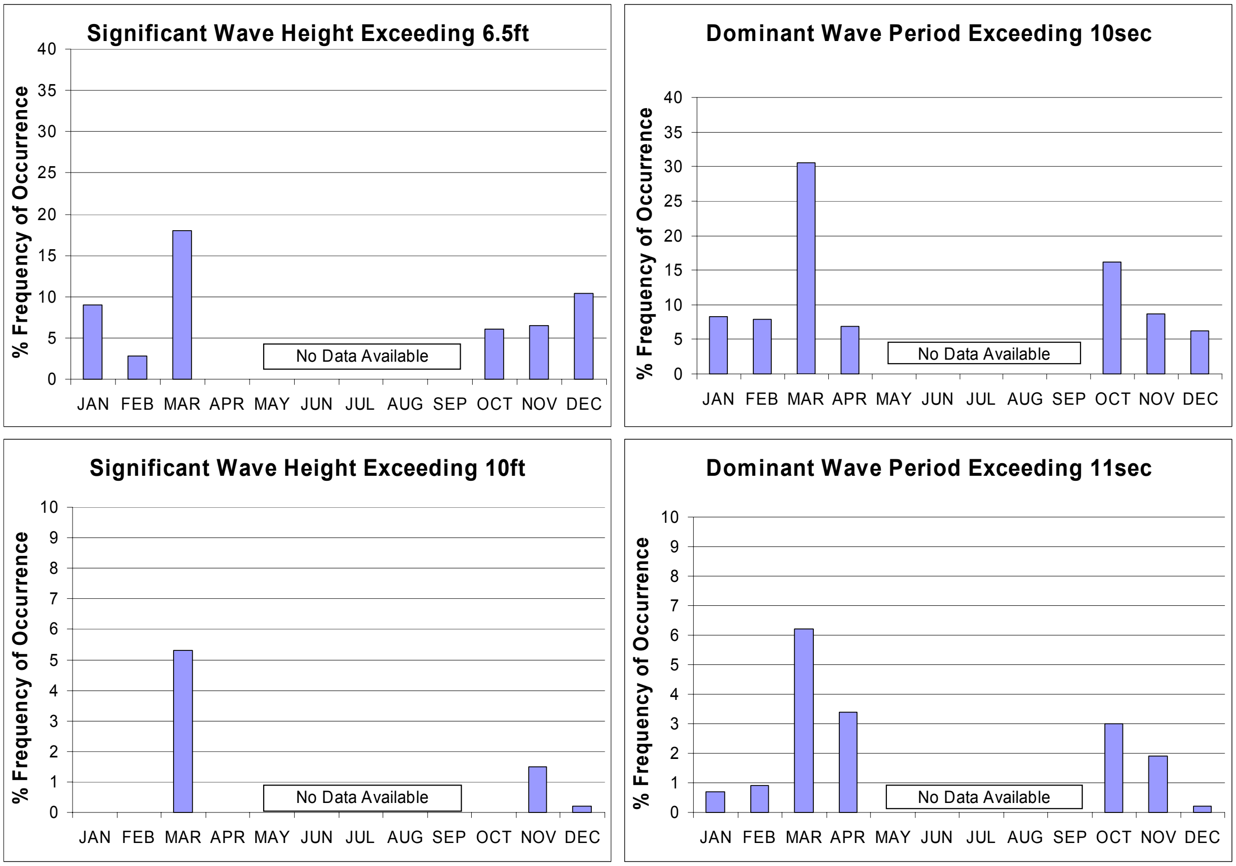
Wave Climate

The ZSF is subject to waves that are generated by both local winds and by distant storms that propagate into the area. In winter, average wind speeds in the ZSF of 16 to 17 knots are common, and gales (> 34 knots) occur up to 5 percent of the time. Waves that result from winds over the region depend on both wind speed and direction, since the fetch (the continuous area of water surface over which the wind blows to generate waves) is limited to the north. The frequency of occurrences of certain wave heights and periods (measured by the NDBC at the meteorological station on the Buzzards Bay Tower during the period 1990 to 1992) are presented in Figure 3-13. A long-term record of waves in the region is not available; however, the available data are consistent with a 10-year wave model hindcast presented in Section 3.4.3. The 1990-1992 data showed that the average monthly wave heights are lower during January and February, when winds are strong but predominantly out of the northwest, than during the early spring, when predominant winds are weaker but southerly. The most common occurrence of high waves was in March and November-December, when wave heights exceeded 6.5 ft more than 10 percent of the time. Wave heights exceeded 10 ft more than 5 percent of the time in March. Long period swells (wave periods that exceeded 11 seconds [sec]) result from either severe local storms or storms offshore in the North Atlantic Ocean and occur most often in the spring and fall. Waves that exceeded 10-ft heights and 11-sec periods occur 5 percent of the time in March and 1 percent to 2 percent of the time in November-December and represent the severe wave climate capable of substantial reworking of sediments on the seafloor.

3.4.2 Site E

Currents

No long-term current measurements are available from within Site E or from the immediate vicinity of Site E. However, Site E is located in the open waters of the ZSF, where the factors that drive water column currents, including the tide, winds, storms, and water column stratification, are generally consistent across the ZSF. Because of the influences of Long Island Sound and Buzzards Bay/Vineyard Sound, the direction and velocity of the tidal currents varies



Source: NDBC.
Note: The left two charts represent frequency of occurrence of significant wave heights (percent of all waves that exceed 6.5- and 10-ft heights). The right two charts represent frequency of occurrence of the dominant wave period (percent of all wave periods that exceed 10 and 11 sec) during each month of the year.

Figure 3-13. Significant Wave Height and Dominant Wave Period (1990 to 1992) Recorded at the Buzzards Bay Tower C-MAN Station (41.40 ºN 71.03 ºW).

somewhat throughout the ZSF. In the area of Site E, however, those influences are minimal. A short-term current meter deployed at a location several miles east of Site E in the spring of 1995 (Paul, 2003) provides some verification. The information from that deployment is limited but shows that tidal currents are between 10 to 20 cm/s and are directed north or northeast and south or southwest. Currents observed during the 45-day deployment period reached approximately 45 cm/s but appear to exceed 25 cm/s less than 10 percent of the time, which is consistent with previously described tidal current observations for the ZSF in general.

Density Structure

There have not been any studies of temperature, salinity, and density in Site E. In the open waters of the ZSF, the primary factors controlling water column structure (i.e., solar heating, surface cooling, water column mixing, and freshwater inflow) are relatively constant. Thus, the density structure at Site E, including its seasonal variation, is assumed to be similar to that described for the open waters of the ZSF in general.

Wave Climate

No wave measurements are available at or near Site E. The site can be expected to experience a wave climate similar to that described previously for the ZSF in general; however, the fetch varies somewhat throughout the open waters of the ZSF, which will result in some variation in wave climatology from the general area. The exposure of Site E to winds and waves from the east-southeast is partly blocked by the presence of Martha's Vineyard. (The fetch from the north is of little interest because the primary concern is for large ocean swells and storm-generated waves that can propagate into the area only from the south). To determine the effect of fetch at Site E, the results of the 10-year wave model hindcast presented in Section 3.6.1 were examined (Corps, 2004b). Table 3-1 presents model-predicted wave heights and periods at Site E for storms occurring at different frequencies (predictions are based on climatology data). A storm with a 5-percent frequency of occurrence can be expected to occur in the ZSF several times a year, while a storm with a 0.2-percent frequency of occurrence can be expected to occur only once in several years. These wave heights are consistent with observations measured by the NDBC at the meteorological station on the Buzzards Bay Tower during the period 1990 to 1992 and presented in Section 3.4.1.

Table 3-1. Model-Predicted Wave Heights and Periods at Site E for Storms of Various Frequencies of Occurrence.

Storm Frequency of Occurrence	Estimated Wave Height (ft)	Estimated Wave Period (sec)
5 %	9.5	7.2
1%	14.4	9.4
0.2 %	16.1	14.2

3.4.3 Site W

Currents

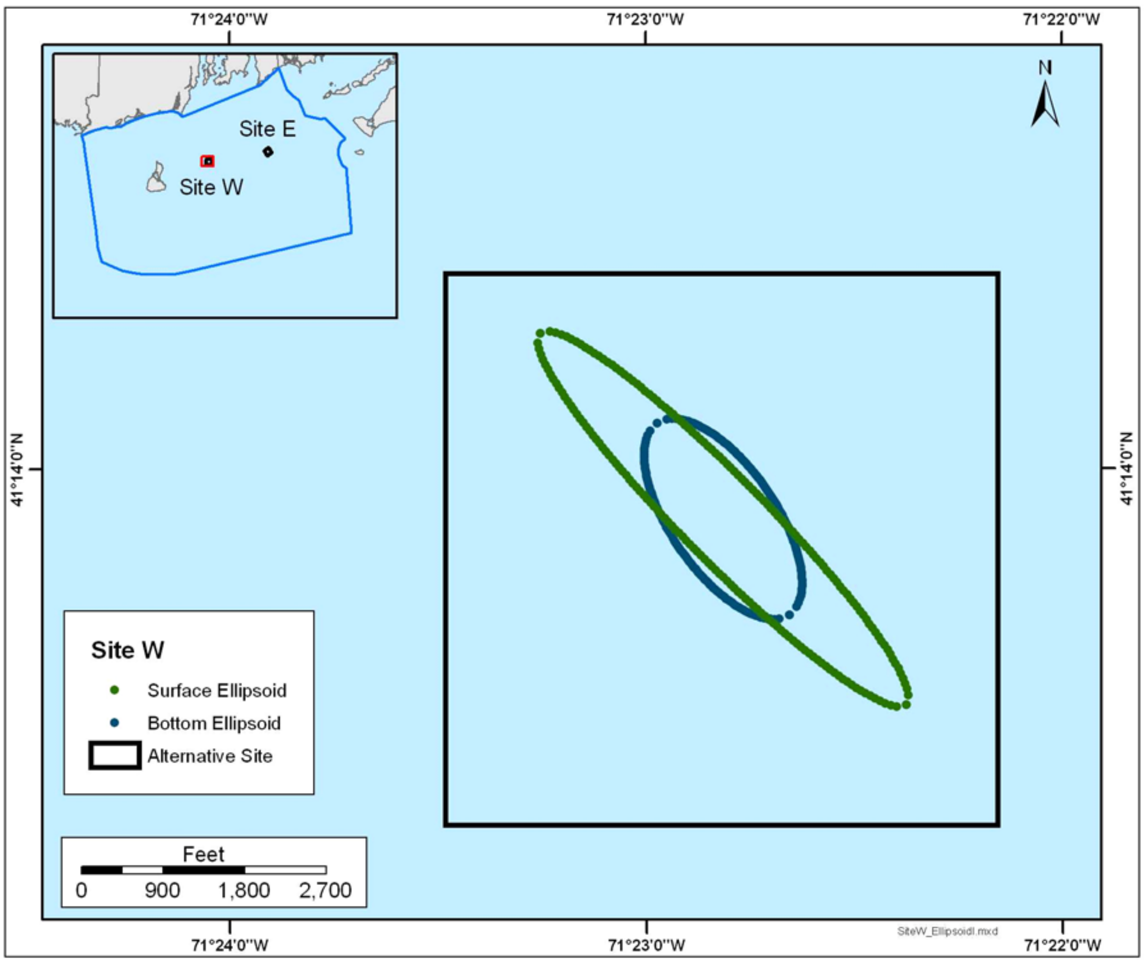
As with Site E, no long-term current measurements are available from within Site W or from the immediate vicinity of Site W to confirm whether general ZSF conditions apply to that site. Short-term measurements, however, are available from a 1-month current meter deployment in the fall of 1999 (Corps, 2001b) and a 2-month deployment in April and May 2002 (Corps, 2003b). They provide illustrative evidence of the local conditions.

Tidal ellipse parameters for surface, middle, and near-bottom currents based on 2002 data (Corps, 2003b; Corps, 2004c) are presented in Table 3-2. The dominant tidal flow directions were northwest and southeast, with the narrow ellipses indicating little flow perpendicular to the dominant flow direction (Figure 3-14). The amplitude of the tidal velocity decreased with depth. The surface tidal amplitude was 12.7 cm/s, and the near-bottom amplitude was approximately 7 cm/s. Based on these data, only 40 to 50 percent of the current variance during the 2-month late spring deployment period is due to the tide. The remainder of the current is caused primarily by wind stress and atmospheric pressure gradients associated with storms.

Table 3-2. Tidal Ellipse Parameters for Near-bottom, Middle, and Surface Currents Measured in Site W, April-May 2002.

Layer	Major Amplitude (cm/s)	Minor Amplitude (cm/s)	Inclination (deg)	Phase (deg)	% Vx Tidal Variance	% Vy Tidal Variance
Surface	12.7	2.0	135	25	50.4	34.8
Middle	11.2	0.9	131	29	43.1	58.7
Near-Bottom	7.0	2.4	143	5	48.8	58.6

Source: Corps, 2003b; Corps, 2004c



Note: Ellipses are scaled to show tidal excursion (ft).

Figure 3-14. Surface and Bottom Tidal Ellipses at Site W.

Near-surface currents recorded at Site W reached as high as 60 cm/s flowing toward the south. Currents this strong, however, were infrequent, with current speeds greater than 30 cm/s occurring only 4 percent of the time near-surface. Surface currents tend to be much stronger due to the effect of the wind stress on the surface layer. Throughout the rest of the water column, the maximum currents were 30 cm/s and occurred only very infrequently. Velocities of 30 cm/s occurred 2 percent of the time at mid-depth and 0.2 percent of the time near-bottom. Currents greater than 20 cm/s occurred approximately 10 percent of the time at mid-depth and 0.6 percent of the time near-bottom. The mean current for the station was 2.5 cm/s directed toward the west at mid-depth and 1.6 cm/s toward the west at the near-bottom depth.

Density Structure

There have not been any comprehensive long-term studies examining the density structure at Site W. Some profile measurements of water column temperature, salinity, and density were made in the fall of 1999 (Corps, 2000a) and in the spring of 2002 (Corps, 2003b). These observations were consistent with the general description of the water column stratification and density structure in the open waters of the ZSF presented in Section 3.4.1.

Wave Climate

No wave measurements are available at or near Site W. As with Site E, Site W is expected to experience a wave climate similar to that of the ZSF in general; however, because of differences in fetch, wave climatology may be expected to vary somewhat from the general area. The exposure of Site W to winds and waves from the southwest is partly blocked by the presence of Block Island, including the island itself and its surrounding bathymetry. Table 3-3 presents predicted wave heights and periods from the 10-year wave model hindcast at Site W for storms of different frequencies or occurrence (Corps, 2004b). These results indicate that Site W experiences wave heights that are slightly lower and wave periods that are slightly shorter than those experienced at Site E under the same storm conditions.

Table 3-3. Model-Predicted Wave Heights and Periods at Site W for Storms of Various Frequencies of Occurrence.

Storm Frequency of Occurrence	Estimated Wave Height (ft)	Estimated Wave Period (sec)
5 %	8.9	6.6
1%	13.4	9.0
0.2 %	15.1	14.2

3.5 SEDIMENT CHARACTERISTICS [40 CFR SECTION 228.6(a)(4)]

This section describes the sediment characteristics (grain size, total organic carbon [TOC], metals, and organic contaminants) of the ZSF and of Sites E and W. The sediment characteristics and quality can influence the type of habitats available to benthic and fish communities.

3.5.1 Rhode Island Region ZSF

There are relatively few studies of the sediment characteristics within the ZSF. Studies in the 1960s focused on characterizing bottom sediment types of the Narragansett Bay system and Rhode Island Sound (McMaster, 1960). McMaster's study assessed the gravel, sand, silt, and clay content of over 900 samples collected from bays and adjacent inner shelf to a distance of around 17 nmi off the Rhode Island coast. Savard (1966) also conducted an extensive investigation of the distribution of sediments in Block Island Sound. A study conducted by Boehm and Quinn (1978) evaluated the hydrocarbon contents of surface sediments, sediment cores, and ocean quahogs (*Arctica islandica*) from Rhode Island Sound. Studies conducted in 1978 at Site 16 as part of the Disposal Area Monitoring System (DAMOS) project evaluated physical, chemical, and biological parameters of surface sediments (Corps, 1979). More recently, studies were completed at Sites 18, 69A, and 69B in support of the proposed dredging of the Providence River (Corps, 2000b). These three sites were sampled to support the description of the physical, chemical, and biological characteristics of the sediments of the RIR (Corps, 2003c). Summary data tables with contaminant concentrations measured during these studies are included in Appendix A-2.

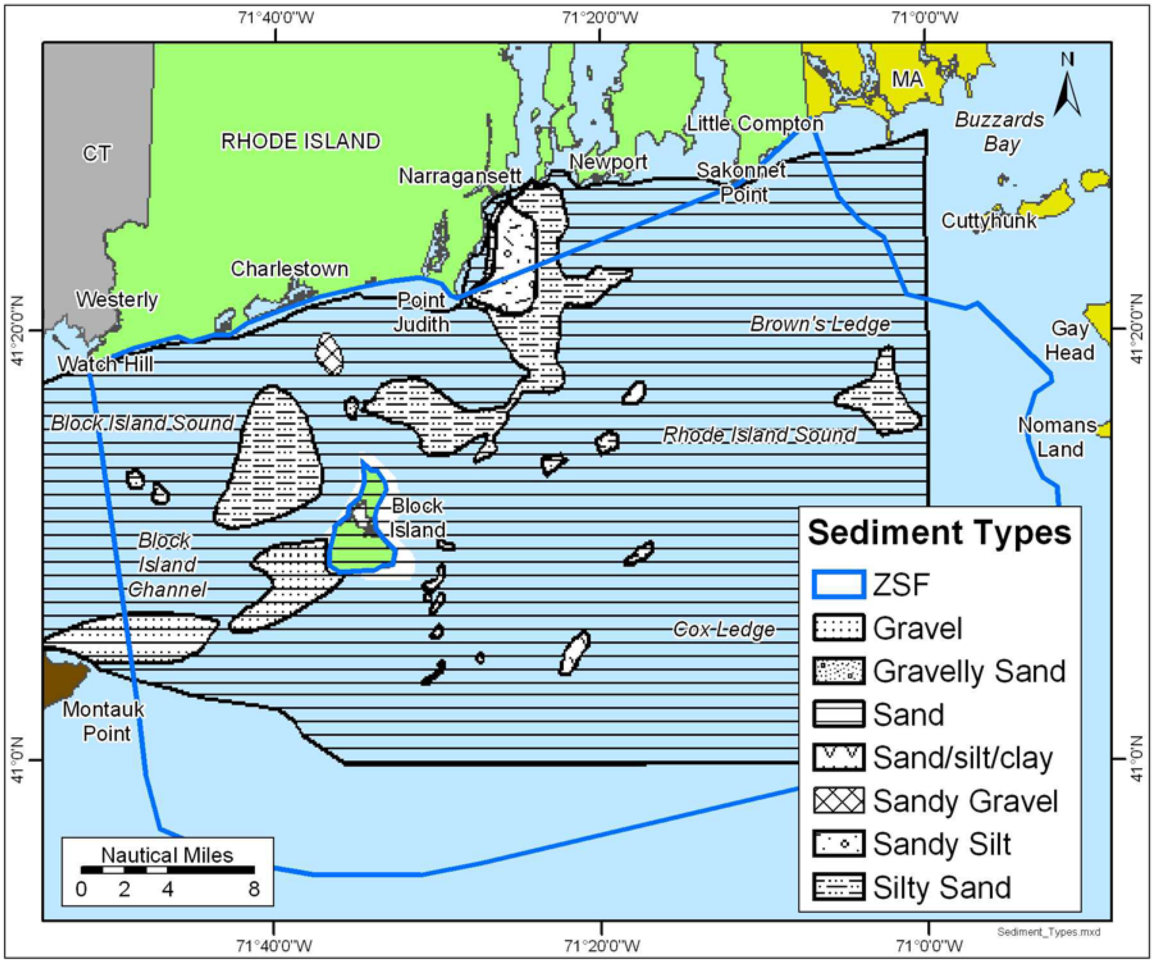
Grain Size Distribution

Grain size and TOC are important physical characteristics of the sediment environment. These factors play a large role in the suitability of the sediment as habitat for benthic organisms and may control the fate, transport, and uptake of contaminants. Sediment grain size at a site is influenced by the hydrodynamic environment (coarser-grained sediments deposit usually in higher-energy environments and finer-grained sediments deposit in lower-energy environments). The various sedimentary environments in the ZSF, as determined by McMaster (1960) and Savard (1966), are shown in Figure 3-15.

McMaster (1960) characterized the surface sediments of Rhode Island Sound as predominantly clean, well-sorted sand with some areas of fine and coarse sediments. One of the largest areas of fine sediments was found near the Rhode Island mainland, just south of the entrance to the West Passage of Narragansett Bay, and just east of Point Judith (Figure 3-15). Within this area of fine sediment was a core of sandy silt with less than 10 percent clay (McMaster, 1960). Areas of silty sand stretched west toward Block Island and east toward Site 16, the historic dredged material disposal site (Figure 3-15). Isolated patches of coarse (e.g., gravel) and fine (e.g., silt/clay) sediments were also found throughout Rhode Island Sound; however, many of these patches were characterized based on single samples. McMaster's study also showed that clay-sized particles generally did not accumulate in the study area. This finding suggested that either the sources of sediment deposits lacked clay or that relic deposits were stripped of the fine-grained material during sea level rise over the past 10,000 years and transported farther out to sea.

According to McMaster (1960), there is some relationship between bottom configuration and sediment type of Rhode Island Sound, with finer material (silt and clay) accumulated in the deeper areas and coarser material associated with pronounced elevations. For example, the large area of fine sediment found just east of Point Judith was located along the base of the relatively steep transition from approximately 60 ft into a broad area with a depth of approximately 120 ft. The tongue of silty sand that stretched southwest toward Block Island also followed the base of this curving slope. A submarine trunk valley, found in the south-central region of Rhode Island Sound, contains several patches of fine sediment. The largest was found at the junction of the valleys leading toward Buzzards Bay to the north and Vineyard Sound to the northeast.

Localized areas that contained greater than 10 percent gravel were associated with the two discontinuous ridges that trended across Rhode Island Sound from west to east.



Source: McMaster, 1960; U. S. Department of Navy, 1973.

Figure 3-15. Representation of Sediment Types in the ZSF.

The sediment characteristics of Block Island Sound were studied extensively (Savard, 1966 and U.S. Department of Navy, 1973). These studies revealed that areas of gravel and sandy gravel covered the shallow ridge between Montauk Point and Block Island, the ridge and shallow areas north of Block Island, and the deep channels in the western region of Block Island Sound (Figure 3-15). Overall, the predominant sediment type was sand, which covered the bottom in the western and central areas and the floor of the channel that passes through the ridge between Montauk Point and Block Island (Figure 3-15).

More recently, surface sediment samples were collected for grain size analysis at Sites 16, 18, 69A, and 69B (Corps, 2003c) (Figure 3-16). Surface sediments were also collected for grain size analysis at Site 18, Site 69B, and additional locations (Area #1, Area #2 and Area #3) to characterize benthic habitats in support of fish population studies (Corps, 2003d) (Figure 3-16).

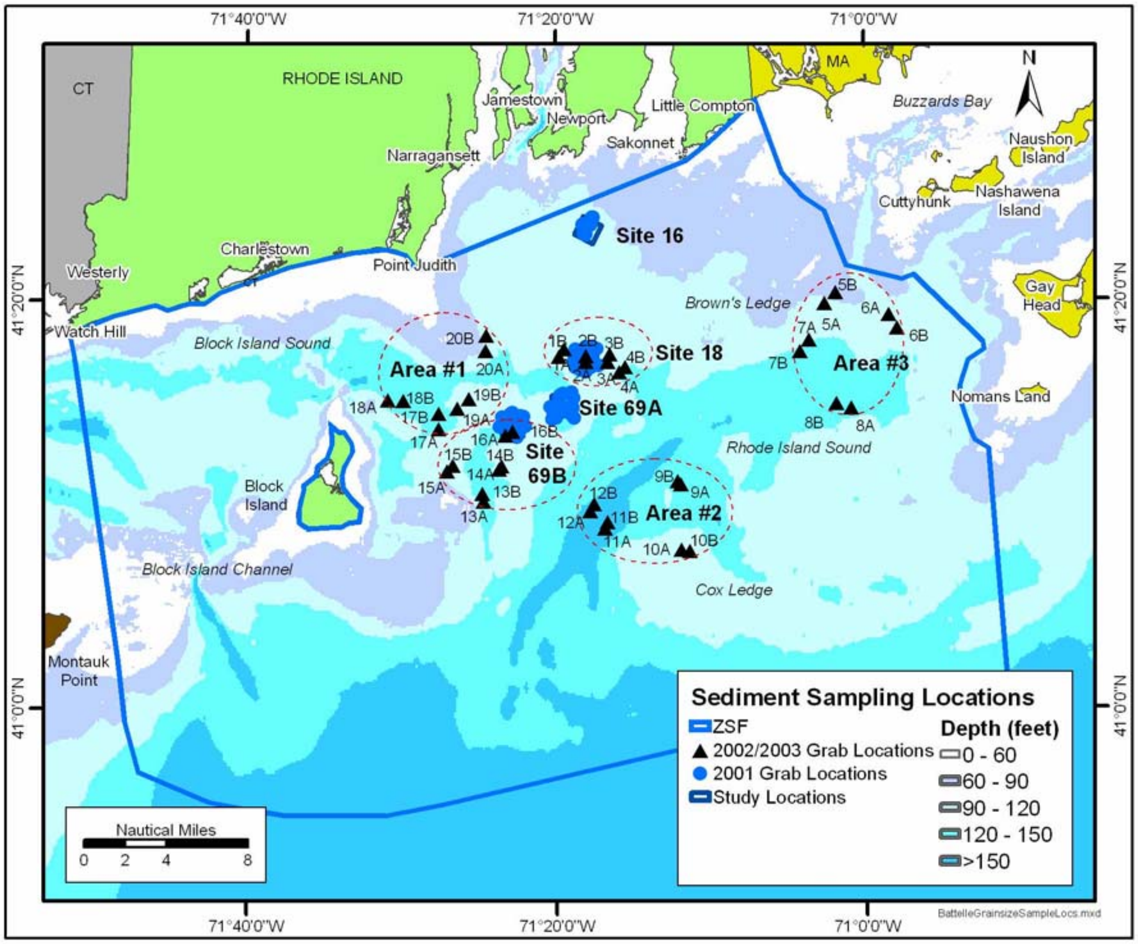


Figure 3-16. Grain Size Sampling Locations in the ZSF During 2001, and 2002/2003.

Results from these more recent studies support previous findings that the surface sediments of the ZSF were characterized as predominantly sandy with some areas of silty sand, sandy silt, sandy gravel, and gravel (McMaster, 1960). These data (Corps, 2003c; Corps, 2003d) showed that fine sand was the dominant fraction of the majority of sediments, and in most cases, medium sand, silt, or both made up the bulk of the remaining sediment. Figure 3-17 shows fine and medium sand comprise greater than 90 percent of the material among all samples collected in Area #1.

While most sediments consisted primarily of sand, sediment composition varied widely within small areas of the ZSF. For example, Figure 3-18 shows the composition of 26 sediment samples collected in and around Site 18. Although most samples consisted of greater than 80 percent fine and medium sand, the ratio of fine to medium sand changed dramatically. In addition, a limited number of samples from Site 18 contained upwards of 20 percent clay or coarse sand. Sediments with the highest amounts of fine-grained particles (i.e., silt and clay) were generally found near Site 18, just north of Site 16, and at locations in the bathymetric trough straddled by Area #2.

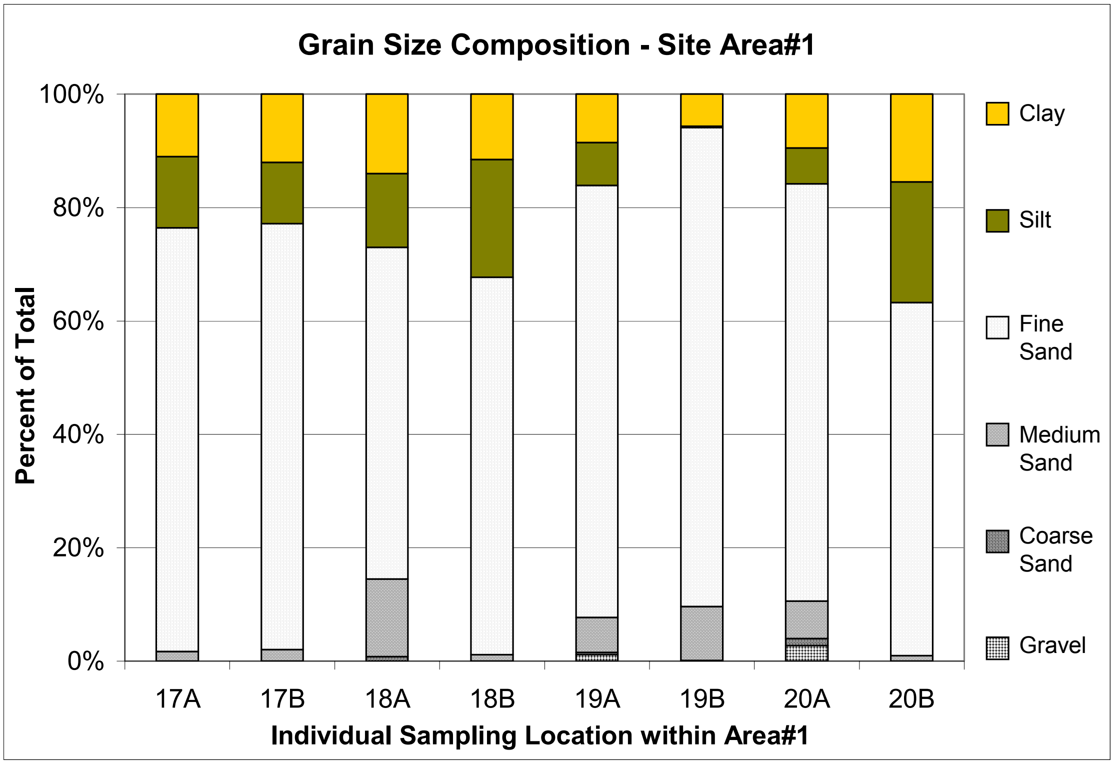


Figure 3-17. Grain Size Composition of Surface Sediments from Area #1.

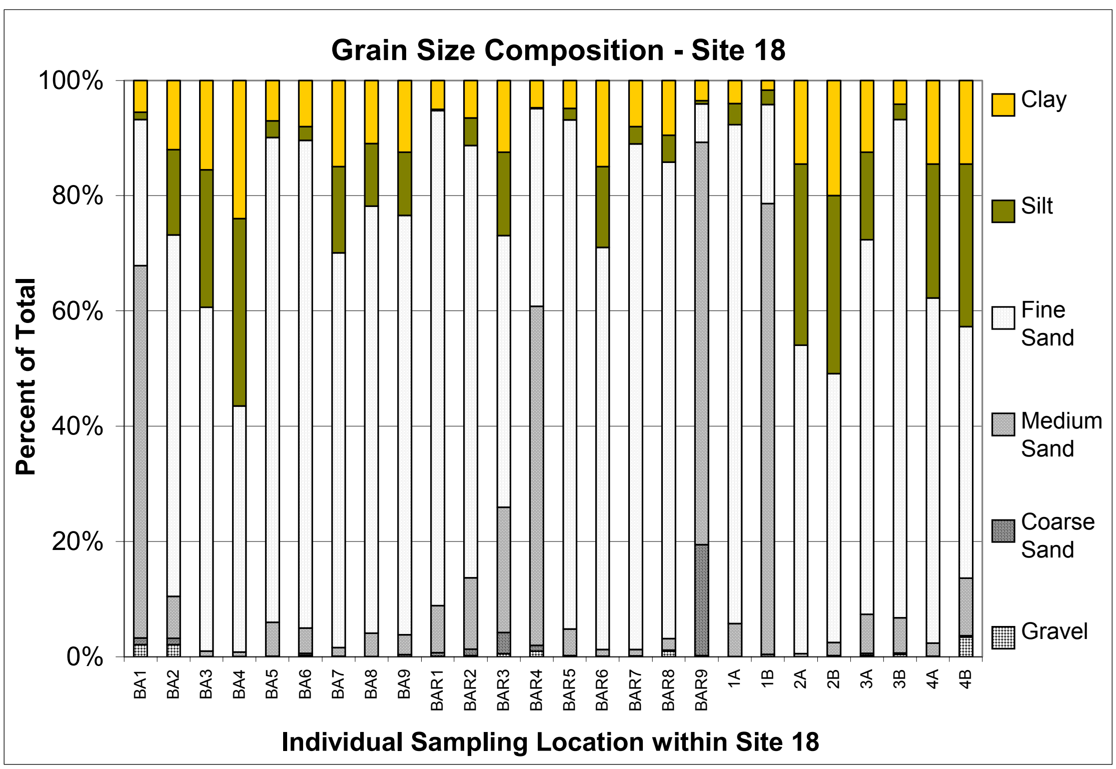


Figure 3-18. Grain Size Composition in Individual Sediment Samples Collected at Site 18.

Sediment characteristics of Site 16, an area previously impacted by dredged material disposal activities, were distinct from the surrounding sediments of the ZSF. Between December 1967 and September 1970, the Providence River was dredged, and material made up of fine, muddy sediments with relatively high organic content (approximately 4 percent TOC) was disposed of at Site 16 (Boehm and Quinn, 1978). This was followed by disposal of coarser material, consisting of silt and sand, which had a much lower organic carbon content (approximately 1 percent). Current surface sediments at the site are characterized as predominantly sand.

Organic Carbon Content

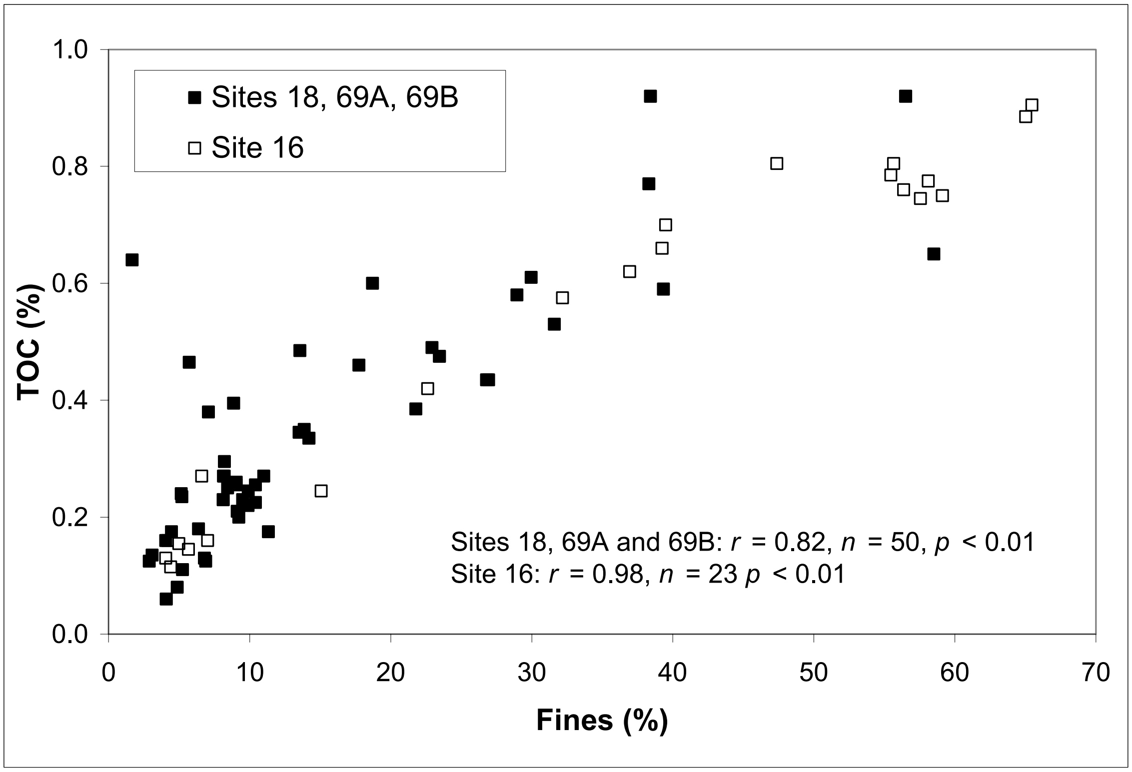
TOC is a measure of the total amount of organic material in sediment. The organic carbon content of sediment can significantly influence the chemical and biological conditions of sediment (Steimle, 1990a; Steimle and Ogden, 1982). Although the distribution of organic carbon in the sediment is strongly affected by grain size distribution, it is the organic content of the sediments that often influences chemical concentrations in the sediments (Hunt, 1979; Dayal *et al.*, 1981; 1983; Krom *et al.*, 1985; Steimle and Ogden, 1982; Corps, 1996) as well as the biological community (Wilber and Will, 1994; Corps, 1996).

Generally, increasing levels of organic carbon in marine sediments correlate with increasing amounts of fine-grained sediment fractions (i.e., silt and clay). Historical and current study results from within the ZSF are consistent with this generalization, as demonstrated by the strong correlation between fine-grained sediment and organic carbon content in surface sediments of the ZSF (Figure 3-19). Historical and recent data showed that sediments from the ZSF generally contained relatively low organic carbon content (<1 percent TOC). The majority of sediments (approximately 70 percent) sampled in the ZSF contained less than 0.5 percent TOC, with slightly higher organic carbon content in the fine-grained sediments from within, and to the northeast, of Site 16 (Corps, 2003c). Typically, such information suggests that contaminant levels in such sediments would be low.

Metals Distribution

Few historical studies have been conducted to evaluate metals distributions in sediments from the ZSF. More historical data are available for the sediments of Narragansett Bay, which opens into Rhode Island Sound. While Narragansett Bay is not in the ZSF, these historic studies of the Bay have shown that metals concentrations decreased with distance from the head to the mouth of the Bay (Bricker, 1990; King *et al.*, 1995). This gradient suggests that the sediments of Rhode Island Sound may not be impacted by the historic metals contamination of Narragansett Bay, which has been confirmed by recent measurements (Corps, 2003c).

Of the studies conducted in the last 25 years to assess metals concentrations in sediments of the ZSF (Corps, 1979), the most comprehensive assessment was performed in support of the proposed dredging of the Providence River (Corps, 2000b). Results from the study showed that surface (top 1 inch) and subsurface (top 3 ft) sediments contained low levels of metals that are generally representative of concentrations found in relatively unimpacted marine and estuarine sediments (Brown and Neff, 1993). Moreover, subsurface sediment metal concentrations were two-fold lower compared to surface sediments (Corps, 2000b).

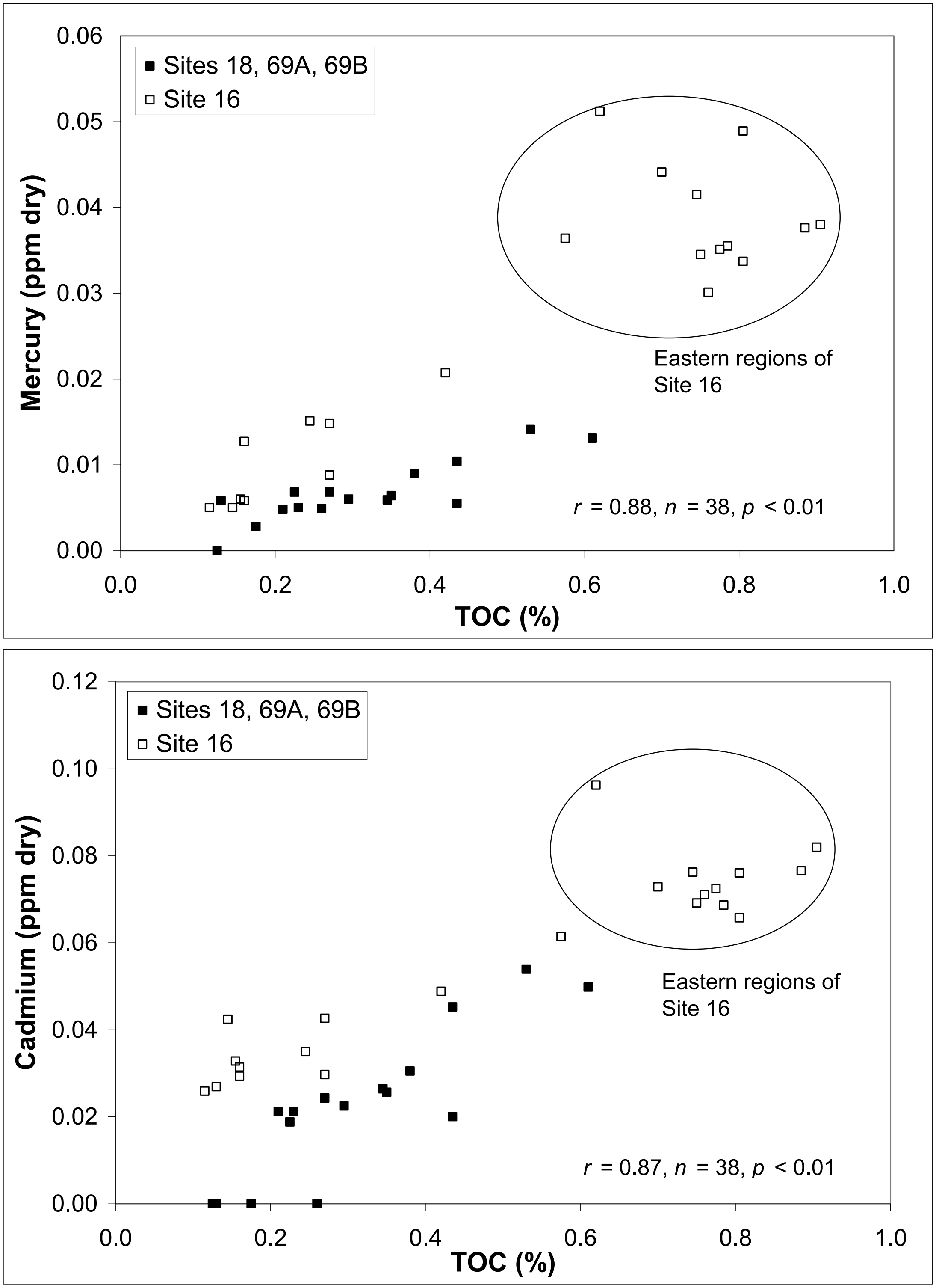


Note: r = correlation coefficient; n = number of samples; p = probability

Figure 3-19. Correlation between Percent Fines (Sum of Silt and Clay) and TOC Content of ZSF Surface Sediments.

A study conducted under the DAMOS program in 1978 (Corps, 1979) found that surface sediments from Site 16, located in the northern part of the ZSF, contained relatively low concentrations of metals, which were also comparable to concentrations measured in relatively unimpacted marine and estuarine sediments.

Low concentrations of metals were measured in surface sediments (top 1 inch) collected from several locations throughout the ZSF (Corps, 2003c). Concentrations of most metals were strongly correlated with TOC content and percent fines, with correlations against organic carbon being slightly higher overall (see Figure 3-20 for representative metals mercury [Hg] and cadmium [Cd]). This phenomenon is generally found in sediments worldwide. Within the ZSF, sediments in, and to the northeast of, Site 16, the historic disposal site, contained a higher range of both metals and TOC than the other locations sampled within the ZSF (Figure 3-20).



Note: r = correlation coefficient; n = number of samples; p = probability

Figure 3-20. Correlation between TOC and Representative Metals (Hg and Cd) of ZSF Surface Sediments.

The concentrations of metals in surface sediments (top 1 inch) from the ZSF were also low when compared to concentrations measured in nearby coastal waters in the northeast United States. Figure 3-21 shows mean concentrations of representative metals (Hg and lead [Pb]) in surface sediment collected from Long Island Sound (Corps, 2003e), New York Bight (EPA, 1997), Cape Cod (Maciolek *et al.,* 2003), Boston Harbor (Battelle, 2003), and Massachusetts Bay (Maciolek *et al.,* 2003) compared to the mean concentrations from 2001 samples collected from the ZSF and reference values for relatively unimpacted marine and estuarine sediments (Brown and Neff, 1993). ZSF mean metals concentrations are lower than most other coastal regions in the northeast United States (Long Island Sound, Cape Cod, New York Bight) and much lower than urban sediments (Boston Harbor). Mean concentrations of representative metals (Hg and Pb) in ZSF sediments were also well below their respective sediment quality benchmarks (Long *et al.*, 1995) (Figure 3-21). The low metals concentrations found in sediments of the ZSF were likely related to the relatively sandy, low organic nature of the sediments, and indicate little if any influence from sources of contamination identified in Narragansett Bay and other nearby urban harbors.

Sediment Quality Benchmarks

Sediment quality benchmarks were derived by NOAA (Long *et al*., 1995) and are intended to represent concentrations at which no effects or minor effects to benthic organisms are anticipated, as follows:

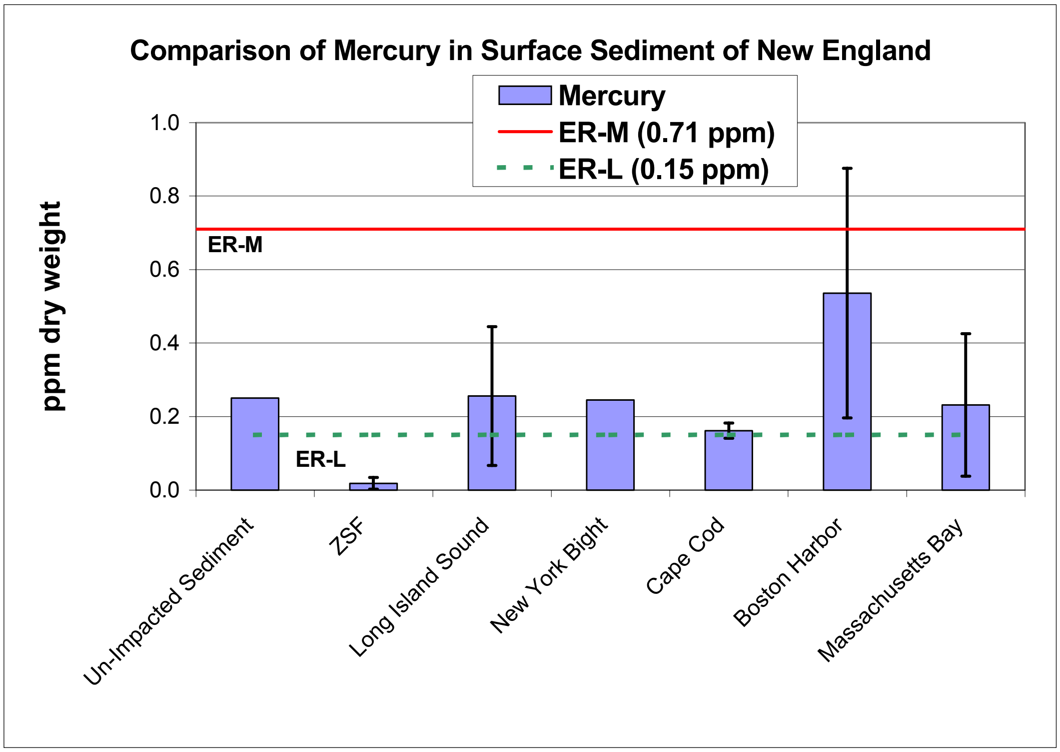
Effects Range Low (ER-L): concentrations at which no harmful effects to benthic organisms are anticipated.

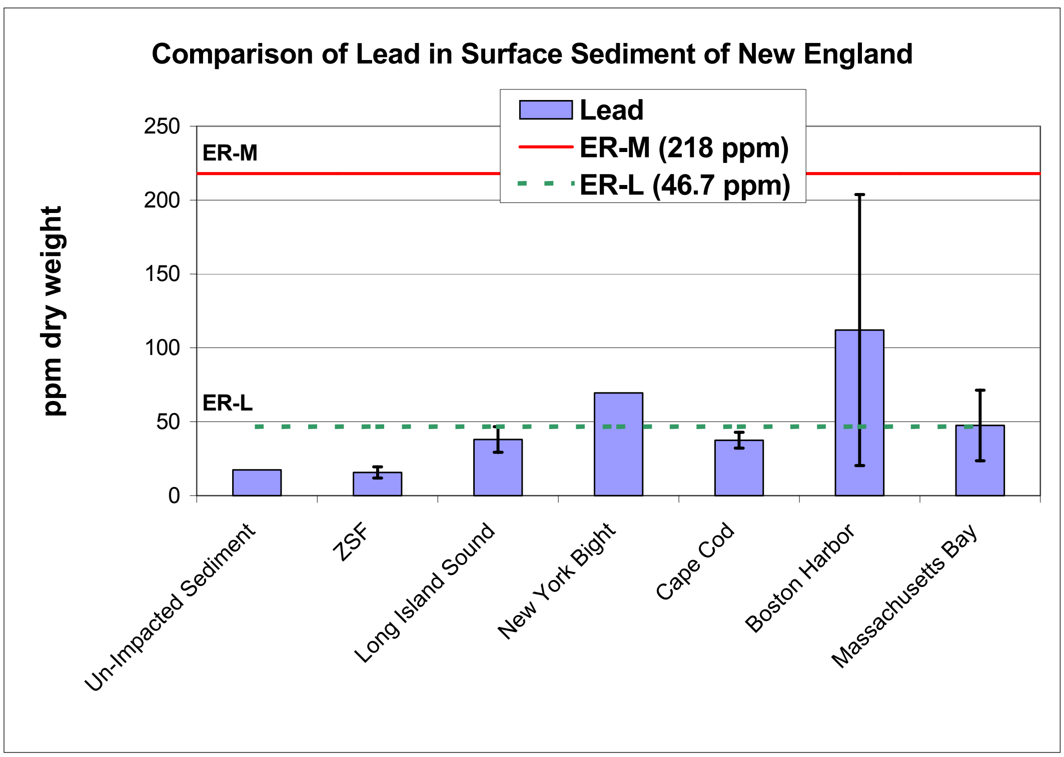
Effects Range Median (ER-M): concentrations at which minor effects are anticipated.

Organic Contaminants

Unlike metals, most organic contaminants, such as polychlorinated biphenyls (PCBs), are not naturally occurring in the environment. As a result, any contamination found is derived directly or indirectly from human activities (Brown and Neff, 1993). Polycyclic aromatic hydrocarbons (PAHs) are an exception to this generalization, as this class of organic contaminants may be derived from natural sources such as fires, fossil fuels, and direct biosynthesis by microbes and plants (Neff, 1979).

Organics data collected in surface sediments (top 1 inch) from several locations in and around Sites 16, 18, 69A, and 69B within the ZSF (Corps, 2003c) found generally low concentrations of organic contaminants that correlated well with sediment grain size and TOC content. For example, slightly higher concentrations of organic contaminants were measured in sediments from the ZSF located near the historic disposal site (Site 16), an area with fine-grained sediments (>50 percent silt + clay) and higher organic carbon content (>0.5 percent).





Note: Error bars represent standard deviation around the mean, where available.

Figure 3-21. Mean Concentrations of Representative Metals, Mercury (Top) and Lead (Bottom), in Surface Sediments from Coastal Waters of the Northeast United States.

Concentrations of organic contaminants in surface sediments from the ZSF were also relatively low compared to concentrations measured in other nearby coastal waters (Figure 3-22), and were similar to available reference values for relatively unimpacted marine and estuarine sediments (Brown and Neff, 1993; Peven, personal communication, 2004[2]). Mean concentrations of representative organic contaminants in sediments from the ZSF were also well below Effects Range-Low (ER-L) and Effects Range-Median (ER-M) sediment quality benchmarks (Figure 3-22).

Sediment Quality

Organic contaminant and metals data from both historical and recent studies demonstrate that sediments from the ZSF are relatively uncontaminated. Concentrations of organic contaminants and metals were also relatively low compared to nearby coastal waters, and well below concentrations found in impacted urban areas. Furthermore, concentrations of organic contaminants and most metals in sediments from the ZSF are strongly correlated with sediment properties (i.e., percent fines, TOC content), suggesting that the primary factors influencing chemical concentrations are grain size and TOC content. Last, and perhaps most important, organic contaminants and metals concentrations in sediments from the ZSF are, for the most part, well below applicable sediment quality benchmarks (i.e., NOAA ER-L and ER-M values) for marine sediments (Corps, 2003c). This indicates that the sediment habitats in the ZSF are of reasonably good quality.

3.5.2 Site E

Sediment profile imaging (SPI) studies conducted in 2003 at Site E and areas adjacent to the site showed that sediment type was highly variable (Corps, 2003f). Surface sediments (top 1 inch) located within Site E consisted largely of medium sands interspersed with patches of coarse and fine sands (Figure 3-23). The surrounding areas included coarser sediments to the east and finer sediments in the deeper waters southeast of Site E (Figure 3-23). Side-scan sonar results (see Section 3.2.2) coupled with the SPI data showed that areas with hard bottoms generally contained coarser sediments, whereas areas with soft bottoms generally contained finer sediments.

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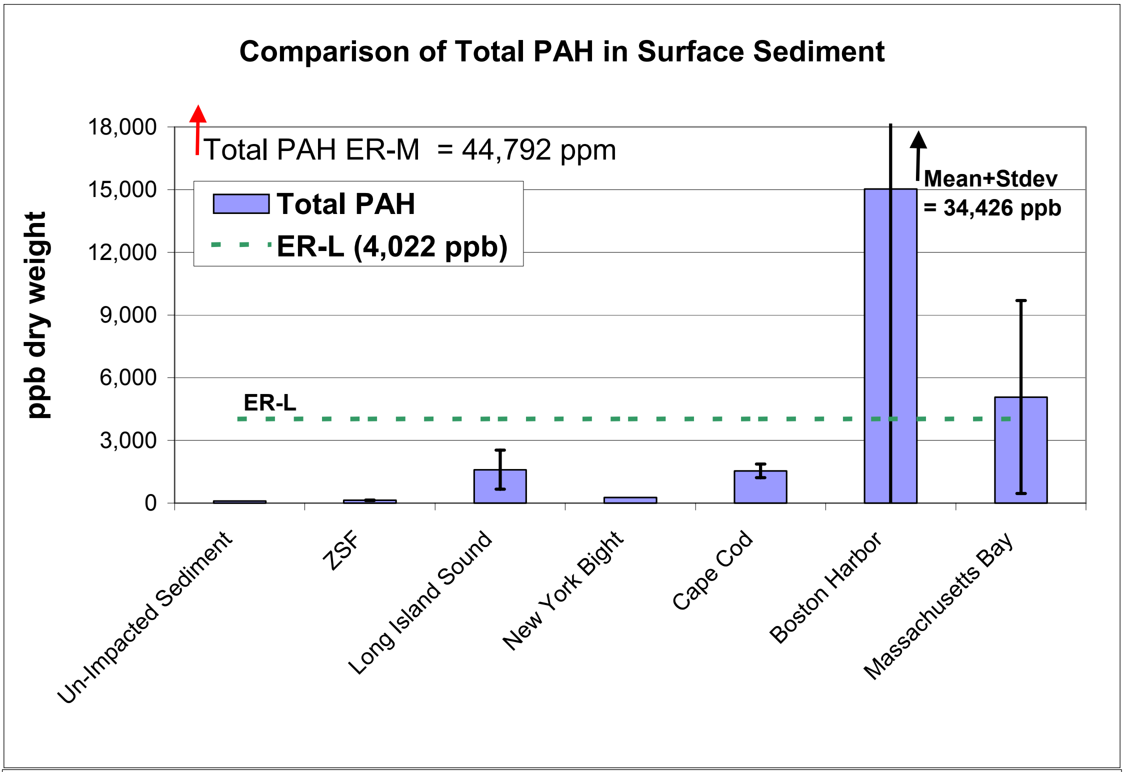
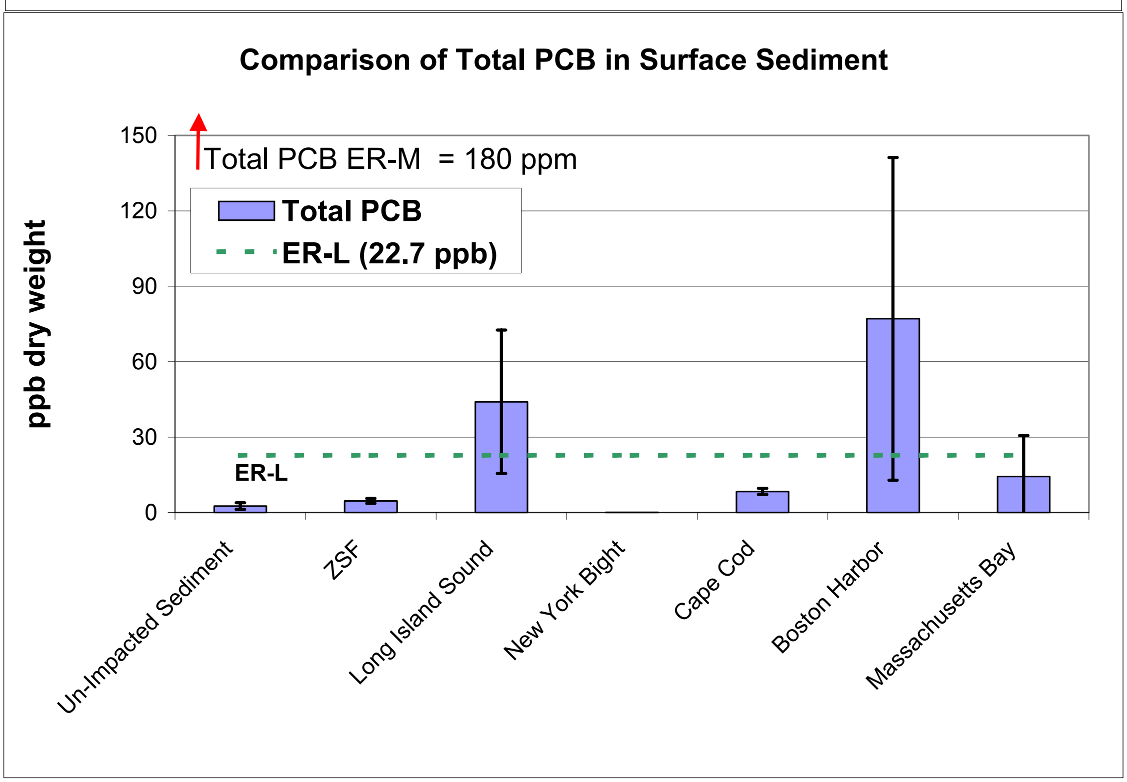
[2] The concentration of total PCB in five replicates of a sandy, clean reference sediment from Long Island, New York, ranged from 0.6 to 3.7 ppm dry. For the purposes of this evaluation, the mean value of the replicate analyses (mean ± stdev = 2.56 ± 1.34 ppm dry weight) was selected as the reference value for comparison to the ZSF.





Note: Error bars represent standard deviation around the mean, where available.

Figure 3-22. Mean Concentrations of Representative Organic Contaminants, Total PAH (Top) and Total PCB (Bottom) in Surface Sediments from Coastal Waters of the Northeast United States.

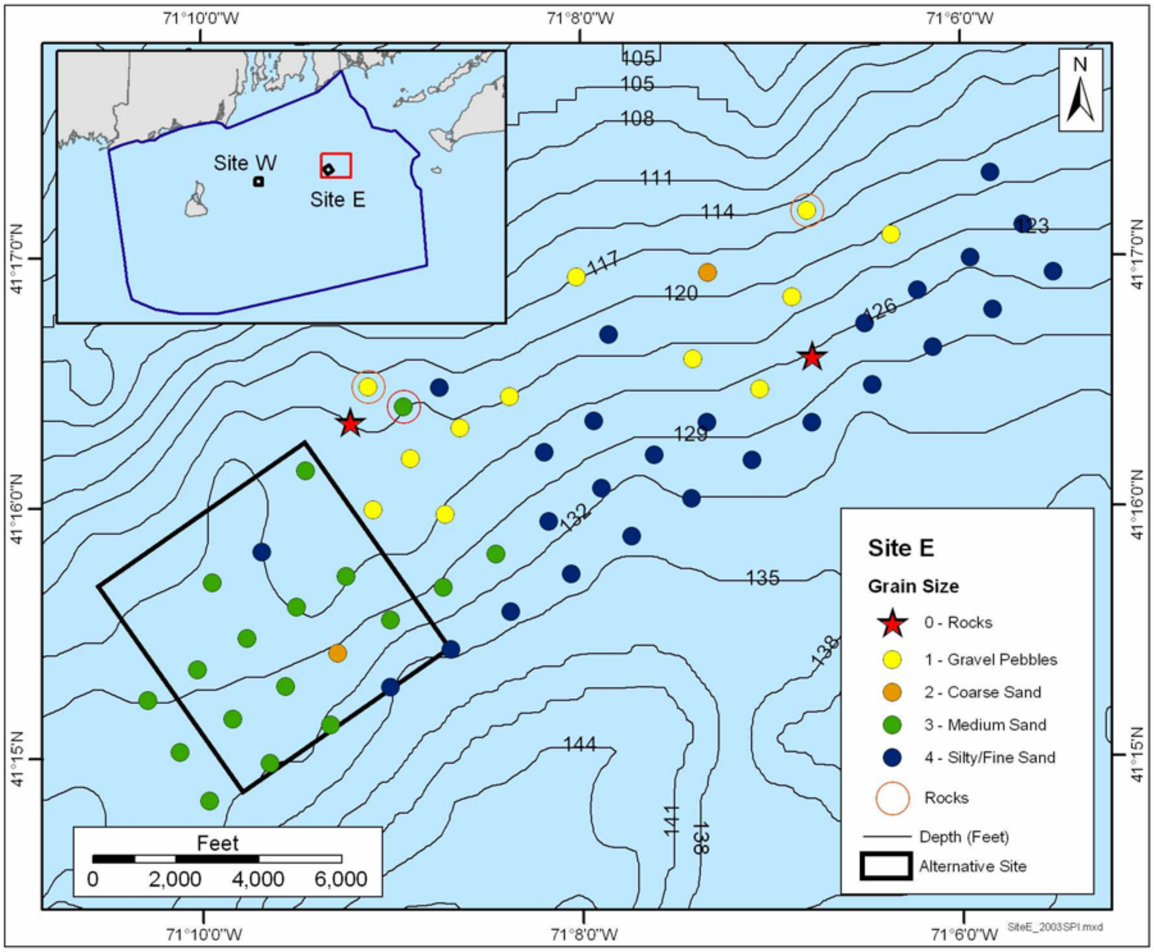


Figure 3-23. SPI Estimates of Grain Size Type for Surface Sediments from Site E and Areas Adjacent to Site E.

The physical and chemical characteristics of surface sediments (top 1 inch) in Site E correlated well with nearby sediments and sediments from the ZSF in general (Corps, 2003f) (Table 3-4). Surface sediments collected within Site E were characterized as predominantly sandy sediments (79 percent to 98 percent sand) (Table 3-4). Consistent with the sandy nature of Site E sediments, concentrations of TOC were low (<0.5 percent). Concentrations of chemicals (i.e., PAHs, metals) were also relatively low, and correlated well with sediment grain size and TOC. For example, sandy sediments with low TOC generally had lower concentrations of chemicals, whereas concentrations of chemicals were higher in the finer sediments with higher TOC. Concentrations of chemicals in surface sediments from Site E were well below established sediment quality benchmarks (i.e., NOAA ER-L and ER-M values) for marine sediments, indicating that surface sediments from this site are not impacted by contamination.

Table 3-4. Summary Physical and Chemical Characteristics of Surface Sediments from Site E, Areas Adjacent to Site E, and the ZSF.

Parameter	Surface Sediment (top 1 inch)					
	Site E (n=5)		Adjacent to Site E (n=13)		ZSF (a)	
	Range	Mean	Range	Mean	Range	Mean
Physical (pct)						
Gravel	0 to 7.17	1.73	0 to 61.9	9.87	0 to 49.3	3.18
Sand	79.1 to 98	90.1	35.4 to 97.6	76.8	11.6 to 98.1	75.1
Silt	0.66 to 10.4	3.13	0.05 to 21.5	6.32	0.11 to 53.3	12.4
Clay	1.2 to 10.3	5.07	0.45 to 16	7.01	0.42 to 36	9.34
Fines	1.97 to 20.6	8.2	1.83 to 37.5	13.3	0.84 to 88.5	21.8
TOC	0.07 to 0.38	0.216	0.08 to 0.58	0.34	0.06 to 0.92	0.396
Organic Chemicals (parts per billion [ppb] dry wt)						
Total PAH	2.71 to 27.1	12.7	3.59 to 70.6	22.7	5.05 to 407	137
Metals (parts per million [ppm] dry wt)						
Aluminum (Al)	<1.5 to 26,300	20,700	<1.3 to 50,300	31,900	7,550 to 45,600	34,300
Chromium (Cr)	<23	<23	<29 to 35	24.7	8.59 to 43.2	26.2
Copper (Cu)	3.8 to 5.2	4.78	3.5 to 8.5	5.72	2.16 to 19	8.01
Lead (Pb)	6 to 15	11	5.2 to 16	11.9	2.69 to 21.7	15.7
Mercury (Hg)	0.0053 to 0.0172	0.0103	0.00569 to 0.023	0.0143	<0019 to 0.0512	0.0186
Nickel (Ni)	<5.6 to 4.8	4.54	<11 to 8.7	6.83	2.94 to 14.6	8.27
Zinc (Zn)	11 to 25.8	19.1	11.4 to 43.9	27.0	4.37 to 50	31.4

(a) 71 stations sampled in 2001 (Corps, 2003c) and 40 stations sampled in winter 2002 (Corps, 2003d). For grain size n = 111; for TOC n = 71; for organics and metals n = 38. Range and Mean data for the ZSF are based on sample data collected prior to 2003 (Corps 2003d,e).
Note: In cases where a parameter was not detected (ND), the detection limit (DL) is reported as '<DL'. Note that DLs varied from sample to sample, and when the parameter result for more than one sample was undetected, then the highest DL among those non-detect samples is reported in the Range above. Also note that in cases where the parameter result for a single sample was not-detected, the sample DL was used in the Mean calculation.

3.5.3 Site W

SPI studies conducted in 2001 and 2003 at Site W (Figure 3-24) and areas adjacent to the site showed that surface sediments (top 1 inch) in Site W were composed primarily of fine sands. Sediment type in the surrounding area varied considerably, with coarser sediments to the north and finer sediments with some areas of silt to the west (Corps, 2002c; Corps, 2003f). Side-scan sonar results (see Section 3.2.3) coupled with the SPI data showed that areas with hard bottoms generally contained coarser sediments, whereas areas with soft bottoms generally contained finer sediments.

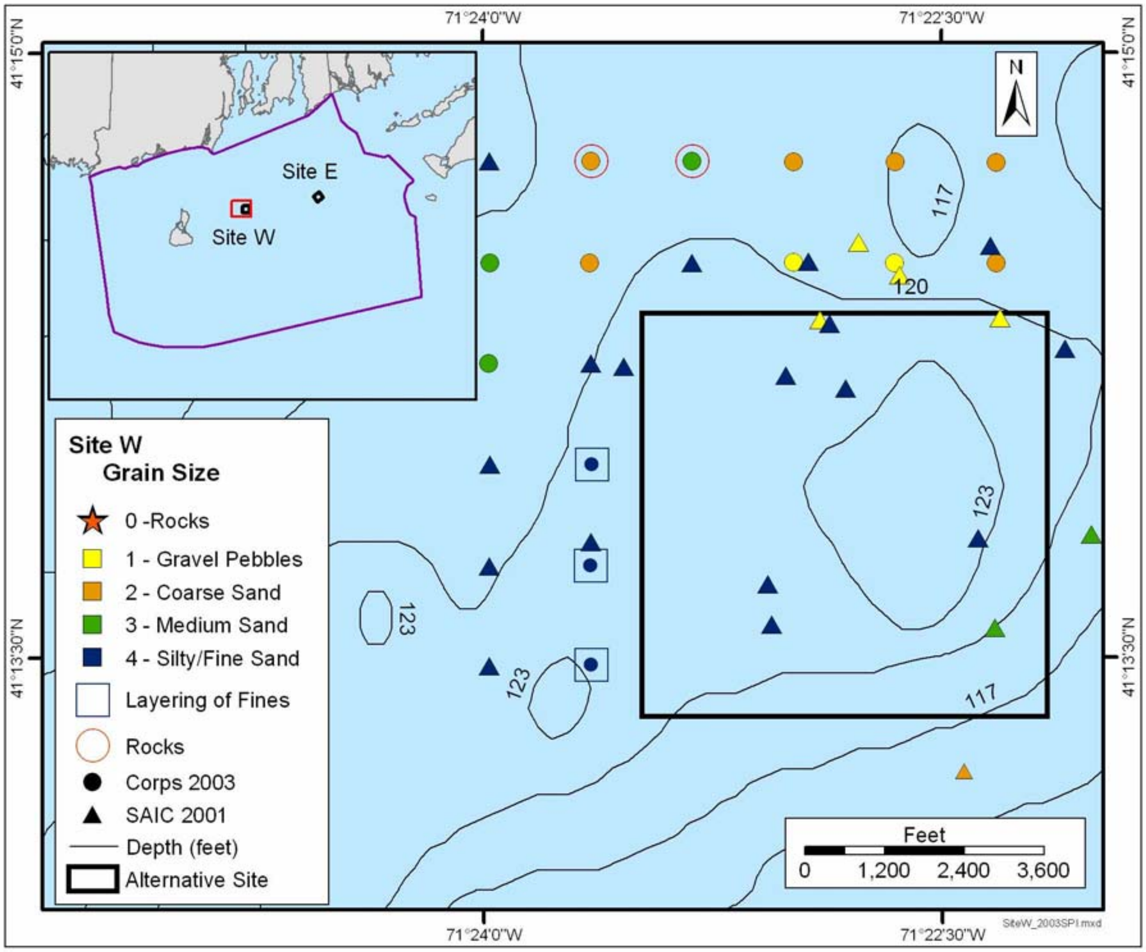


Figure 3-24. SPI Estimates of Grain Size Type for Surface Sediments from Site W and Areas Adjacent to Site W.

The physical and chemical characteristics of surface sediments (top 1 inch) in Site W were fairly similar to nearby sediments and to sediments from the ZSF in general (Corps, 2003c; Corps, 2002c). Grain size analyses found that surface sediments from Site W were characterized mainly as sandy sediments (45 percent to 96 percent sand), although areas of silt were noted in some surrounding locations west of the site (Table 3-5).

Concentrations of TOC were relatively low (<0.8 percent) in surface sediments from Site W and were strongly correlated with grain size. Concentrations of organic contaminants (i.e., total PAH) and most metals correlated well with TOC but not with grain size. For example, lower chemical concentrations were found in sediments with low TOC and higher chemical concentrations were found in sediments with higher TOC. However, sediments from Site W contained slightly higher chemical concentrations than expected for sediments with small amounts of fine material (<15 percent fines). Interestingly, the correlation between chemical concentrations and sediment grain size was stronger in sediments located adjacent to Site W.

Table 3-5. Summary Physical and Chemical Characteristics of Surface Sediments from Site W, Areas Adjacent to Site W, and the ZSF.

Parameter	Surface Sediment (top 1 inch)							
	Site W (a)		Adjacent to Site W, 2001 (b)		Adjacent to Site W, 2003 (c)		ZSF (d)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Physical (pct)								
Gravel	0 to 49.3	11.8	0 to 19.1	7.04	0 to 56.7	7.65	0 to 49.3	3.18
Sand	45 to 95.9	74.6	75.8 to 96.9	86.1	37.7 to 81.6	62.9	11.6 to 98.1	75.1
Silt	0.27 to 23.3	6.72	0.59 to 5.52	2.65	1.17 to 47.3	19.2	0.11 to 53.3	12.4
Clay	3.5 to 15	6.82	1.82 to 8	4.23	2.9 to 15	10.3	0.42 to 36	9.34
Fines	4.05 to 38.3	13.5	2.89 to 13.5	6.88	4.07 to 62.3	29.5	0.84 to 88.5	21.8
TOC	0.16 to 0.77	0.42	0.125 to 0.345	0.22	0.29 to 0.79	0.49	0.06 to 0.92	0.396
Organic Chemicals (ppb dry wt)								
Total PAH	17.1 to 25.1	21.7	5.62 to 24.3	15.1	14.9 to 821	235	5.05 to 407	137
Metals (ppm dry wt)								
Aluminum	30,400 to 39,700	34,100	7,550 to 29,000	17,600	22,200 to 50,100	38,800	7,550 to 45,600	34,300
Chromium	27.2 to 36.4	31.1	10.9 to 22.8	18.6	<27 to 54	30.4	8.59 to 43.2	26.2
Copper	4.76 to 7.69	5.95	2.8 to 5.2	4.38	6.3 to 52.5	18.4	2.16 to 19	8.01
Lead	15.3 to 17.6	16.3	2.69 to 15.1	9.61	12.4 to 33.3	18.8	2.69 to 21.7	15.7
Mercury	0.006 to 0.009	0.00713	<0.006 to 0.0059	0.0038	0.00904 to 0.0815	0.0334	<0.0019 to 0.0512	0.0186
Nickel	9.58 to 14.6	11.3	3.87 to 6.96	5.86	ND to 16.6	10	2.94 to 14.6	8.27
Zinc	36 to 50	40.9	4.37 to 31.1	16.5	25.6 to 75.9	46.1	4.37 to 50	31.4

(a) Nine sediment stations sampled in 2001 (Corps, 2003c). For grain size and TOC n = 9; for organics and metals n = 3.
(b) Seven reference stations sampled in 2001 (Corps, 2003c). For grain size and TOC n = 7; for organics and metals n = 3.
(c) Ten reference stations sampled in 2003 (Corps, 2003f). n = 10 for all parameters reported.
(d) 71 stations sampled in 2001 (Corps, 2003c) and 40 stations sampled in winter 2002 (Corps, 2003d). For grain size n = 111; for TOC n = 71; for organics and metals n = 38.

Note: In cases where a parameter was not detected (ND), the detection limit (DL) is reported as '<DL'. Note that DLs varied from sample to sample, and when the parameter result for more than one sample was undetected, then the highest DL among those non-detect samples is reported in the Range above. Also note that in cases where the parameter result for a single sample was not-detected, the sample DL was used in the Mean calculation.

For example, concentrations of some chemicals (e.g., total PAH, Cu, and Hg) were higher in sediments located to the west of Site W, which typically had higher amounts of fines and TOC. Concentrations of chemicals found in the Site W sediments were well below established sediment quality benchmarks (i.e., NOAA ER-L and ER-M values), suggesting that surface sediments from Site W are not impacted by contamination.

3.6 SEDIMENT TRANSPORT [40 CFR SECTION 228.6(a)(6)]

The potential erosion and transport of sediment is an important factor in assessing a suitable location for dredged material disposal. Dredged material disposal sites designated as containment sites are intended to retain dredged material within their boundaries. This section examines potential erosion and sediment transport in order to determine whether there will be any significant movement of dredged material deposited at either alternative site. This will be done by examining the sedimentary environment of the ZSF, which provides insight into sediment transport processes that may be at work. To aid this interpretation, the results of a separate ZSF area-wide sediment transport model study, based on a Grant-Madsen formulation (see for example, Glenn and Grant, 1987), are also presented. A full description of the modeling study methods and results is presented in a recent modeling report (Corps, 2004b). Additional site-specific dredged material erosion and transport modeling results are presented in Section 4.0.

3.6.1 Rhode Island Region ZSF

In this section, erosional areas of the ZSF are distinguished from depositional areas using information on the sediment environment, as well as and an analysis of the hydrodynamic processes (waves and currents) that can cause erosion and transport in the coastal environment.

Approach

The sedimentary environment of the ZSF is described in Sections 3.2 and 3.5. Erosional/depositional processes can, in part, be inferred from the sedimentary environment of the ZSF. Much of the ZSF has been classified by previous investigators (Savard, 1966; Danbom, 1975; Knebel *et al*., 1982) as areas of erosion (or non-deposition) and areas of sediment sorting and reworking. Only the area in the north-central portion of the ZSF and the bathymetric depression running from northeast to southwest in Rhode Island Sound southeast of Block Island are potential areas of deposition, based on the presence of high percentages of fine-grained sediment (Figure 3-15). These depositional areas corresponded to the areas of the lowest near-bottom wave and current energy.

An examination of only the sedimentary environment cannot tell the complete story of the potential for sediment transport. There are two compounding issues that must be considered. First, sediments found throughout the ZSF reflect the predominance of coarse-grained source material as well as any erosional/depositional processes at work. Previous studies of sediments of the continental shelf off the east coast of the United States recognized that rivers are of little importance in supplying sediment to the continental shelf. McMaster (1960) noted that sediments carried by major rivers in the east are effectively trapped by the deep basins of Long Island Sound and the Gulf of Maine. It is not possible, therefore, to determine conclusively whether areas of coarse, unconsolidated sand are present wholly because of sorting and reworking by waves and currents or are present in part because of a lack of available fine sediments. Second, dredged material from harbors is high in fines and clay and tends to be more cohesive than sandier sediment typical of the ZSF. It is, therefore, necessary to also characterize the erosional/depositional processes at work (i.e., the hydrodynamic environment) throughout the ZSF as it relates to the potential erodability of placed dredged material.

The transport of bottom sediments in the ZSF, like other open continental shelf environments, is predominantly caused by storm-generated waves that create oscillatory currents near the seabed. Oscillatory currents (the to-and-fro water motion beneath passing waves) are present under all surface waves; they are strongest near the surface and weaker with increasing depth. When the waves are large, and their period long, these to-and-fro currents occur well below the surface. If they are present close to the bottom with sufficient strength, they can provide enough energy to resuspend bottom sediments. When these oscillatory currents are combined with other currents, such as tidal currents, conditions potentially resulting in suspended-load transport can occur.

Investigators have found that very few events over the course of a year account for all the annual resuspension and transport of bottom sediments on the inner continental shelf (Manning *et al*., 1994; Vincent *et al*., 1981). Manning *et al.* (1994) documented storm-driven resuspension and transport of sediments in the New York Bight using the continental shelf bottom boundary layer model of Glenn and Grant (1987). The model indicated that sediment resuspension occurred at the measurement sites approximately 5 percent of the time, primarily during winter months. The model results confirmed the observations of a side-scan and bathymetry study in the apex of the New York Bight (Stubblefield *et al.,* 1977). The analysis and modeling done for the New York Bight cannot be directly applied to the ZSF because of the site specific nature of the wave and current climate and bottom sediments. A similar approach, using the same sediment transport model and relating those model results to the sedimentary environment, was used in this study.

Sediment Transport Model (Grant-Madsen) Description and Methods

A full description of the modeling study methods and results is presented in a recent modeling report (Corps, 2004b). Long-term current measurements are not available in the open waters of Rhode Island Sound, although tidal current flow throughout the ZSF is well understood. Wave measurements are available from a 2-year period (1990 to 1992) at the Buzzards Bay Tower (see Section 3.4.1); however, these measurements did not include data for the summer months, provided no spatial information, and do not provide the long-term characterization required for this analysis. To develop these kinds of statistics, the wave climate and storm currents were modeled using available wind hindcast data. Long-term archives of the wind field over both the mainland and coastal waters of the United States are readily available from the U.S. Weather Service. A directional wave model was applied to characterize the long-term wave climate over the ZSF from the historical wind field, a technique routinely used in the study of ocean waves.

To estimate the potential resuspension of sediments caused by the modeled wave and current field, the bottom shear stress generated by the wave and current forces was determined. Shear stress is the frictional or "sliding" force that horizontal currents exert on the seabed (Figure 3-25).

Resuspension was estimated by comparing shear stress exerted by the waves and currents to the critical shear stress that causes the initiation of sediment motion. Bottom shear stress is a function of the current velocity, wave height, wave period, water depth, and bottom roughness. Critical shear stress was estimated from grain size.

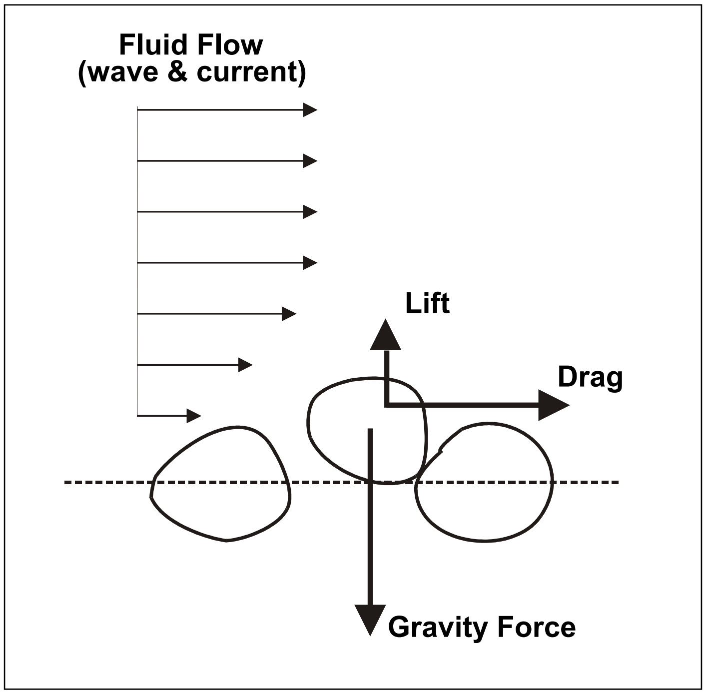


Figure 3-25. A Schematic Depicting Shear Stress on the Seabed.

The Grant-Madsen model of sediment transport was then applied to the ZSF for various grain sizes, tidal current, and wave conditions. The model predicted the distribution of sediment erodability (the erodability parameter is the ratio of the wave- and current-induced bottom shear stress to the critical threshold shear stress) (Dyer, 1986). The predicted distribution of sediment erodability over the ZSF for the 1-percent frequency of occurrence wave conditions combined with the typical peak tidal currents for 1.0-millimeter (mm) grain size sediments is shown in Figure 3-26. The modeled wave conditions represent the waves expected during the strongest winter storm of a single year. Cohesive sediments, typical of harbor dredged material, are more resistant to erosion by hydrodynamic forces; thus, a coarse grain size was chosen for use in the non-cohesive model to offset the effect. Lower sediment erodability values indicated that less energy was available for the erosion, resuspension, and transport of bottom sediments. Sediment erodability parameter values less than 1 indicated that wave and current energy were not sufficient to resuspend and transport even non-cohesive bottom sediments for the given storm conditions and indicated depositional areas. Sediment erodability parameter values greater than 1 but less than 3 indicated that wave and current energy may occasionally be sufficient to mobilize non-cohesive bottom sediments and indicated areas of some sediment sorting and reworking. This corresponds to peak near-bottom combined wave and current velocities of between 36 cm/s and 69 cm/s. Sediment mobility parameter values greater than 3 indicated high wave and current energy environments and areas of coarse-grained deposits and/or erosion (non-deposition).

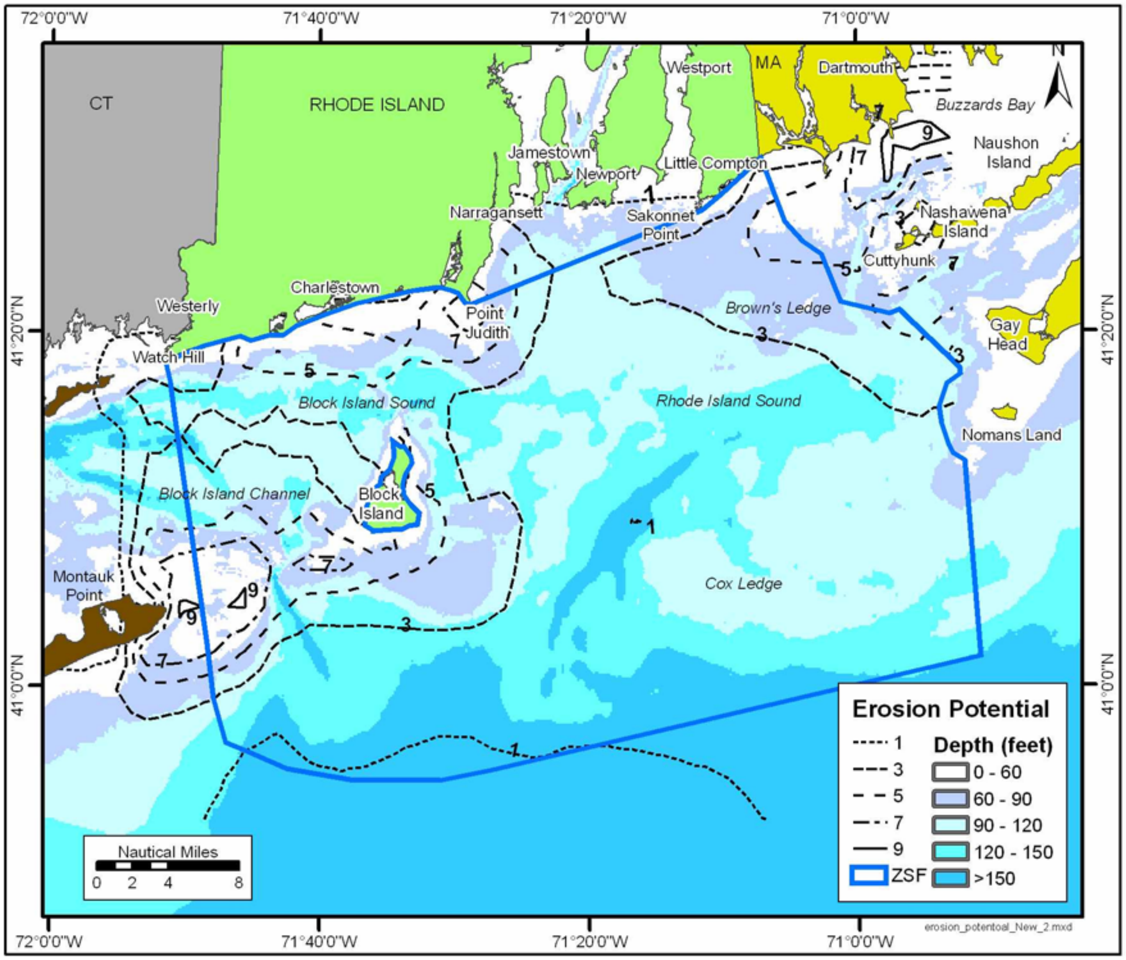


Figure 3-26. Predicted Sediment Erodability Parameter for 1.0-mm Grain Size for Typical Peak Tide and 1-Percent Frequency of Occurrence Wave Conditions.

Figure 3-26 shows the modeled areas of deposition (erodability parameter less than 1) in deep water offshore and in the central bathymetric depression of the ZSF. The figure also shows areas of infrequent reworking of bottom sediments (erodability parameter between 1 and 3) in the north-central portion of the ZSF and in central Block Island Sound (although the effect of the tidal currents in Block Island Sound may be underestimated based on the modeling results). For the unsheltered area of the outer ZSF, the model predicted that sediments were not expected to be resuspended at depths below 170 ft and would probably only occasionally be resuspended at depths below 105 ft. Inshore, it was more difficult to relate potential erodability to depth alone, because of the sheltering effect of Block Island and Martha's Vineyard on wave heights and the strong tidal currents between Block Island and Point Judith and between Block Island and Montauk Point. The relationship between erodability parameter and depth is presented in Figure 3-27.

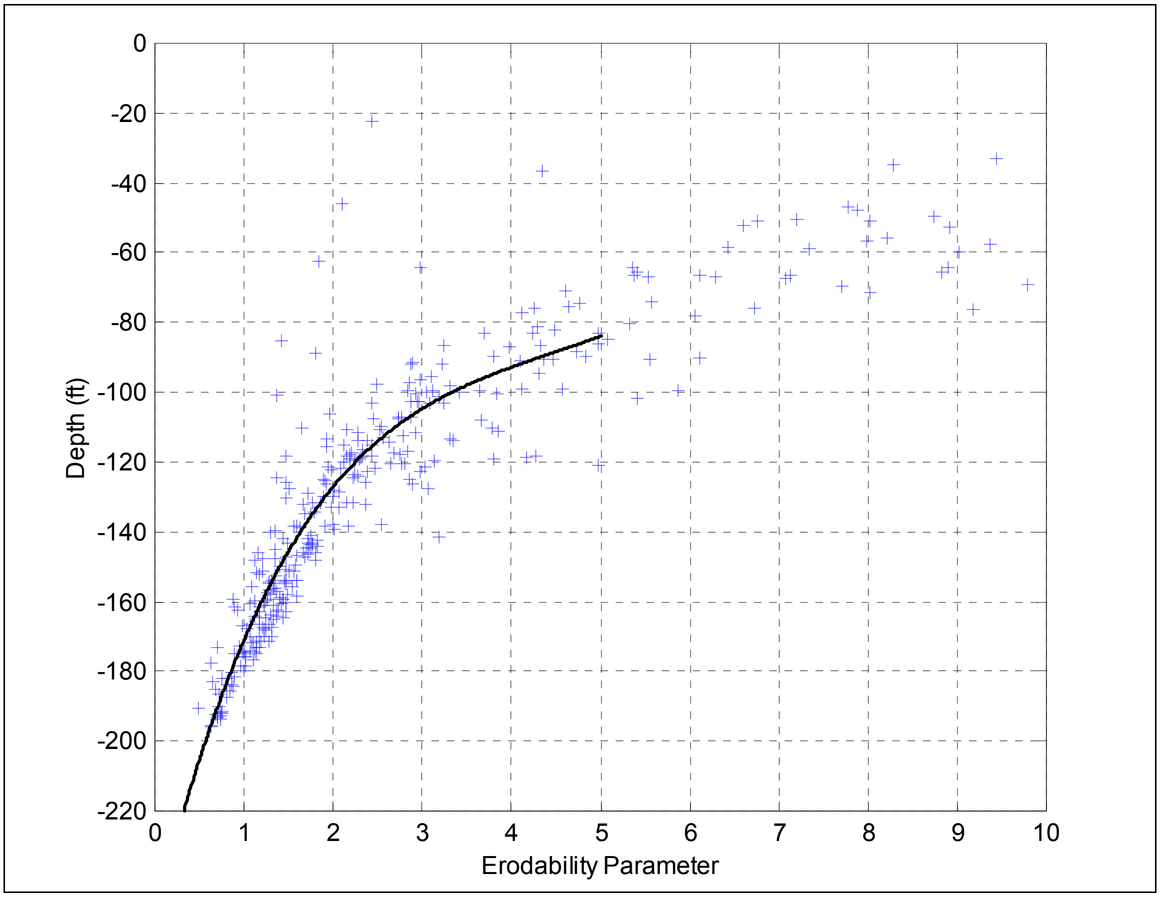


Figure 3-27. Predicted Relationship Between Depth and Sediment Erodability Parameter for 1.0-mm Grain Size, Typical Peak Tide, and 1-Percent Frequency of Occurrence Wave Conditions.

These results are consistent with observations of the surficial sediments of disposal mounds at Site 16, the historic disposal site. A mix of fine and coarse grained sediment was observed below a depth of approximately 90 ft, but coarse grains were observed in depths shallower than 90 ft (Corps, 1979). This indicated that the fine grains had been winnowed out by the action of waves in depths shallower than 90 ft. The model results were also consistent with the results of another modeling study performed as part of the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001c), which examined the likelihood of erosion and transport of cohesive sediments proposed for placement at Site 69B, located at a depth of 128 ft. Gailani *et al.* (Corps, 2001c) concluded that a disposal mound placed at Site 69B would not be dispersive under any conditions other than the most severe hurricane (50-year return period), which would at first seem inconsistent with these results; however, their results were based on an assumption of extremely cohesive sediments and should therefore be viewed as potentially underpredicting erosion. The critical shear stress required to initiate sediment motion used by Gailani *et al.*, determined from Providence River sediment cores (Sturm *et al.*, 2000), was 250 times higher than critical shear stress measured in sediments for disposal in the Portland, Maine Disposal Site

(Corps, 1998a). Thus, we would expect, within a range of typical critical shear stresses, to find occasional mobilization of bottom sediments at 128-ft depth.

Taken together, the characterization of sediment, the studies of continental shelf and ZSF-specific sediment transport, and the sediment transport modeling preformed for this Final EIS suggest that:

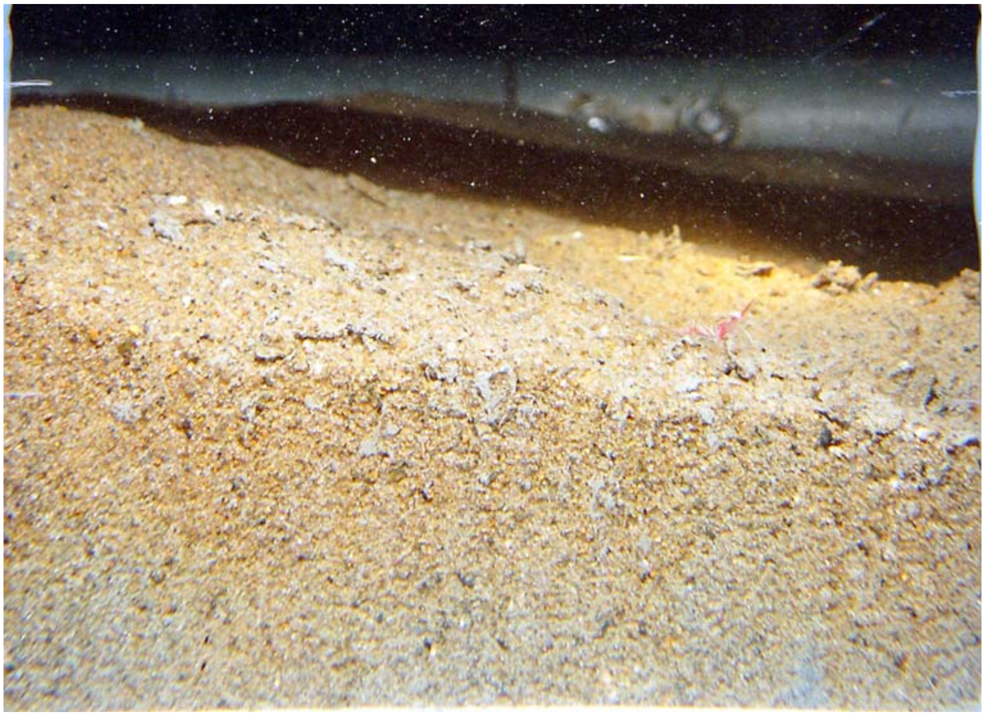
- Deep areas of the outer ZSF and the central bathymetric depression (deeper than 170 ft) are depositional in nature, except in some of the deep areas of Block Island Sound and Block Island Channel where strong tidal currents alone mobilized bottom sediments.
- Areas of the ZSF between 105 and 170 ft, including the north-central portion northeast of Block Island, are likely to be depositional with some infrequent sorting and reworking by waves and currents.
- Areas of the ZSF shallower than 105 ft likely experience occasional erosion and frequent sediment sorting and reworking by storm waves and tidal currents.

3.6.2 Site E

Direct observations of sediment transport can be made in the field using cameras or optical sensors placed on the seafloor to observe resuspension of sediment particles. Usually these direct measurements of sediment transport are made in conjunction with measurements of wave height and current to provide a more complete picture of the transport process. More frequently, however, only measurements of waves and currents are available. This requires the use of models to estimate sediment transport. Because sediment transport occurs during large, infrequent storms, observations of sediment transport (either direct or indirect) are best made over a long period of time, typically 6 months to several years. As discussed previously, the sedimentary environment can also be inferred from an examination of the sediments that are present on the seafloor, but this must be done with careful attention to the issue of availability of source material in order to avoid misinterpretation.

No site-specific measurements of the sediment transport, near-bottom currents, or waves have been made in Site E. The modeling study described earlier was performed on a scale large enough to model the entire ZSF with a coarse grid size (1.2 kilometers [km] by 1.2 km). At that scale, details of the sediment transport within Site E cannot be discerned. However, since Site E has a depth range of 125 to 133 ft, the model results would indicate that it would be expected to be depositional with some infrequent sorting and reworking by waves and currents (mobility parameter between 1 and 3). Care must be used in applying this interpretation, however, since the depth of Site E would place it closer to a mobility parameter of 1 rather than 3.

To clarify how frequently and to what degree bottom sediments in Site E may be reworked, transported, or both, sediment type mapping done in and around Site E was examined using the results of an SPI survey conducted during July 2003 (Corps, 2003f) and discussed in Section 3.5. The SPI survey revealed that throughout Site E, the bottom consisted of unconsolidated medium sand (Figure 3-28 presents a seafloor image typical of the site; more images from Site E are available in Corps, 2003f). Some fine sediment is visible below the surface in this image and in



Source: Corps, 2003f

Figure 3-28. Sediment Profile Image from Site E, Station E16 Acquired July 2003.

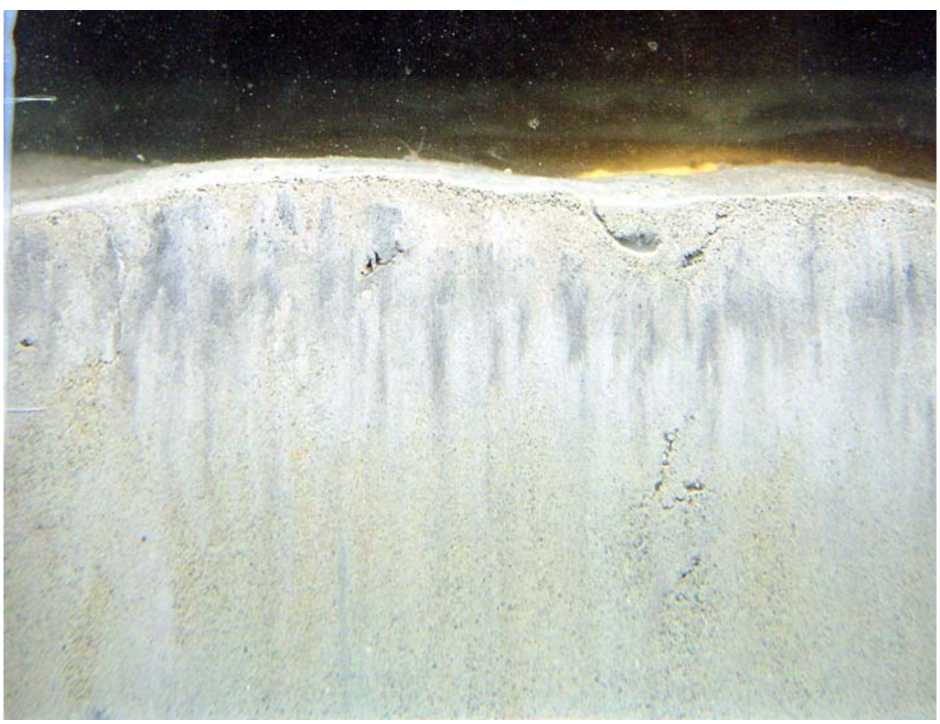
some of the other images collected in Site E. This suggests that fine material is available to the area but has been winnowed out of the surface layer during reworking of the sediments by waves and currents. This is supported by the fact that just outside the site to the east, a large area consisting of fine sediments (silty/sand and fine sand) was observed and indicates that there is no lack of fine material in the area. In addition, the side-scan survey conducted in July 2003 (Corps, 2003a) found sand waves present in the southeastern part of Site E. Sand waves are a clear indication of an energetic bottom environment where fine material is readily eroded and transported. These observations strongly suggest that Site E is a non-depositional environment where fine sediments (fine sands, silt, and clay) do not accumulate due to frequent reworking of the sediments by waves and currents.

3.6.3 Site W

No site-specific direct measurements of sediment transport have been made in Site W. Two short-term (1- to 2-month) indirect measurements (near-bottom currents and waves) were made (Corps, 2001b; Corps, 2003b), and these data were used to verify the sediment transport model results.

Bathymetric surveys of Site W have shown that the site encompasses a topographic depression with water depths around the boundary of the site generally around 120 ft and depths within the depression roughly 130 ft. The water depth in Site W ranges from a minimum of 116 ft in the southeast corner to a maximum of 132 ft in the depression. The sediment transport model results indicate that Site W would be expected to be depositional, with some infrequent sorting and reworking by waves and currents (mobility parameter between 1 and 3). Again, care must be used in interpreting the model results.

To clarify how frequently and to what degree bottom sediments in Site W may be reworked, transported, or both, SPI surveys conducted in the area (June 1997 and November 1999 [Corps, 1997], July 2003 [Corps, 2003f], and October 2003 [Corps, 2004a]) were reviewed. The results show that sediment texture at most stations sampled in Site W consisted of unconsolidated sediments made up of very fine sand mixed with silt and/or clay. Figure 3-29 presents a typical SPI image taken just outside the western boundary of Site W. Some stations along the northern boundary of the site consisted of a hard bottom of fine sand, while the southernmost stations consisted of very fine rippled sand. These areas correspond to shallower depth values. At several stations near the western boundary of Site W, SPI sampling in November 1999 revealed a thin silt layer over sand, suggesting recent deposition. Sediment profile images in the southeast-central portion of Site W, made in October 2003, frequently showed a depositional layer of fine sand over underlying dredged material (Corps, 2004a). Ripples observed in this sand layer were likely due to bedload transport of ambient fine sand during storm events. The side-scan survey conducted in July 2003 (Corps, 2003a) characterized the bottom throughout the depression as consisting of soft material. These observations suggest that Site W is predominantly a depositional environment, particularly in the depression, although some occasional reworking of bottom sediments by waves and currents, including the occasional transport of fine silt, does occur.



Source: Corps, 2003f

Figure 3-29. Sediment Profile Image from Site W, Station W15 Acquired July 2003.

3.7 WATER QUALITY [CFR 40 SECTION 228.6(a)(9)]

The quality of coastal water is generally determined by the amount of particles (turbidity), dissolved oxygen (DO) levels, nutrient and chlorophyll levels, and contaminant concentrations in the water column. These water quality parameters can be affected by direct inputs (e.g., continuous and periodic point source discharges, atmospheric sources, ocean disposal activities), indirect inputs (e.g., nonpoint sources), and secondary processes (e.g., remobilization from the seafloor, primary production by marine plants and animals).

3.7.1 Rhode Island Region ZSF

The number of field studies characterizing the quality of the waters of the ZSF is very limited, with most of the studies dating from the 1960s and 1970s (Collins, 1976; Day, 1960; Pratt *et al.*, 1975; Pratt and Heavers, 1975; Snooks *et al.*, 1977) (Figure 3-30). These works, including a more recent publication edited by Armstrong (1998), describe the turbidity and hydrographic structure of the water column. Pilson (1985) and Pilson and Hunt (1989) collected nutrient and metals data in water from the north-central region of the ZSF. Recent studies conducted in support of this Final EIS (Corps, 2002d; Corps, 2002e; Corps, 2003d) gathered physical and chemical information about the water column (i.e., temperature, salinity, density, turbidity, DO), including the concentrations of organic and inorganic contaminants, at several sampling locations farther offshore within the ZSF (Figure 3-30).

The Rhode Island Department of Environmental Management (RIDEM) has established water quality goals for all marine surface waters in Rhode Island that are classified by the water uses to be protected (RIDEM, 2000). These classifications consider public health, recreation, growth and protection of fish and wildlife, and economic and social benefits (Table 3-6). The highest classification for marine waters is the SA classification, which includes the most sensitive water uses (e.g., harvesting of shellfish for human consumption). The designated uses for SC-classified waters are the most restricted of these classifications (i.e., no shellfish harvesting or primary recreational contact). Physical, chemical, and biological criteria have been established as parameters of minimum water quality necessary to support these surface water use classifications. The waters of the ZSF within Rhode Island territorial waters are classified as SA waters. These waters are designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. These waters must be suitable for aquacultural uses, navigation, and industrial cooling and must have good aesthetic value.

Temperature, Salinity, and Density

The hydrographic structure (temperature, salinity, and density) of the waters of the ZSF has been well documented (Pratt *et al.,* 1975; Armstrong, 1998; Corps, 2002d; Corps, 2002e). Temperatures in the ZSF have a well-defined seasonal cycle that evolves from a vertically homogenous temperature structure in winter to weak stratification in summer. In late fall and winter, the water column in the ZSF is almost completely unstratified (constant density from surface to bottom) (Armstrong, 1998). Minimum temperatures in coastal waters (~0 to 3.3 °C)

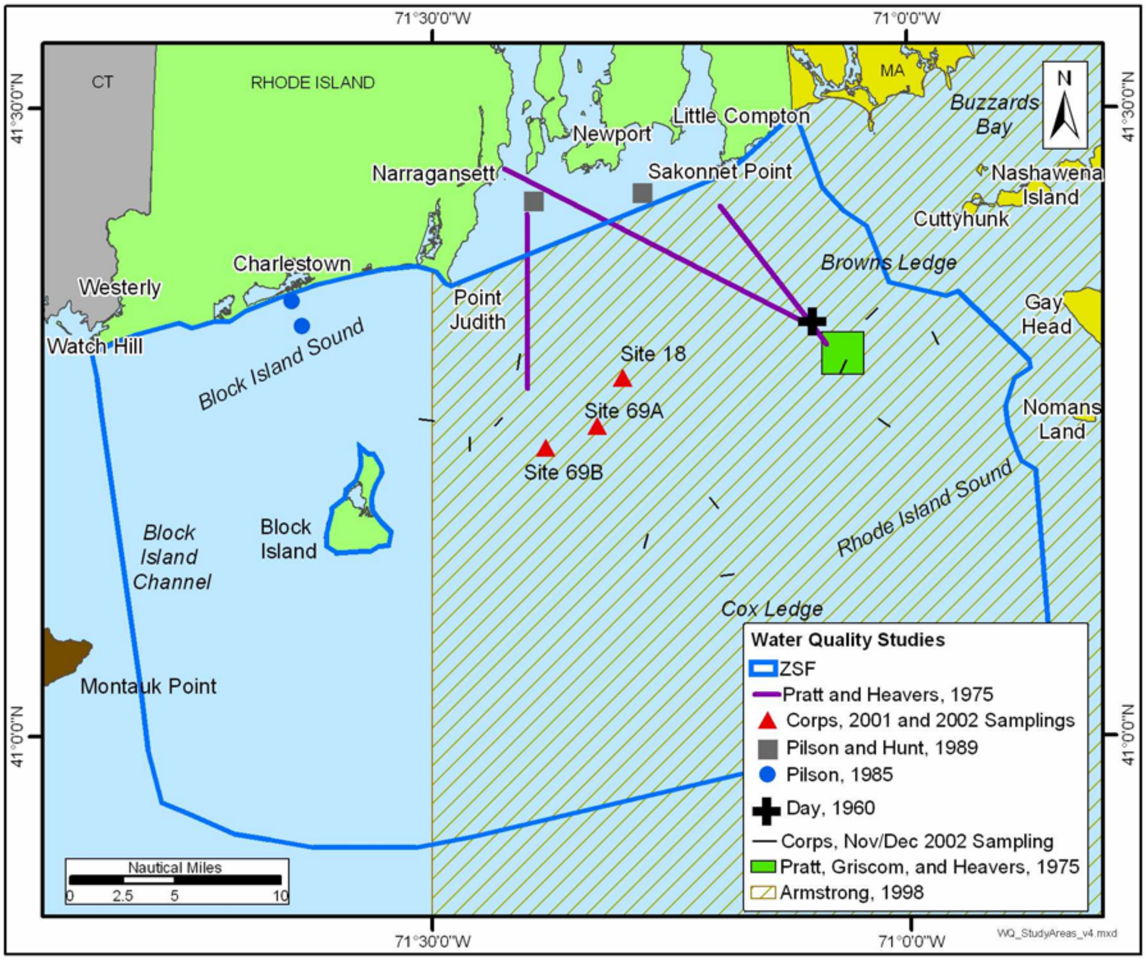
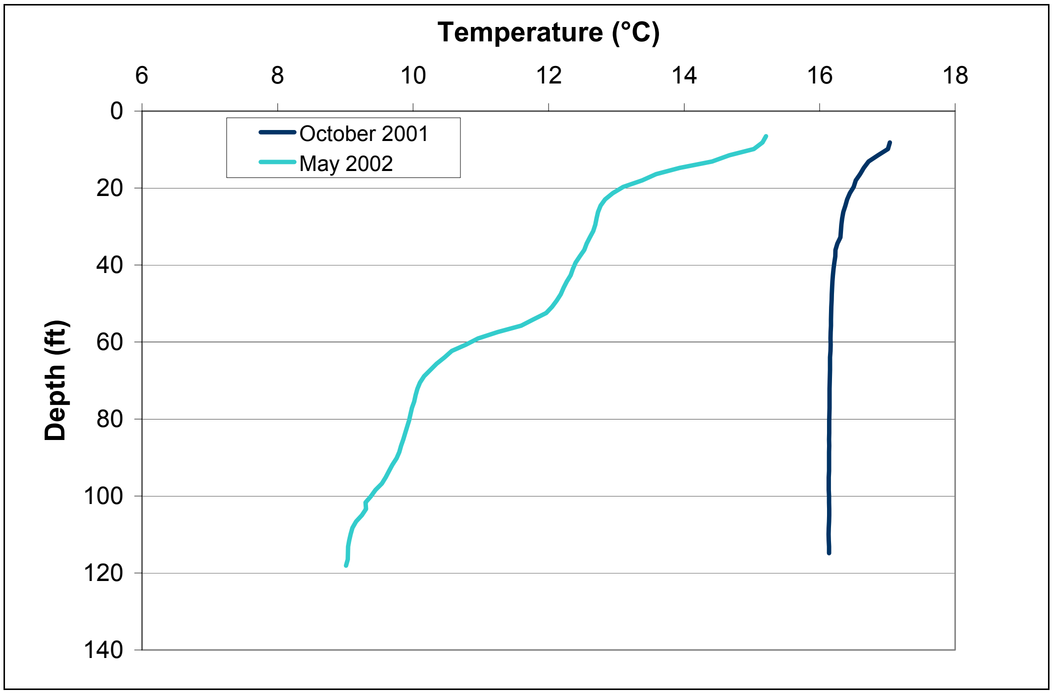


Figure 3-30. Location of Water Quality Studies Conducted in the ZSF.

generally occur during February, and midshelf waters (midway across the continental shelf at approximately 230 ft depth) are coldest in March (2.5 to 5.4 °C). Waters in the ZSF begin to stratify thermally in April, when surface waters warm rapidly. Water column profiles collected in the ZSF in May 2002 (Corps, 2002e) demonstrated the development of seasonal stratification with the presence of moderate temperature and density gradients from surface to bottom (Figure 3-31, Figure 3-32). The surface water in May 2002 was fresher and warmer than the bottom waters, possibly due to diurnal solar heating and runoff of freshwater (Figure 3-33). The thermocline intensifies and deepens through the spring and summer, with surface waters reaching their maximum temperatures in August (20.4 to 22.7 °C) (Armstrong, 1998). Pratt *et al.* (1975) reported water temperatures ranging from 11 °C in bottom waters to 18 °C at the surface in the vicinity of Browns Ledge (shown in Figure 3-30 in the northeast area of the ZSF) during June and July 1974. Snooks *et al.* (1977) observed a thermocline (rapid change in temperature over a short vertical distance) in the western portion of the ZSF (Block Island Sound) from May to August 1976.

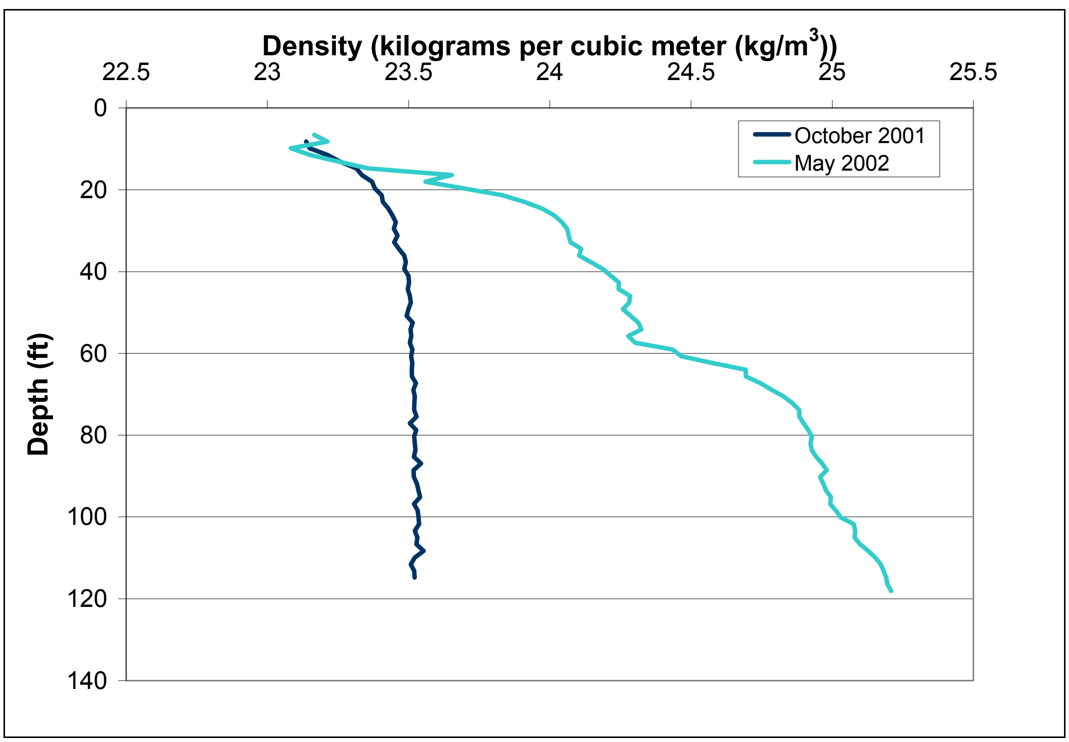
Table 3-6. RIDEM Water Quality Classifications.

Marine Water Classes	Designated Uses
SA	• Harvesting of shellfish for direct human consumption • Primary and secondary contact recreational activities • Fish and wildlife habitat • Aquaculture • Navigation • Industrial cooling • Good aesthetic value
SB	• Primary and secondary contact recreational activities • Shellfish harvesting for controlled relay and depuration • Fish and wildlife habitat • Aquaculture • Navigation • Industrial cooling • Good aesthetic value
SB1	• Primary and secondary contact recreational activities (primary contact activities may, at times, be impacted due to pathogens from approved wastewater discharges) • Fish and wildlife habitat • Aquaculture • Navigation • Industrial cooling • Good aesthetic value
SC	• Secondary contact recreational activities • Fish and wildlife habitat • Aquaculture • Navigation • Industrial cooling • Good aesthetic value



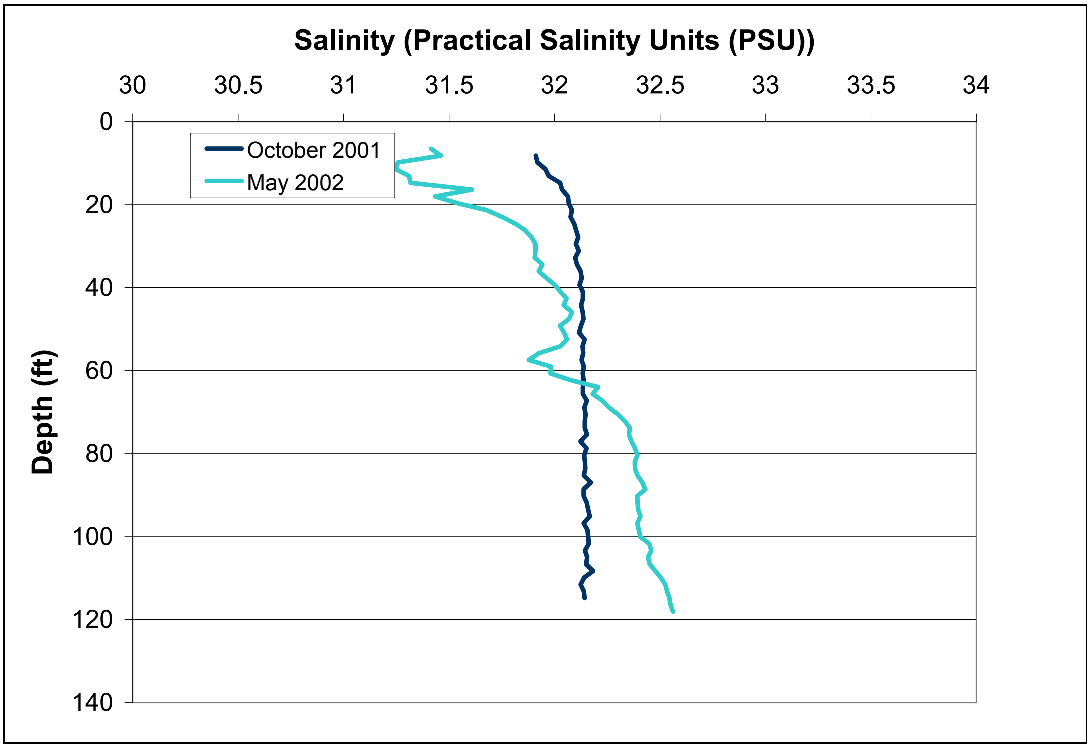
Source: Corps, 2002e

Figure 3-31. Temperature versus Depth in the ZSF (Site 69B) in October 2001 and May 2002.



Source: Corps, 2002e

Figure 3-32. Density versus Depth in the ZSF (Site 69B) in October 2001 and May 2002.



Source: Corps, 2002e

Figure 3-33. Salinity versus Depth in the ZSF (Site 69B) in October 2001 and May 2002.

In the fall, the thermocline breaks down as surface waters cool and storms begin to mix the water column. These processes usually cause the water column to become isothermal (constant temperature with depth) by October (Figure 3-31). Bottom waters of the ZSF are generally warmest in October and November (Armstrong, 1998). In October 2001, there was a difference of only 0.5 to 1.1 °C between surface (16.9 to 17.2 °C) and bottom (~120 ft) (16.1 °C to 16.5 °C) waters in the ZSF (Corps, 2002d). The mixing process also causes density and salinity to become fairly uniform throughout the water column, as shown for October 2001 (Figure 3-32, Figure 3-33).

Day (1960) found that tides and winds may also influence water temperature in the area. These are superimposed on the seasonal cycle described above.

Water Column Turbidity

Turbidity (clarity of water) relates to the levels of organic and inorganic particulate matter in water. Waters with higher levels of particulate matter have a higher turbidity. Water column turbidity can be affected by many factors, including growth of phytoplankton, river plumes, and energy events that resuspend sediments. High turbidity lowers water transparency, increasing light extinction (a measure of the penetration of light through water) and reducing the depth of the photic zone (the uppermost portion of the water column where sunlight penetrates). This may decrease primary production (synthesis of new plant matter through photosynthesis) of phytoplankton and, if sustained over long periods and spatial scales, may consequently decrease secondary (animal) production.

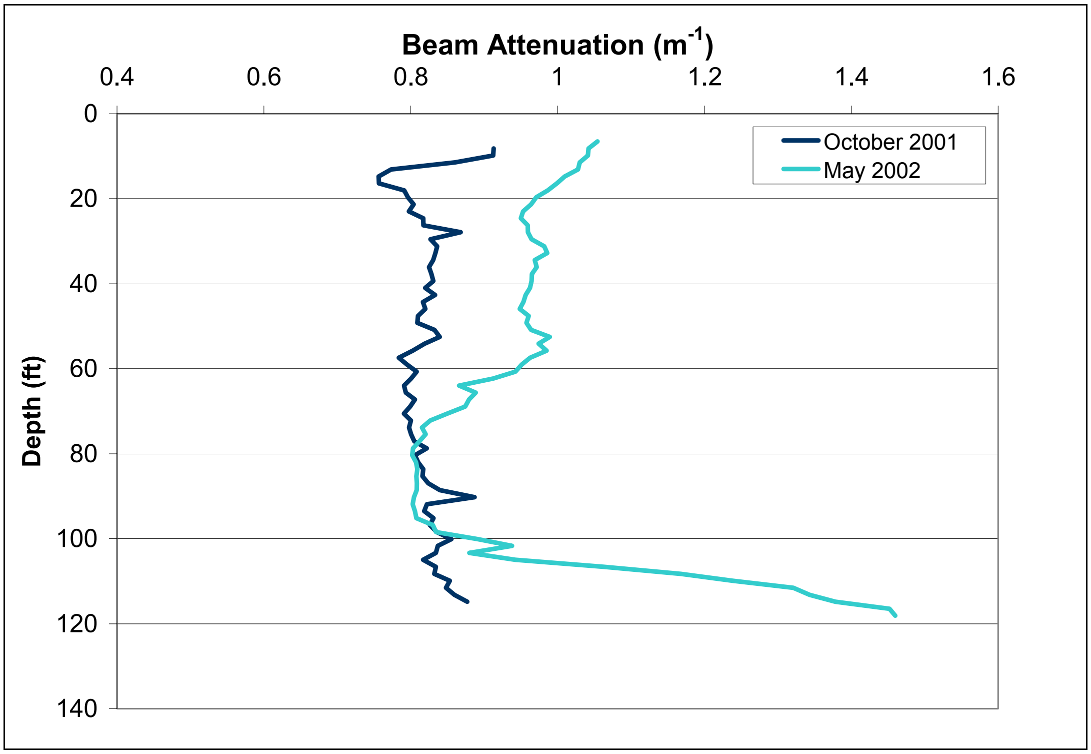
Turbidity can be measured in a number of ways, including the transmission or scattering of light, water clarity, or the concentration of particulate matter concentration. The majority of measurements reported for waters in the ZSF were based on total suspended solids (TSS). Several investigators have measured TSS in the ZSF since 1975, as shown in Table 3-7. The concentrations of TSS from all of these studies ranged from 0.1 milligrams per liter (mg/L) to 7.4 mg/L. Compared with other major estuaries, the background TSS appears to be relatively low in the ZSF. For example, the TSS during a normal tidal cycle in New Haven Harbor, Connecticut, ranges from 15 to 25 mg/L (Bohlen *et al*., 1996). In Massachusetts Bay, an area more like the ZSF, TSS ranges from 0.5 to 2 mg/L.

Table 3-7. Water Column Turbidity in the ZSF.

Study	TSS
Pratt and Heavers, 1975	0.1 – 7.4 mg/L
Collins, 1976	0.23 – 1.61 mg/L
Pilson and Hunt, 1989	0.33 – 3.79 mg/L
Corps, 2002e	0.51 – 1.42 mg/L
Corps, 2002d	0.28 – 1.26 mg/L

The measured concentrations of TSS in the Rhode Island Sound portions of the ZSF appear to be relatively consistent since the 1970s. Measurements from 2001 and 2002 (Corps, 2002d; Corps, 2002e) were within the range of historical values (Table 3-7). These values were also spatially consistent over different areas of the ZSF, indicating a generally clear water column within the region.

Pratt *et al.* (1975) found that dense offshore waters of the ZSF with low turbidity generally intrude under the more turbid surface waters of coastal Rhode Island. The turbid coastal surface waters extended as far south as Browns Ledge (see the northeast corner of ZSF in Figure 3-30). Turbidity profiles obtained by Pratt and Heavers (1975) found an increase in turbidity near the bottom, with a very well-developed bottom turbidity layer in the northwest portion of the ZSF. The near-bottom turbidity zone is typically caused by the resuspension of particulate matter by tides and waves. Data collected in October 2001 and May 2002 (Corps, 2002d; Corps, 2002e) also detected this feature and suggested that the turbidity of bottom waters was higher in May than in October (Figure 3-34). Resuspension of bottom sediments, along with remnant material from a spring phytoplankton bloom in the ZSF, are possible reasons for this increased bottom water turbidity in the spring.



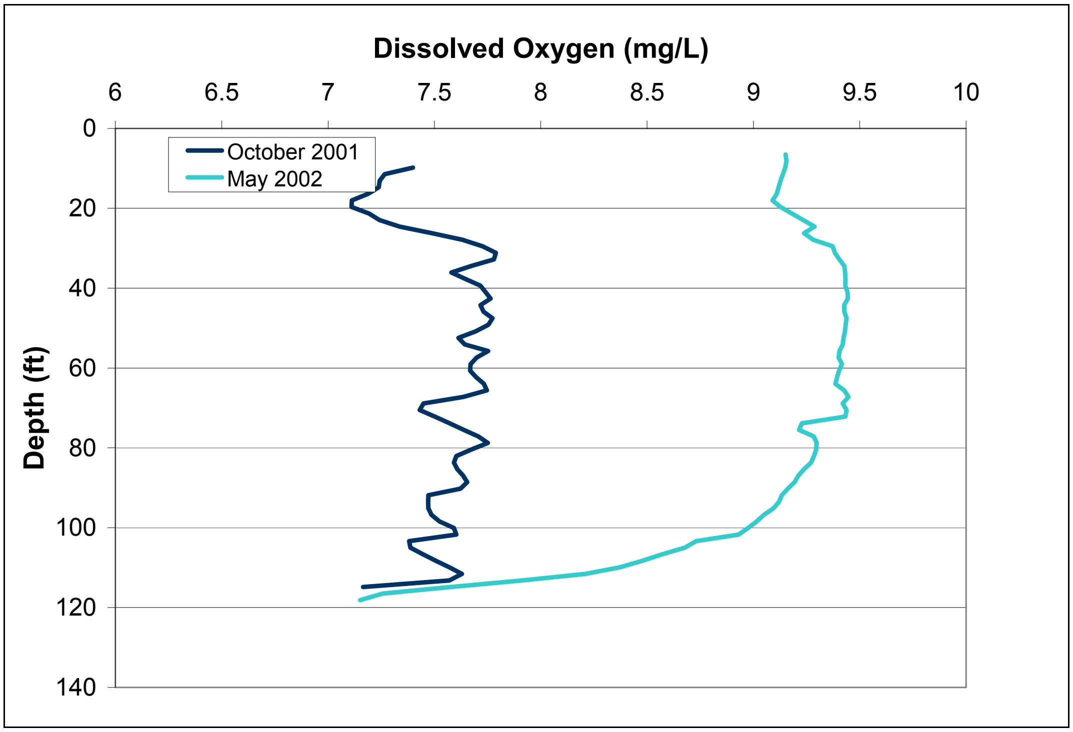
Source: Corps, 2002e

Figure 3-34. Beam Attenuation (A Measure of Turbidity) versus Depth in the ZSF (Site 69B) in October 2001 and May 2002.

Dissolved Oxygen

Dissolved oxygen is a measurement of the volume of oxygen contained in water and it indicates the ability of the water body to support a well-balanced aquatic faunal community. Levels of DO are controlled by physical factors (i.e., temperature and salinity) and biological factors (i.e., photosynthesis and respiration). In estuaries, DO concentrations can range from supersaturated (when primary production [photosynthesis] is high) at times to 0 mg/L (anoxia–a lack of oxygen). Exposure to DO concentrations of less than 2 mg/L for 1 to 4 days will kill most of the biota in an ecosystem. DO concentrations of greater than 5 to 6 mg/L are considered suitable for supporting aquatic life.

Concentrations of DO in surface waters within the ZSF ranged from 7.2 mg/L in October 2001 to 10.8 mg/L in December 2002 (Corps, 2002d; Corps, 2003d), well above the Rhode Island water quality criteria for DO for SA waters (6.0 mg/L) (RIDEM, 2000). These DO concentrations were similar to those measured by Pilson and Hunt (1989) in northern Rhode Island Sound in May 1986 (9.0 to 9.9 mg/L). The fall DO concentrations were homogeneous from surface to bottom in the ZSF and exhibited no appreciable increase or decrease in concentration at depths greater than 20 to 26 ft (Figure 3-35). The spring DO concentrations, however, began to decline at approximately 82 ft. Bottom-water DO concentrations in both the fall and spring ranged from 7.1 to 7.3 mg/L.



Source: Corps, 2002e

Figure 3-35. DO versus Depth in the ZSF (Site 69B) in October 2001 and May 2002.

DO concentrations in temperate marine surface waters are usually lowest in the fall, due to warmer water temperatures and lack of nutrients in surface waters to support primary production. DO concentrations in water near the seafloor are often lower than in surface waters due to oxygen consumption as organic matter decays. DO concentrations increase again during the winter, when water temperatures cool and the water column becomes well mixed. DO concentrations in the ZSF follow the expected trends, although the May 2002 sampling found a lower-than-expected DO concentration (7.2 mg/L) in the bottom waters. The low DO concentration may have been due to the degradation of remnant material from a spring phytoplankton bloom in Rhode Island Sound.

Nutrients

Nitrogen and phosphorus are the two major nutrients essential for primary production in the ocean. The availability of nitrogen in most marine waters typically limits the growth of phytoplankton, as this element is consumed before other nutrients, such as phosphorus. Other major nutrients, notably silicon, as well as many micronutrients and metals are also necessary for plant growth and may enhance or retard production based on local conditions.

Concentrations of ammonia (NH_3), nitrate and nitrite (NO_x), and inorganic phosphate (IPO_4) in the upper portion of the ZSF measured in fall 1985 and spring 1986 by Pilson and Hunt (1989) (Figure 3-30; Table 3-8) were higher in the fall than in the spring. Lower spring concentrations likely reflect utilization by phytoplankton during a winter/spring bloom period.

Table 3-8. Concentrations of Nutrients in Rhode Island Sound.

Date	TN µM	NH_3 µM	NO_x µM	TP µM	IPO_4 µM
Oct. 1985	13 - 28	0.8 - 1.18	0.8 – 3.4	2 – 2.6	0.5 – 1
Nov. 1985	16 - 22	1.7 - 2.1	1.8 – 2.9	2.6 – 3.2	1 – 1.1
Apr. 1986	7 - 11	0.2 - 0.5	0	1.5 – 2.7	0.3 – 0.4
May 1986	6 - 12	0.3 - 1	0.1 – 0.6	2 - 3	0.4 – 0.6

Source: Pilson and Hunt, 1989
TN = total nitrogen; NH_3 = ammonia; NO_x = nitrate and nitrite; TP = total phosphorus; IPO_4 = inorganic phosphate, µM = micromoles

Phosphate concentrations measured by Pilson (1985) in the northwestern portion of the ZSF (Figure 3-30) were generally between 0.35 micromoles (µM) and 1.0 µM during the months sampled. Total dissolved inorganic nitrogen ranged from approximately 2 µM to 9 µM, with concentrations being highest in January through March (Pilson, 1985). These concentrations represent the typical range of values seen in North Atlantic coastal waters.

Contaminants

Data on contaminant levels in the ZSF are very limited. However, organic contaminants (polychlorinated biphenyls [PCBs] and pesticides) measured in October 2001 and May 2002 in support of this Final EIS were generally undetected at the parts per trillion (pptr) level (Corps, 2002d; Corps, 2002e).

Concentrations of dissolved metals in the ZSF measured by Pilson and Hunt (1989) and the Corps (2002f and 2002d) were also low (Table 3-9). Dissolved metal concentrations appeared similar throughout the year and throughout the ZSF. Levels of dissolved metals measured in 2001 and 2002 in support of this Final EIS were generally comparable to historic data (Pilson and Hunt, 1989) and generally similar among the locations sampled (within a factor of two) for most metals. The distribution of dissolved metals within the water column varies with depth (higher in surface waters) due to the presence of the vertical salinity gradient in the ZSF during the spring and summer (Figure 3-33). When this gradient is present, surface waters are fresher than bottom waters. Because concentrations of metals tend to be higher in freshwater than in marine water, surface waters tend to have slightly greater metal concentrations than higher-salinity bottom waters.

Detected levels of organic and inorganic contaminants in the water column of the ZSF were well below the ambient water quality guidelines for toxic pollutants adopted by RIDEM (2000), as required by Section 303(c)(2)(B) of the Clean Water Act (Table 3-10).

Table 3-9. Concentrations of Dissolved Metals (ppb) in Water from the ZSF.

Metal	Fall 1985[a]	Spring 1986[a]	Fall 2001[b]	Spring 2002[c]
Arsenic (As)	NM	NM	0.82 - 1.21	0.97 - 1.17
Cadmium (Cd)	0.017 - 0.025	0.020 - 0.026	0.029 - 0.058	0.027 - 0.029
Copper (Cu)	0.25 - 0.52	0.15 - 0.42	0.24 - 0.92	0.31 - 0.39
Chromium (Cr)	0.098 - 0.16	NM	0.17 - 0.49	0.17 - 0.24
Mercury (Hg)	NM	NM	0.00030 - 0.0011	0.00062 - 0.00082
Nickel (Ni)	0.16 - 0.94	0.22 - 0.5	0.25 - 1.38	0.37 - 1.15
Lead (Pb)	0.012 - 0.035	0.0041 - 0.14	0.045 - 0.25	0.045 - 0.28
Selenium (Se)	NM	NM	0.038 - 0.11	0.013 - 0.045
Silver (Ag)	0.0015 - 0.0042	0.00054 - 0.0019	0.014 - 0.028	0.018 - 0.037
Zinc (Zn)	NM	NM	0.58 - 5.88	0.74 - 2.36

NM = Not measured
[a]Pilson and Hunt, 1989
[b]Corps, 2002d. Data were collected from Sites 18, 69A, and 69B. Note: Due to suspected sample contamination in some of the sample triplicates, one of three sample replicates analyzed during the October 2001 survey was eliminated from this analysis.
[c]Corps, 2002e. Data were collected from Site 69B only.

In summary, data characterizing the hydrographic structure (temperature, salinity, and density), turbidity, DO levels, and concentrations of nutrients and contaminants in the ZSF indicate that the waters of the ZSF are typical of New England offshore waters. Contaminant levels are low and do not appear to be directly affected by anthropogenic sources of pollution. DO and contaminant concentrations are well within the water quality guidelines established by the State of Rhode Island (RIDEM, 2000).

3.7.2 Site E

Site E is in the offshore open waters of the ZSF, distant from nutrient and contaminant sources. Although no recent or specific studies on water quality have been performed at Site E, its location gives no reason to believe that the water quality at this site would be any different than that described for the open waters of the ZSF in general. Rhode Island has designated these waters as "SA" (RIDEM, 2000).

3.7.3 Site W

Recent studies conducted within Site W (Corps, 2002d; Corps, 2002e; Corps, 2003d) gathered physical and chemical information about the water column (i.e., temperature, salinity, density, turbidity, DO), including concentrations of organic and inorganic contaminants. When compared to similar data collected elsewhere within the ZSF, the water quality at Site W was found to be consistent with and representative of the water quality of the ZSF in general. Rhode Island has designated these waters as "SA" (RIDEM, 2000).

Table 3-10. RIDEM Ambient Water Quality Guidelines for Toxic Pollutants.

Pollutant	Aquatic Life Criteria (ppb)		Average[a] Measured Value in the ZSF (ppb) (Corps, 2002d; Corps, 2002e)
	Saltwater (Acute)	Saltwater (Chronic)	
Arsenic (As)[b]	69	36	1.14
Cadmium (Cd)[b]	42	9.3	0.038
Chromium (Cr) VI[b]	1100	50	0.292
Copper (Cu)[b]	4.8	3.1	0.425
Lead (Pb)[b]	210	8.1	0.087
Mercury (Hg)[b]	1.8	0.025	0.001
Nickel (Ni)[b]	74	8.2	0.516
Selenium (Se)[b]	290	71	0.078
Silver (Ag) [b]	1.9	-	0.025
Zinc (Zn)[b]	90	81	1.44
PCBs[c]	-	0.03	0.02
Aldrin	1.3[d]	-	0.0009
Chlordane	0.09[d]	0.004	0.0004
4,4-DDT	0.13[d]	0.001	0.0002
4,4-DDE	-	-	0.0003
4,4-DDD	-	-	0.0002
Dieldrin	0.71[d]	0.0019	0.0004
Endosulfan (Alpha, Beta)	0.034[d]	0.0087	ND
Endosulfan Sulfate	-	-	ND
Endrin	0.037[d]	0.0023	0.0003
g-BHC (Lindane)	0.16[d]	-	0.0003
Heptachlor	0.053[d]	0.0036	0.0004
Heptachlor Epoxide	0.053[d]	0.0036	0.0003
Toxaphene	0.21	0.0002	ND

- = No criteria recommendation.

ppb = parts per billion

ND = Analyte was not detected in any of the samples analyzed (*n* = 40).

[a] Average measured values (*n* = 40) were calculated using the maximum detection limit (MDL) value for non-detected samples.

[b] Values for metals represent dissolved criteria using the EPA-recommended conversion factors, as listed: As = 1.000; Cd = 0.994; Cr (VI) 0.993; Cu = 0.83; Pb = 0.951; Hg = 0.85 (see note below); Ni = 0.990; Se = 0.998; Ag = 0.85; Zn = 0.946

NOTE: Conversion factors on this table were calculated for acute criteria only. Conversion factors for chronic criteria are not currently available. In the absence of chronic conversion factors, saltwater acute conversion factors were used. Chronic criteria for Hg cannot be converted to dissolved because it is based on Hg residues rather than toxicity.

[c] PCB criteria apply to each of the following:
PCB 1016, PCB 1248, PCB 1242, PCB 1232, PCB 1254, PCB 1260, PCB 1221

[d] The aquatic life criteria for these compounds were issued in 1980 utilizing the 1980 Guidelines for Criteria Development. The acute values shown are final acute values that, by the 1980 Guidelines, are instantaneous values as contrasted with a Criteria Maximum Concentration (CMC), which is a 1-hour average.

3.8 PLANKTON COMMUNITY [40 CFR SECTION 228.6(a)(9)]

Plankton are small, free-floating or weakly swimming organisms that drift through the water column. Despite their small sizes and short lifespans, plankton form the base of most of the ocean's food chains and have key ecosystem roles in the distribution, transfer, and recycling of nutrients and minerals. Plankton are divided into two major groups: phytoplankton and zooplankton. The phytoplankton community, consisting of unicellular plants such as diatoms and dinoflagellates, is the major contributor to primary production (the conversion of inorganic materials to organic products by photosynthesis) in the sea. Phytoplankton often rapidly grow into large aggregates or blooms. Subsequent decomposition of the dead phytoplankton can lead to local depletion of oxygen in the water. Some phytoplankters are toxic and their blooms contribute to fish kills and shellfish poisoning. The zooplankton community, consisting of microscopic animals, includes the primary consumers of phytoplankton and consumers of other zooplankton. Consequently, zooplankters play a central role in the functioning of marine ecosystems. Zooplankters include animals that spend their entire lives in the plankton community (holoplankton) and the larval forms of many species of invertebrates and fish that are part of the planktonic community for only a short time (meroplankton). Important zooplankton include unicellular (Foraminifera, Radiolaria) and multicellular animals (copepods).

3.8.1 Rhode Island Region ZSF

Few studies focus on plankton communities in the area of the ZSF. Information about plankton within and near the ZSF was compiled from studies of the southern New England shelf area, which includes the Rhode Island Sound area and lower regions of Narragansett Bay. Sherman *et al.* (1988) summarized the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) surveys (1977–1987) in the southern New England region, which included the ZSF and the outer waters of the shelf. Consequently, the description of plankton is generally applicable to Rhode Island Sound but not specific to the ZSF. Because of the paucity of information within the ZSF, phytoplankton species composition and abundance data from the lower regions of Narragansett Bay, which is well-mixed and strongly influenced by marine waters, were also examined to characterize the plankton community within the ZSF (Kremer and Nixon, 1978; Karentz and Smayda, 1984).

Phytoplankton

Phytoplankton communities are characterized by large spatial and temporal fluctuations in abundance. Most of the phytoplankton present in the ZSF fall into two broad categories: the diatoms, with two glass-like shells composed of silica that fit together, forming a protective box; and the dinoflagellates, with one or more whip-like appendages that propel them through the water.

Phytoplankton Species Composition in the ZSF: Small diatoms such as *Leptocylindricus danicus*, *Skeletonema costatum*, and *Thalassiosira nordenskioldii* predominate in southern New England and Rhode Island Sound coastal waters from February through April, accounting for 75 percent of the phytoplankton abundance (Falkowski *et al.*, 1988; Sherman *et al.*, 1988). By May, phytoplankton abundance is reduced to levels observed in early February. *Skeletonema costatum* dominated the shelf area from August to October, reaching maximum concentrations nearshore of 73 x 10^6 cells per cubic meter (m^3). Falkowski *et al.* (1988) found a distinct diatom assemblage characterized by *Rhizosolenia delicatula* at the most nearshore sampling station (just within the 164-ft isobath) in Rhode Island Sound. Diatom species widespread throughout the region included *Nitzschia seriata*, *Rhizosolenia hebetate*, and *R. shrubsoleia*. *Hemiaulus sinensis*, *Leptocylindricus danicus*, three *Nitzschia* species, *R. delicatula*, and *Thalassionema nitzschoides* are other common diatoms in shelf or Rhode Island Sound waters (Marshall and Cohn, 1980; Falkowski *et al.*, 1988). Farther offshore, diatoms and dinoflagellates were about equally abundant (Falkowski *et al.*, 1988). Small naked (shell-less) dinoflagellates, including several *Gymnodinium* species, were abundant. Additional dinoflagellates common offshore included *Ceratium lineatum*, *C. trichoceros*, *Dinophysis fortii*, and *Prorocentrum micans* (Marshall and Cohn, 1980). The phytoplankton assemblage in the vicinity of Rhode Island Sound may receive seed populations from Georges Bank and Nantucket Shoals, Massachusetts, that may be modified by biological and physical processes during transport (Falkowski *et al.*, 1988). The phytoplankton assemblages occurring at any specific site in the sound may differ because as waters move southwest across the shelf, phytoplankton may either be grazed, grow differentially, or sink. Many of the species described by Falkowski *et al.* (1988) within the study area were also noted by others to occur there or in contiguous waters.

Data collected within Rhode Island Sound near the mouth of Narragansett Bay indicated that, in general, the species present at the mouth of Narragansett Bay also occurred throughout the Bay, but at lower levels of abundance. At the mouth of the Bay, there was a modest bloom in the winter-spring (cell counts to about 4,000 cells per milliliter [mL]) and a minor bloom in the late summer (cell counts to about 1,000 cells/mL) (Martin, 1965). A systematic increase in phytoplankton (total cell counts and biomass) occurred from the mouth to the upper Bay throughout the annual cycle. Farmer *et al.* (1982) found that phytoplankton biomass along a transect extending from Rhode Island Sound to upper Narragansett Bay and lower Narragansett Bay was low and relatively constant, while abundance and variability increased two- to four-fold in the upper Bay.

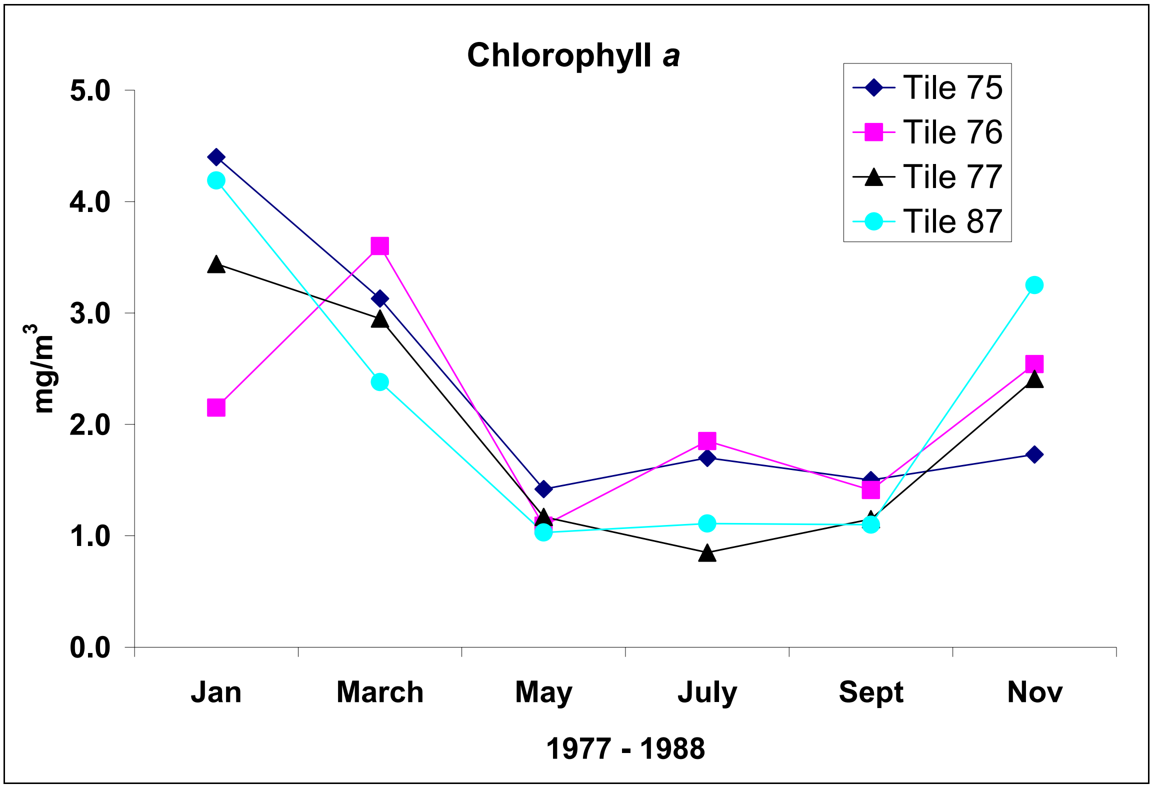
Ocean currents transport most of the phytoplankton found in Narragansett Bay from Rhode Island Sound (Hargraves, 2003); therefore, the species identified by Hargraves (1988) for the Bay are indicative of phytoplankters likely to occur in Rhode Island Sound. The most abundant species present during winter in Narragansett Bay and the adjacent Rhode Island Sound were species having northern or world-wide distributions (Hargraves, 1988). However, the summer flora was a variable mixture of warm-water and cosmopolitan species dominated by flagellates or diatoms.

Seasonal Distribution of Phytoplankton in the ZSF: Annual changes in abundance and species composition are key features of phytoplankton community structure, particularly in temperate marine waters. Typically, diatoms dominate during the winter-spring bloom, and flagellates are more abundant in the summer in Rhode Island Sound. Measurements of chlorophyll *a*, a traditional measure of phytoplankton biomass, indicate that phytoplankton biomass within the ZSF varies considerably at all temporal and spatial scales. Despite this variability, phytoplankton biomass shows a large-scale seasonal cycle in Rhode Island Sound. A classical winter-spring phytoplankton bloom occurs in Rhode Island Sound (first documented by Riley, 1952), with the highest seasonal biomass occurring during February–March (O'Reilly and Zetlin, 1998). The bloom size may be partly regulated by zooplankton, which show greater feeding activity during the summer when water temperatures are warmer than those encountered during spring (Keller *et al.*, 1999). Generally, the winter-spring bloom appears earlier (January–February) in nearshore areas and later (March–April) offshore. The magnitude of the winter-spring bloom and overall seasonal biomass decreases farther offshore in Rhode Island Sound. During the April–June period, biomass decreases in offshore waters of Rhode Island Sound but remains somewhat elevated near estuaries. The low point of the annual cycle occurs during July–September, when the water column becomes stratified (warm surface waters are layered over colder subsurface layers) and subsurface chlorophyll maxima are associated with the thermocline (a sharp boundary between warm and cold water layers) along shelf waters. Water column chlorophyll *a* concentrations increase during the October–December period; however, standing stocks during the fall bloom are lower than those in spring (Figure 3-36).

Environmental Factors Affecting Phytoplankton in the ZSF: Environmental variables that control phytoplankton dynamics in Rhode Island Sound include light, temperature, nutrients, grazing, and species interactions. Water column characteristics such as turbulence, turbidity, stratification, and current patterns also affect species distributions. Rhode Island Sound waters are well-mixed during winter and stratified during summer, except when storms and upwelling and downwelling events cause vertical mixing in shallow coastal areas (Ingham and Eberwine, 1984). Nearshore waters are more turbid than deeper waters because of estuarine outflow and sediment resuspension, which limits light penetration into the water column and reduces photosynthesis.

During winter-spring, phytoplankton are most abundant in nearshore areas of Rhode Island Sound adjacent to the mouths of estuaries. Diatom dominance during the spring bloom and flagellate dominance after the onset of stratification may result from their different physiological requirements (Anderson and Nival, 1987). Williams (1964) and Malone (1971) hypothesized that the small flagellates are better able to take up nutrients, which are in short supply at the end of the bloom. Temperature also may be important for the summer increase in small flagellates because some grow better at temperatures greater than 15 °C. During October–November, the fall bloom period, as silica becomes more available, diatoms again increase in numbers but generally not to the levels seen in the spring. Minor, short-duration blooms may occur outside of the spring and fall bloom periods (O'Reilly and Zetlin, 1998).

Blooms in Rhode Island Sound begin when a critical light intensity threshold (about 40 langleys per day) is reached (Riley, 1952). Blooms end as nutrients in surface waters decrease with the onset of stratification in late spring and as grazing pressure increases. Fall blooms occur as nearshore waters destratify and nutrients increase through water column mixing or regeneration (O'Reilly and Zetlin, 1998). The extent of the fall bloom depends on the offset between nutrient-enhanced growth and decreased light in the deepening mixing zone. Decreased zooplankton grazing pressure also contributes to the fall bloom (Sherman *et al.*, 1987).



Source: O'Reilly and Zetlin, 1998

Figure 3-36. Mean Water Column Chlorophyll *a* Concentrations by 2-Month Periods for Areas (Tiles) in Rhode Island Sound (1977–1988 MARMAP Program).

Nuisance Phytoplankton Species in the ZSF: Several phytoplankters are called nuisance or toxic-bloom species (Nelissen and Stefels, 1988; Paerl *et al.*, 1998) because they are poisonous to fish and zooplankton, cause paralytic and diarrhetic shellfish poisoning in humans, or form toxic red tides. Most marine nuisance species are dinoflagellates (Paerl *et al.*, 1998). Anderson *et al.* (1982) found overwintering cysts, which are linked to recurrent red tide blooms, of the potentially toxic red tide species *Alexandrium tamarense* from nine estuaries in the vicinity of Rhode Island Sound and concluded that the potential for outbreaks in the area was significant. At least two additional nuisance species (*Phaeocystis pouchetti* and *Gymnodinium* sp.) occur in Rhode Island Sound. Other toxic species (*Olisthodiscus luteus*, *Dinophysis acuminata*, *Amphidinium* spp., and *Gyrodinium aureolum*) occasionally reach bloom concentrations in Narragansett Bay and may occur in the nearby waters of Rhode Island Sound (Oviatt *et al.*, 1989; Hargraves, 1988).

A major bloom of a previously unidentified alga, *Aureococcus anophagefferens*, occurred in 1985 in Narragansett Bay and extended into Rhode Island Sound (Sieburth *et al.*, 1988; Tracey, 1988). Populations of this small phytoplankter grew very dense (1×10^6 cells per mL in the nearshore region of Rhode Island Sound) (Tracey, 1988). The bloom, or "brown tide," interfered with the feeding of many filter feeders and caused shellfish mortalities, particularly mussels and bay scallops. The bloom had significant adverse effects on zooplankton, benthic larval abundance, anchovy fecundity, and kelp beds (Smayda and Fofonoff, 1987). Brown tide outbreaks have continued to occur along the southern New England coast since 1985; however, the reasons for the global increase in harmful bloom events remain unknown (Hargraves and Maranda, 2002). The threat of toxic events increases with the spread of causative species and may be related to subtle environmental changes that create conditions conducive to bloom development.

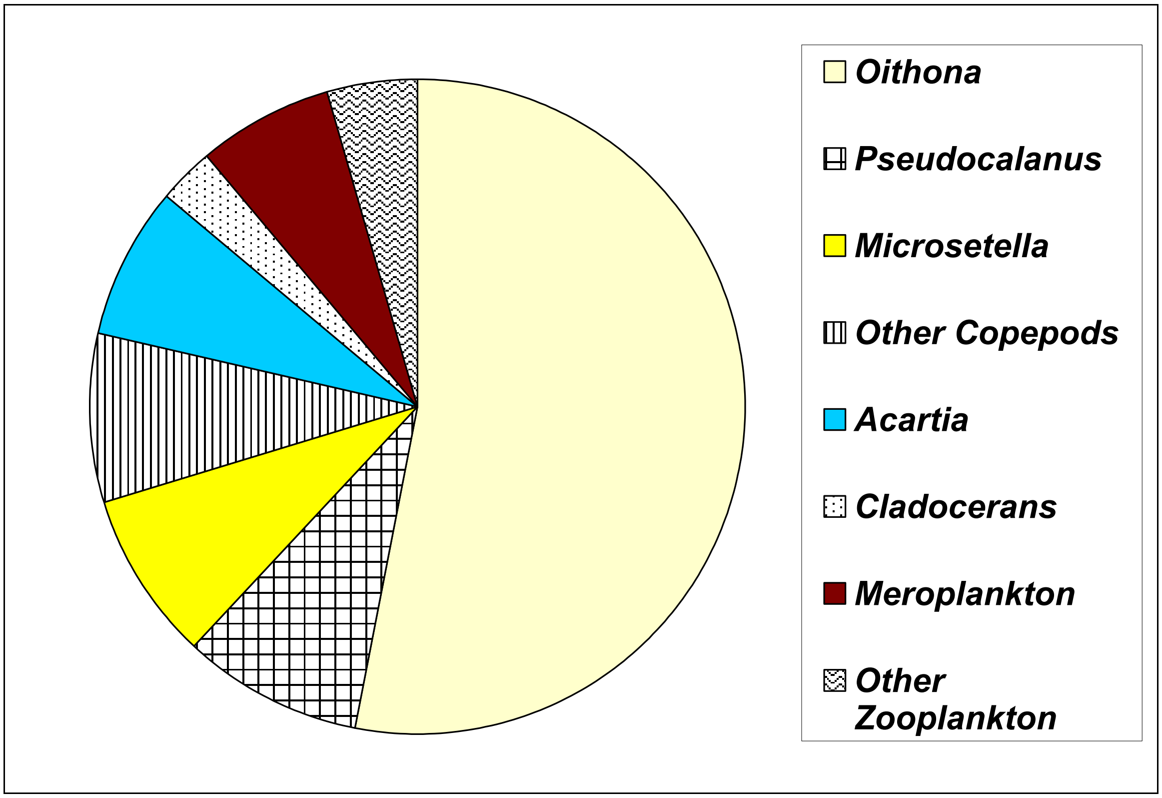
Zooplankton

Holoplankton are usually the dominant form of zooplankton present in the ZSF. However, meroplankton may predominate for a short time in summer when invertebrate larvae are abundant.

Zooplankton Species Composition in the ZSF: The MARMAP surveys in southern New England waters (1977–1988), used a large-mesh (333-micrometer [μm]) plankton net to collect zooplankton; therefore, many smaller zooplankton such as *Oithona* spp., copepod nauplii, and copepodites may be underrepresented in the survey data. These surveys, however, provide the most comprehensive plankton composition data for the ZSF.

In southern New England waters, zooplankton biomass is greatest in the spring, when it undergoes a two-step increase. The most rapid increase occurs from late winter to early spring, with a secondary increase from spring through late summer. Biomass declines from summer through fall. Sherman *et al.* (1988) noted that many taxa (394) were represented in the shelf zooplankton, but only 12 taxa, all copepods, comprised 85 percent of the dominance: *Acartia hudsonica*, *A. tonsa*, *A. longiremis*, *Calanus* spp., *Calanus finmarchicus*, *Centropages hamatus*, *Centropages typicus*, *Metridia lucens*, *Oithona* spp., *Paracalanus parvus*, *Pseudocalanus minutus*, and *Temora longicornis*. In southern New England waters, three species (*Pseudocalanus minutus*, *Centropages typicus*, and *Calanus finmarchicus*) accounted for 75 percent of the total dominance. *Pseudocalanus minutus* was the dominant copepod early in the year, succeeded by *C. typicus* in the early summer. An important missing component was *Oithona* spp., a cyclopoid copepod that is too small to be adequately sampled with the 333-μm mesh net. Other seasonably important zooplankton included the cladocerans (water fleas) *Penilia avirostris* and *Evadne nordmanni*, barnacle larvae, the chaetognath *Sagitta elegans,* and decapod larvae.

In a 1959–1962 study in Rhode Island Sound near the mouth of Narragansett Bay, Martin (1965) observed 26 species of copepods, 21 additional species of holoplankton, and 8 benthic taxa. Copepods accounted for more than 70 percent of the zooplankton throughout the annual cycle. Peak zooplankton occurrence (averaged by month) occurred in July, with a secondary peak in October. *Oithona* spp. was the predominant copepod present, followed by *Pseudocalanus minutus, Microsetella norvegica*, and *Acartia hudsonica* (Figure 3-37).



Source: Martin, 1965

Figure 3-37. Relative Abundance of the Dominant Zooplankton Species or Groups at the Mouth of Narragansett Bay.

Calanus finmarchicus and *Centropages typicus* were more abundant in the later surveys; *Oithona* spp. was more abundant in nearshore waters but was most likely undersampled in the offshore waters because of the large mesh size of the nets used there.

Durbin and Durbin (1988) summarized the status and trends for zooplankton in Narragansett Bay. They noted that zooplankton communities in Narragansett Bay and adjacent areas behave as a single entity with simultaneous changes occurring throughout the region. They concluded that the zooplankton community of Narragansett Bay was similar to other open-water coastal areas in the northeast, and that many of the species present in the Bay also occur in Rhode Island Sound. The predominant copepods in Narragansett Bay were *Acartia* spp., *Oithona* spp., *Centropages* spp., and *Pseudocalanus minutus*. With the exception of Martin's (1965) findings, *Acartia* spp. tended to be the dominant copepod found by most of the surveys. However, Durbin and Durbin (1988) noted that the abundance of *Acartia hudsonica*, *A. tonsa*, *Hemicyclops*, *Eurytemora*, *Podon* spp., bivalve larvae, and polychaete larvae decreased along a 21-nmi transect from the upper Bay to outside the Bay. The switch in dominance from *Acartia* to *Oithona* may occur with distance offshore or may represent interannual variability in dominance among years. Species that tended to become more abundant at the mouth of the Bay and in Rhode Island Sound included *Acartia longiremis, Calanus finmarchicus, Temora longicornis, Oncea* spp., *and Penilia avirostris*, species that are typically oceanic or coastal species.

The zooplankton community in the lower regions of Narragansett Bay was generally representative of that occurring in the shallower regions of Rhode Island Sound. Durbin and Durbin (1988) concluded that between 1950 and 1986, there were no major changes in zooplankton composition or in the abundance of different taxa within the community. They further noted considerable interannual variability among surveys and large seasonal variations in the abundance of major taxa. There have not been more recent studies of similar sampling intensity in the area. However, there is no reason to suspect that zooplankton species or abundances in offshore waters are different now than in the mid- to late 1900s.

Seasonal Distribution of Zooplankton in the ZSF: Zooplankton abundance in the ZSF peaks in early- or mid-summer and then declines as predation by benthic filter feeders and comb jellies (ctenophores) increases. Within Narragansett Bay and, by inference, Rhode Island Sound, ctenophore predation pressure was particularly prevalent during July and August (Hulsizer, 1976). Ctenophores were abundant from June to November 2000–2001 at a single station sampled in Rhode Island Sound, with peak abundances from June through August (Klein-MacPhee, 2003). The occurrence of gelatinous zooplankton may be increasing with ctenophores now present throughout most the year, although abundances vary annually.

The abundance of meroplankton increases in spring as benthic organisms spawn. As summer approaches, competition for limited food resources (phytoplankton or smaller zooplankton) and increased seasonal grazing pressure cause zooplankton abundance to decrease during the late summer to early fall. A second, brief increase in zooplankton abundance tends to accompany the fall phytoplankton bloom.

Sherman *et al.* (1988) found that *Pseudocalanus minutus* was the most abundant copepod present from winter through spring and that it was replaced by *Centropages typicus* from summer through fall. The standing stock of *Calanus finmarchicus* peaked in early spring, was low during the late spring and summer, and was more variable than for the other two species. Other common late spring and summer zooplankton were cladocerans, echinoderm larvae, salps, and barnacle larvae.

Oithona spp. occurred year-round in Rhode Island Sound near the mouth of Narragansett Bay, with peak abundances in July through October (Martin, 1965). *Pseudocalanus minutus* was present in all months, but most abundant from February through July. *Microsetella norvegica* was most abundant in November but was not common throughout the summer. *Acartia hudsonica* was present from November through July but absent during the summer and early fall. In coastal waters, *A. hudsonica* typically reached peak abundance during the spring and virtually disappeared from the plankton community in late summer to fall (Conover, 1956; Durbin and Durbin, 1981).

Although decapod larvae are not abundant zooplankters in Rhode Island Sound, their abundance and survival in offshore areas may be linked to future recruitment success in adjacent estuaries. Larvae developing in offshore waters are a potentially important component of recruitment to the estuary. Maintenance of stable decapod populations of some commercially important species within the adult estuarine habitat may depend on reinvasion by late-stage larvae or juveniles.

Decapod larvae were present in Rhode Island Sound from May–October, with a peak occurrence in July–August (Martin, 1965; Frolander, 1955).

Two dominant decapods in coastal waters from Nova Scotia to the mid-Atlantic Bight, including the ZSF, are rock crab (*Cancer irroratus*) and Jonah crab (*Cancer borealis*). Clancy and Cobb (1991) reported larval crabs in Block Island Sound in excess of hundreds per cubic meter in the plankton. These values are at least three orders of magnitude greater than levels reported for similar crab species elsewhere. The elevated abundances may be the result of unequal larval mortality or some physical or behavioral mechanism. The elevated larval abundance suggested that Block Island Sound may be a unique habitat for *Cancer* spp. larval populations.

Environmental Factors Affecting Zooplankton in the ZSF: In addition to competition and predation, temperature, food availability, currents, and water column structure are important controls of the temporal and spatial variability of zooplankton populations. Growth and production rates in copepods depend on food availability and temperature. Temperature is positively related to growth rate (Landry, 1975) and egg production (Uye, 1981) in copepods. Checkley (1980) and Durbin *et al.* (1983) noted a positive correlation between copepod growth, egg production, and phytoplankton biomass. Wishner *et al.* (1988) suggested that one possible explanation for the aggregation of zooplankton into dense clusters, termed patches, may simply be a response to high phytoplankton abundance leading to zooplankton population increases through trophic interactions. Other possible explanations include physical concentrating mechanisms (currents and weather fronts), species-specific swarming, and elevated predation outside the patch.

Sullivan (1993) clearly demonstrated that the presence of a pycnocline has important effects on coastal zooplankton populations independent of temperature effects. Stratified waters were associated with high abundance of cyclopoid copepods, such as *Oithona* spp., which are more typical of intermediate to offshore waters. Calanoid species were typically present in well-mixed water columns and were considerably less abundant.

Lamoureux (1967) found that among 16 stations in Block Island Sound in July 1967, the highest displacement volumes (measures of abundance) were in the northeast section; and the lowest displacement volumes were at the southern and southwestern edge of Rhode Island Sound. The reduced plankton volumes at the southwestern edge of Rhode Island Sound were believed to be associated with the higher current speeds there (Lamoureux, 1967). The species composition in Block Island Sound was the same as that from a single station close to the mouth of Narragansett Bay (Martin, 1965).

In summary, the phytoplankton and zooplankton populations within the ZSF fluctuate annually and seasonally. Phytoplankton species and abundance are affected by environmental factors such as water temperature, nutrient abundance, and water column turbulence and stratification. Phytoplankton populations within the ZSF are influenced by the presence of certain zooplankters and the grazing of those zooplankton on the existing phytoplankton species. Zooplankton populations are also influenced by some of these factors. Additionally, the presence of various finfish that prey upon zooplankton influences the zooplankton species that are present within the ZSF and their abundances.

3.8.2 Alternative Sites

There have not been any recent studies specifically examining the phytoplankton or zooplankton communities at either of the two alternative sites. Each site is located within the open waters of the ZSF, where the primary factors controlling fluctuations in plankton communities are water temperature, nutrient abundance, water column turbulence and stratification, and the presence of predators. The information about plankton communities in general gives no reason to conclude that the plankton community at each alternative site differs from that described for the open waters of the ZSF.

3.9 BENTHIC INVERTEBRATES [40 CFR SECTIONS 228.6(a)(2) AND 228.6(a)(9)]

The benthic community refers to those invertebrate organisms (e.g., mollusks [clams], crustaceans [crabs], polychaetes [worms], etc.) that live on or within the bottom substrate. Benthic invertebrates represent an important biological community that interacts closely with both pelagic (open water) communities in the overlying water (Steimle *et al.*, 1994) and with the physical environment. Benthic communities are particularly useful for evaluating the effects of physical disturbances because their constituents are relatively immobile, thus providing only a local measure of impact. In addition, many benthic organisms, especially crustaceans, are very sensitive to anthropogenic impacts (Thomas, 1993; Conlan, 1994). The condition and diversity of the infaunal community, typically defined as the organisms inhabiting the sediment from its surface to a depth of about 4 inches, is particularly useful as an indicator of anthropogenic impacts. Also of interest are the larger animals, or megafauna, that typically burrow deep into the sediment (sea anemones) or roam its surface (crabs). This section focuses primarily on the infaunal benthic community, but also provides information about some key megafaunal species. Commercially and recreationally important shellfish (e.g., clams, mollusks, lobster) are discussed in Sections 3.11 and 3.12.

3.9.1 Rhode Island Region ZSF

Consideration of the benthic communities in the ZSF focused on three geographic areas: coastal Rhode Island, Block Island Sound, and Rhode Island Sound (see Figure 3-1). Information about the general condition of the benthos in the ZSF was derived primarily from several studies conducted since the late 1960s. No large regional studies have been conducted to characterize benthic communities in the entire area; however, a number of studies have focused on specific locations within the ZSF, including recent benthic characterizations at four locations in support of this Final EIS (Corps, 2002f; Corps, 2003g). The following sections discuss three studies as they pertain to the condition of benthos present in the ZSF.

Coastal Rhode Island

The Rhode Island coastal offshore area is a shallow part of the ZSF consisting primarily of sandy bottom (Figure 3-15). Studies conducted after a 1996 North Cape oil spill west of Point Judith described nearshore habitats as being dominated by rocky glacial moraines interspersed with small sediment patches, extending seaward about 2.2 nmi (Cobb *et al.*, 1999). The oil spill, while disastrous, provided a unique opportunity to estimate the total population abundances for several important invertebrates living in the affected habitats. Cobb *et al.* (1999) estimated that the American lobster (*Homarus americanus*) population before the spill was about 1.7 lobsters per square meter (m^2) in an area from Point Judith to about Charlestown Breachway, Rhode Island. The rocky habitat would also house populations of rock crabs (*Cancer irroratus*) and hermit crabs (*Pagurus* spp.). Rock crab densities were estimated at 3.4/m^2 at impacted areas and 6.7/m^2 at a control area (Cobb *et al.*, 1998, as cited in French, 1998). French estimated total mortality of these two groups at about 20 million. Sediment patches in the area supported significant populations of surf clams (*Spisula solidissima*) and benthic macroinvertebrates (mainly worms and amphipods), as shown by the estimated numbers of mortalities resulting from the spill: 75 million surf clams and about 17 billion macroinvertebrates (French, 1998).

Block Island Sound

The National Marine Fisheries Service (NMFS) conducted surveys in February and September 1976 to collect data on the infaunal communities in Block Island Sound (Steimle, 1982). Nine stations, six of which were located within the ZSF, were sampled to represent major habitats in Block Island Sound. The portion of Block Island Sound in the ZSF consisted primarily of a broad plain west-northwest of Block Island that was about 100 ft deep and made up mostly of poorly sorted sands (Steimle, 1982). Along the western boundary of the ZSF, depth varied more, descending to a 174-ft deep depression south of Watch Hill Point. The most prominent feature at the southern edge of Block Island Sound was Block Channel, a 184-ft-deep gorge bisecting the submerged ridge between Montauk Point and Block Island (Steimle, 1982).

Steimle (1982) found that the primary constituents of the infaunal communities in the broad plain west of Block Island and the deeper region near the boundary of the ZSF were the amphipods *Ampelisca agassizi* and *A. vadorum* and the nut clam *Nucula proxima* (now known as *N. annulata*). Sediments at the stations where these animals were found were primarily silty-sand or sand. In a later study based on fisheries data collected in the 1980s, Steimle (1990a) reported a very similar community at a station just west of the ZSF boundary, dominated by *N. annulata*, *A. agassizi*, and the bamboo worm *Clymenella torquata*. Other stations in the ZSF had coarse sand to gravel sediments. The deep station in Block Channel was characterized by the amphipod *Byblis serrata* and the worm *Spirorbis borealis*. Steimle described the fauna as generally similar to that within the Middle Atlantic Bight. Steimle further mentioned that the similarity between his study and previous ones suggests that the *Ampelisca* community has been prevalent in Block Island Sound since the 1940s and that natural fluctuations in infaunal populations are minor compared to those in other regions of the Bight.

Rhode Island Sound

Studies of the benthos in the Rhode Island Sound portion of the ZSF have been primarily small in scale and restricted in focus. There have been no large-scale, sound-wide studies of the benthos. The data used here to characterize the benthos of Rhode Island Sound were derived from two main research areas: fisheries-related studies conducted by the NMFS that began in the 1970s, and studies since the 1960s relative to dredged material disposal at Site 16. The fisheries studies (Steimle, 1990a) typically included few stations in the ZSF but still provide some useful information. The studies focused on dredged material disposal have been concerned with two major activities and, although restricted in geographic scope, included the predominant habitat types found in Rhode Island Sound. Field studies conducted in support of the Providence River and Harbor Maintenance Dredging Project (Corps, 1997) as well as those conducted in support of this Final EIS (Corps, 2002c; Corps, 2002f) have provided data about benthic communities and habitats within Rhode Island Sound.

The sedimentary habitats in much of Rhode Island Sound were described by Knebel *et al.* (1982) and are discussed in detail in Section 3.2.1. With respect to benthic biology, Knebel *et al.* identified four main habitats. The first is characterized by irregular topography and is restricted to waters shallower than 105 ft located off Newport, Rhode Island. It consists of bedrock outcrops that have been exposed by erosion or where sediments have not been deposited. The second habitat includes boulder areas, representing relict glacial moraines, interspersed with coarse sediments that extend from Point Judith toward the southeast; this type of habitat also occurs in the southeast corner of the area studied by Knebel *et al.* A third habitat represents sediments that have undergone considerable reworking and are predominantly sand with scattered gravel. This habitat covers about one-third of the study area. Large ripples in the sands in this habitat indicate some degree of sediment movement. This habitat type occurs chiefly in the flanks of the ridge off Point Judith and other topographic elevations. Probably most important is the fourth area, a region of silty sediment, representing a depositional area; this habitat covers much of the western portion of Rhode Island Sound. Infaunal animals mainly inhabit the latter two habitat types, whereas megafaunal animals may occur in all habitats.

In the absence of large-scale surveys, the scattered, local-scale studies can be coupled with the four habitat types to develop an overall picture of the infaunal communities that may exist in Rhode Island Sound. A direct comparison of infaunal abundances and numbers of species among the various studies cannot be done because of the variety of equipment used to collect and process samples. Nonetheless, the information does provide an adequate representation on the infaunal communities in the ZSF.

The earliest benthic community studies were conducted a short distance off the town of Newport at Site 16 in the 1970s. The benthic community at Site 16 and the effects of dredged material disposal on the benthos were studied in a series of three reports: Saila *et al.* (1969), Saila *et al.* (1971), and Pratt *et al.* (1973). Later, Pratt *et al.* (1975) studied the area around Browns Ledge, part of a glacial moraine located about 10 nmi southeast of Site 16. Early studies conducted under the Corps DAMOS program included quantitative infaunal data based on dredge and grab samples (Corps, 1979). Subsequent Corps programs monitored Site 16 primarily with SPI (Corps, 1997; Corps, 2002c). Some of the profiling surveys conducted in the late 1990s and early 2000s included other parts of Rhode Island Sound that were being considered as alternative disposal sites for material from the dredging of Providence River Navigation Channel. The most recent benthic survey, which was conducted in support of this Final EIS, also identified benthos present in Rhode Island Sound (Corps, 2002f).

Pratt (1971) identified four major faunal groups in and near Site 16. Although the faunal groups had distinctive features, generally there were not sharp boundaries separating them, and often species typical of one assemblage were found where another assemblage was predominant. Two of the communities were found on natural sand substrates on the seafloor, a third typified silty bottom areas, and the fourth occurred on the dredged material disposed at Site 16. All of the studies of Rhode Island Sound conducted since 1971 have found essentially the same types of faunal groups on the natural sediments, although occasionally reporting slight variations. One of the sand community types reported by Pratt (1971) characterized the clean medium sand found east and north of Site 16. The distinguishing taxa were the suspension-feeding amphipod *B. serrata*, several other small crustaceans, and the sand dollar (*Echinarachnius parma)*. This community type occupied a small set of the area studied.

The second infaunal sand community described by Pratt (1971) was found in the area surrounding Site 16. Silty sands were found in this area, and the community there was overwhelmingly dominated by the tube-dwelling amphipod *A. agassizi*, which formed large tube mats covering the seafloor. Other amphipod species in the community included *B. serrata*, *Unciola irrorata*, *Leptocheirus pinguis*, *Orchomenella pinguis*, and *Phoxocephalus holbolli*. Many species of polychaete worms were present, but clams were uncommon.

The silty sediment fauna differed markedly from the sand fauna. Typical species on silty bottoms were suspension-feeding and deposit-feeding clams such as *Pitar morrhuanus* and *Nucula annulata*, respectively, and deposit-feeding polychaete worms such as *Lumbrineris fragilis*, *Pherusa affinis*, and *Clymenella torquata*.

Pratt *et al.* (1975) found the general sand, silty-sand communities in the area near Browns Ledge. All of the samples were dominated by *A. agassizi*. *Byblis serrata* was common only where the sand content exceeded 90 percent. The nut clam *N. annulata* was common only at stations where there was a significant sand fraction, but the silt-clay content exceeded 15 percent. The polychaete deposit-feeding (or occasionally carnivorous) worm *Nephtys incisa* was present at the higher silt-clay stations but was not one of the numerically dominant species. The bamboo worm *C. torquata*, which feeds well below the sediment surface, was common at stations having very coarse sediments.

A recent study conducted at three locations in the central ZSF (Site 18, Site 69A, and Site 69B [see Figure 3-2]) identified the prevalence of the general sandy, silty-sand faunal assemblages (Corps, 2002f). Most samples were characterized by the *Ampelisca agassizi*-*Nucula annulata* fauna typically found where sediments were primarily sandy but had some fine component present. At the few stations where the sand fraction exceeded 90 percent, the *Byblis serrata* assemblage was present. The separation between these two faunal groups was apparent at each of the sites. This observation indicated that the patchiness of the sediment regime existed at a scale much smaller than that shown by the data collection scale used in the habitat study by Knebel *et al.* (1982). As Pratt *et al.* (1975) found at Browns Ledge, *Nephtys incisa* was present at the higher silt-clay stations but was not one of the numerically dominant species.

Information from the several studies of Site 16 allowed for some estimation of the recovery of the area in the 30 years since disposal ceased. An evaluation using the studies was limited because of the different sampling approaches, sampling stations, and equipment. Still, some generalizations were made. Pratt (1971) stated that the fauna inhabiting the dredged material immediately after disposal included several species that may have been transported to Site 16 during the disposal process. Included among these were the polychaete worm *N. incisa* (~110 to 390/m^2), the clam *Mulinia lateralis* (~120 to 170/m^2), and the detritus-feeding snail *Nassarius trivittatus*, although the latter species was uncommon. The polychaete worm *Tharyx acutus* was very common at one station on the mound (~810/m^2). Amphipods were generally absent. Total abundance at the station directly on the mound was low, ~600 to 3,200/m^2.

Some colonizers of the disposal mound immigrated from nearby areas and were more abundant on the mound than in their usual habitats. These species included deposit-feeding polychaete worms (*Eteone longa* and *Prionospio steenstrupi*), surf clams (*Spisula solidissima*), and lophophorate "worms" (*Phoronis architecta*). Pratt theorized that many of the species introduced during the disposal process would not establish viable populations in Rhode Island Sound because they were primarily adapted for life in brackish waters having high organic content. However, a subsequent study showed that *Nephtys incisa* (~210/m^2), *Mulinia lateralis* (~140/m^2), and *Tharyx acutus* (~730/m^2) still characterized the mound. Amphipods were present but were still rare. By 2001, the situation had changed dramatically (Corps, 2002f). Two stations sampled that were likely on at least part of the old disposal mound had a faunal assemblage that was characterized by *Byblis serrata*, which typically occurred primarily on sand. The presence of this fauna showed that the disposal mound has undergone surface winnowing of the fine sediments during the years between studies. *Nephtys incisa* and *M. lateralis* were not found at these stations. *Tharyx acutus* was present at a density (~900/m^2) similar to that found earlier, but its abundance relative to other worms was much less as many other species had colonized the area. At two stations off the mound, the *Ampelisca agassizi*-*Nucula annulata* assemblage was strongly dominant. *Tharyx acutus* was abundant (~2,800/m^2), *Nephtys incisa* was uncommon (~75/m^2), and *M. lateralis* was absent. Several species thought to represent mature community conditions (e.g., deep deposit feeders such as *C. torquata*) were present. Many species of worms, mollusks, and crustaceans inhabited the area in 2001. Thus, although the time scale cannot be defined adequately, the disposal mound appeared to have become part of the "natural" habitat.

Data on megafaunal species in Rhode Island Sound, other than those of commercial importance, are scarce. Information on the distribution of two commercially important clams (ocean quahogs and surf clams) and lobster are discussed in Sections 3.11 and 3.12, respectively. The other main megafaunal species that frequent Rhode Island Sound, and about which some information is available, are rock crabs (*Cancer irroratus*) and Jonah crabs (*C. borealis*). Many other megafaunal animals occur in the ZSF, most notably northern lady crabs (*Ovalipes ocellatus*), hermit crabs (*Pagurus* spp.), large burrowing sea anemones such as *Ceriantheopsis americanus*, and sand dollars (*Echinarachnius parma*).

The rock crab occurs from Labrador to Miami, Florida (Williams and Wigley, 1977). Rock crabs occur at depths of 20 to 1,496 ft on sand or sand/gravel bottoms (Stehlik *et al.*, 1991) and are expected to occur in most parts of the ZSF. Rock crabs migrate considerable distances, moving offshore during the warmer months of the year and traveling inshore in winter. Stehlik *et al.* (1991) speculate that the crabs moved shoreward in winter to feed in the absence of major competitors, blue crabs (*Callinectes sapidus*) and lady crabs, both of which are dormant in winter. The data used by Stehlik *et al.* were from NMFS groundfish and clam surveys from 1978 to 1987, and included only a few tows in the ZSF. Rock crabs were most abundant in the ZSF in the fall (there were no winter tows in the ZSF). Although rock crabs occur in a variety of habitat, Auster *et al.* (1995) found that they commonly use small depressions in the sand made by other animals. There is little specific information about the abundance of rock crabs in the ZSF. The oil spill study estimated rock crab abundances at about 3 to 7 crabs/m^2 near the shore west of Point Judith (Cobb *et al.*, 1998, as cited in French, 1998).

Jonah crabs range from Nova Scotia to southern Florida and primarily inhabit rocky bottoms, overlapping little with the rock crab (Williams and Wigley, 1977; Williams, 1984). Jonah crabs are generally less abundant than rock crabs and typically do not venture into very shallow waters (Stehlik *et al.*, 1991). They travel inshore during summer months and offshore in the winter. Stehlik *et al.* (1991) reported Jonah crabs in the ZSF during the spring, summer, and fall (there was no winter sampling).

Northern lady crabs are found from Prince Edward Island to Georgia and they inhabit inshore shelf areas at depths <89 ft, where they are typically is found on fine to medium sand or on gravelly sand (Williams and Wigley, 1977; Stehlik *et al.*, 1991). Although not recorded by Stehlik *et al.*, northern lady crabs likely occur in Rhode Island Sound given their distribution range and the fact that they have been recorded in Narragansett Bay (Williams, 1984).

Several species of hermit crabs (*Pagurus* spp.) occur in the general area (Williams and Wigley, 1977), but there is very little information about their distribution in Rhode Island Sound.

Large burrowing sea anemones (Ceriantharia) are common in coastal waters from Nova Scotia to Cape Hatteras (Shepard *et al.*, 1986). Anemones such as *Ceriantheopsis americanus* and *Cerianthus borealis* live in permanent, semirigid tubes. These carnivorous feeders consume small animals that are passively captured by stinging cells in their tentacles. Burrowing anemones inhabit silty-sand sediments with good water movement, which enhances their feeding abilities (Shepard *et al.*, 1986). Large burrowing anemones are captured occasionally in benthic sediment samplers. Battelle (Corps, 2002f) recorded 67 individuals among the 74 sediment samples collected. Most of these occurred in the vicinity of the historic disposal site at Site 16. However, because of their size, large burrowing anemones can not be adequately sampled with grab samples, so it is difficult to characterize anemone abundance in Rhode Island Sound.

Sand dollars (*E. parma*) predominantly occur on the sediment surface of coastal benthic communities that are comprised of fine to medium sand. Steimle (1990b) analyzed the life history patterns of sand dollars by using NMFS trawl data collected from 1978 to 1985 along the Middle Atlantic Bight and Georges Bank. Steimle determined that the average sand dollar lifespan is about 8 years and that recruitment into populations occurs primarily in winter to early spring, but can vary with geographic location. Steimle's study included one station in Block Island Sound and one station near Point Judith but did not include specific abundance data for those sites. Battelle (Corps, 2002f) found about 340 sand dollars/m^2 in the vicinity of Site 18; most of which were relatively small individuals.

Studies conducted in the ZSF in 2001 have shown that the benthic communities are very similar (Corps, 2002f) to what they were at least 30 years ago (Pratt *et al.*, 1973) and perhaps longer (Steimle, 1982). This includes Site 16, which has recovered from disposal in the late 1960s. The primary infaunal community type within the ZSF is characteristic of the open water, primarily sandy areas found along the northeast Atlantic coast of the United States that are not heavily influenced by pollution. Any differences among the communities found in the ZSF and those to the north or south were primarily related to natural biogeographic differences rather than being attributable to any particular characteristics of the ZSF. The ZSF does not contain any unusual or distinctive infaunal community or habitat type. Although much less information is available about the megafaunal communities in the ZSF, the animals described in the previous paragraphs typically range over a considerable portion of the North American Atlantic coast. No megafaunal animals occur uniquely in the ZSF.

3.9.2 Site E

Site E is located in an area generally characterized as having reworked sediments (Knebel *et al.,* 1982). SPI images taken in 2003 indicated that the sediments at Site E were predominantly medium to silty/fine sands (Table 3-11), whereas many stations in the nearby area had coarse sediments, often with a cobble-to-gravel component. Grain-size analyses based on samples collected during the July 2003 sediment survey showed that the Site E stations were primarily sands (90 percent). Stations from the nearby area had a lower proportion of sand (77 percent) but also included a considerable gravel component (10 percent). The TOC content of the sediments from all stations within and near Site E were very low, ranging from 0.1 to 0.6 percent (Corps, 2003f). Mean values were similar among stations from the site and the nearby area (Table 3-11).

SPI data were obtained from 15 stations within Site E and from 42 nearby stations. Analyses of the SPI data generally indicated that habitat quality in Site E and the nearby area was variable, but generally good. Primary evidence for this conclusion was the variability in the average Organism-Sediment Index (OSI) values calculated for the site, ranging from 5.0 to 10.0 (mean = 8.2), and the nearby stations, ranging from 4.0 to 11.0 (mean = 8.5) (Table 3-11). The successional stages evident in the profile images showed that the community was somewhat less developed within Site E (primarily Stages I-II) compared to that in the nearby area (primarily Stages II-III). No anoxic sediments or gas voids were found in the area.

The infaunal communities found within Site E and in the nearby area during the recent sediment characterization surveys conducted in support of this Final EIS were very similar (Corps, 2003f). The number of infaunal animals (see the text box "Ecological Parameters Used to Characterize Infaunal Communities") within each area in July 2003 was relatively high, with about 35,000 individuals/m^2 found within Site E and about 38,000 individuals/m^2 occurring within the reference area (Table 3-11). The average numbers of species found in the disposal and reference site samples were 60 and 62, respectively. These sets of relatively high values were reflected in the relatively high Shannon-Wiener diversity (H') values calculated for the Site E samples. Evenness values were moderately high in the site and at the reference station (0.67, 0.64).

Table 3-11. Comparison of the Sedimentary and Biological Characteristics of Site E (July 2003).

Parameter	Site E[1]	Nearby Area[2]
Sediment Features		
Gravel (%)	2	10
Sand (%)	90	77
Fines (%)	8	13
TOC (%)	0.22	0.34
SPI Features		
Grain Size (modal category)	Medium–silty/fine sand	Silty/fine sand–cobble
Prism Penetration (cm)	3.3–9.1	0.0–10.9
Dominant Surface Processes	Physical/Biological	Physical/Biological
RPD Depth (cm)	>3.3– >5.8	>1.2–7.9
Successional Stage	I-II, III	I-II, III
OSI	7.0–10.0	4.0–11.0
Infaunal Community Features		
Average Abundance (#/sample)	1,392 (~34,800/m^2)	1,512 (~37,800/m^2)
Average Species (#/sample)	60	62
Average Diversity (*H′*)	3.9	3.8
Average Evenness (*J′*)	0.67	0.64
Ten Most Abundant Taxa[3]	*Nucula annulata* *Polygordius* sp. A *Tharyx acutus* *Exogone hebes* *Nucula delphinodonta* *Byblis serrata* *Eudorella pusilla* *Euchone incolor* *Ericthonius fasciatus* *Ampelisca agassizi*	*Nucula annulata* *Polygordius* sp. A *Ampelisca agassizi* *Ericthonius fasciatus* *Eudorella pusilla* *Nucula delphinodonta* *Exogone hebes* *Ampharete lindstroemi* *Scoletoma hebes* *Aricidea catherinae*

Source: Corps, 2003f; Corps, 2003h
OSI = Organism-Sediment Index; RPD = Redox Potential Discontinuity
[1] Five sediment stations; average of values shown. Fifteen SPI stations; range of values shown.
[2] Thirteen reference stations; average of values shown. Forty-two SPI stations; range of values shown.
[3] In order of decreasing abundance.

The small deposit-feeding clam *Nucula annulata* was the most abundant infaunal organism among the Site E and nearby area samples (Table 3-11). This species and a closely related species (*N. delphinodonta*) accounted for about 31 percent of the fauna identified from Site E and the nearby area in July 2003 (Corps, 2003f). The density of *N. annulata* among all samples collected in July 2003 in and around Site E was about 9,125 individuals/m^2. Other numerically important species were three polychaete worms: *Polygordius* sp. A, *Tharyx acutus*, and *Exogone hebes*. Small crustaceans such as *Byblis serrata, Eudorella pusilla, Ericthonius fasciatus,* and *Ampelisca agassizi* were relatively abundant in the area. In general, the infaunal community in

Site E was very similar to that found in the nearby area and was typical of the open-water silty-sand/sand communities found in Rhode Island Sound.

Ecological Parameters Used to Characterize Infaunal Communities

The analysis of a benthic sample begins by identifying and counting the organisms present in the sample. The data resulting from this task are very difficult to understand and interpret by themselves. Therefore, ecologists have developed many univariate parameters that essentially condense the full set of species data into a single number. These parameters range from simple calculations, such as the number of species in a sample, to more complex derivations, such as rarefaction analysis. However, because no single metric can adequately characterize a sample, several should be used in ecological evaluations. The parameters described below are among the more common ones used by marine ecologists to characterize samples, and therefore to characterize communities.

Abundance — measured as the number of infaunal organisms identified in a defined sample size or area; the actual number of organisms counted is often extrapolated to the number per square meter by dividing the count by the sample area.

Species — represents the number of species identified in the sample; this value cannot be extrapolated to the number per square meter.

Shannon-Wiener Diversity (H′) — a measure of species diversity that estimates the uncertainty associated with predicting the species identity of an organism randomly selected from a sample. H' is 0 when there is only one species in the sample and is at a maximum when all species in the sample have the same number of individuals. Generally, maximum H' values for marine infaunal communities are between 6.0 and 7.0 for very diverse tropical communities. Maximum values for southern New England communities are generally <5.0.

Evenness — a measure of the distribution of the abundance of the organisms in a sample among the species in that sample. The index ranges from 0 to 1 and is at the maximum value when all species in the sample have the same number of individuals.

Interpretation of Sediment Profile Imaging to Characterize Benthic Habitats

Sediment profile imaging (SPI), pioneered in the early 1970s, is a common technique used to evaluate soft-bottom benthic habitats. Its principal purpose is to provide photographic documentation of the relationship between infaunal organisms and their sedimentary habitat. SPI images are photographs of a vertical section of the seafloor captured by deploying a 35-mm camera housed atop a wedge-shaped prism that penetrates several centimeters (cm) into the bottom sediments. The prism has a clear faceplate at the front with a mirror placed at a 45-degree angle at the back to reflect the image from the faceplate to the camera lens above. The prism has an internal strobe to illuminate the image. This wedge assembly is mounted on a movable carriage within a stainless steel frame. When interpreting SPI, several specific features are particularly useful in evaluating the quality of the habitat:

Sediment Grain Size—determined by comparing site-specific images with a set of standard images for which mean grain size has been determined in the laboratory. The sediment type descriptors follow the Udden-Wentworth size class system (e.g., clay, sand, gravel, etc.). Data are reported as phi units, which indicate approximate particle size and typically range from 4 (fine) to <–1 (coarse).

Apparent Color Redox Potential Discontinuity (RPD) Layer—an estimate of the depth of the boundary between oxidized and anoxic sediments. It is called the apparent RPD because it is a visual estimate based on differences in the reflectivity or color of oxidized and anoxic sediments and is not an actual measurement of the RPD depth, which must be made with an Eh electrode. The depth of the RPD in the sediment increases as the amount of sediment movement by infaunal organisms (called bioturbation) increases. Habitats considered to be of good quality have relatively deep (>2 cm) RPD layers.

Infaunal Community Successional Stage—based on the hypothesis that after a disturbance, infaunal organisms will recolonize a habitat in a predictable sequence leading from the early colonizing stage to the final climax community. The community is classified as Stage I if it consists primarily of dense assemblages of small polychaete worms that move into an area soon after disturbance. Stage II is the transitional stage between the colonizing and climax communities and consists of tube-dwelling amphipods such as *Ampelisca* spp. Stage III represents the mature, climax community consisting of polychaete worms (e.g., maldanid worms) that feed in deeper parts of the sediment and deposit waste material near the sediment surface. In practice, analysis often detects the presence of more than one stage in an image, with the resulting data being classified as Stage I on III or Stage II on III.

Organism-Sediment Index (OSI)—a summary statistic calculated from four SPI parameters: the apparent RPD depth, the community successional stage, the presence/absence of methane gas voids, and the presence/absence of low DO conditions. The index was developed in the 1980s to map disturbance gradients in estuarine habitats. OSI values range from −10 to +11, with higher values indicating better habitat quality. An OSI value of 6 is generally used to indicate whether a community has recently experienced some type of disturbance, with values less than 6 indicating the influence of disturbance.

3.9.3 Site W

Site W is located in an area of Rhode Island Sound generally characterized as sandy with reworked sediments (Knebel *et al.,* 1982). SPI images taken in 2001 indicated that the sediments at Site W and the nearby area were predominantly fine-grained, with some areas of coarse material such as cobbles or pebbles (Table 3-12). Grain-size analyses based on samples collected during the sediment survey conducted in September 2001 showed that the stations within Site W had primarily sandy sediments (75 percent), although two stations had a very high gravel component (37 and 49 percent). Only one station had a high fine-sediment fraction (38 percent).

Table 3-12. Comparison of the Sedimentary and Biological Characteristics of Site W (September 2001, July 2003).

Parameter	Site W[1]	Adjacent Area[2]	Area West and North[3]
Sediment Features			
Gravel (%)	12	7	8
Sand (%)	75	86	63
Fines (%)	13	7	30
TOC (%)	0.4	0.2	0.5
SPI Features			
Grain Size (modal category)	Silty/fine sand-pebbles	Silty/fine sand	Silty/fine sand–cobble
Prism Penetration (cm)	1.4–14.3	1.1–9.9	0.2–7.6
Dominant Surface Processes	Physical/Biological	Physical	Physical
RPD Depth (cm)	0.9–2.6	1.2–3.3	1.1 – >7.1
Successional Stage	I, II-III	I, I-III	I-II, II-III
OSI	4.0–9.0	3.0–10.0	4.0–10.0
Infaunal Community Features			
Average Abundance (#/sample)	1,298 (~32,450/m^2)	989 (~24,725/m^2)	1,175 (~29,375/m^2)
Average Species (#/sample)	53	46	57
Average Diversity (*H'*)	3.4	3.4	3.7
Average Evenness (*J'*)	0.59	0.62	0.64
Ten Most Abundant Taxa[4]	*Nucula annulata* *Ampelisca agassizi* *Oligochaeta* *Tharyx acutus* *Eudorella pusilla* *Polygordius* sp. A *Byblis serrata* *Exogone hebes* *Levinsenia gracilis* *Nucula delphinodonta*	*Ampelisca agassizi* *Polygordius* sp. A *Nucula annulata* *Eudorella pusilla* *Exogone hebes* *Tharyx acutus* *Goniadella gracilis* Oligochaeta *Spiophanes bombyx* *Byblis serrata*	*Nucula annulata* *Ampelisca agassizi* *Crassicorophium crassicorne* *Eudorella pusilla* *Exogone hebes* *Unciola irrorata* *Crenella decussata* *Nucula delphinodonta* *Tharyx acutus* *Ericthonius fasciatus*

Source: Corps, 2002c; Corps, 2002f; Corps, 2003f; Corps, 2003h
OSI = Organism-Sediment Index; RPD = Redox Potential Discontinuity
[1] Nine sediment stations sampled in 2001; average of values shown. Nine SPI stations sampled in 2001; range of values shown.
[2] Seven reference stations sampled in 2001; average of values shown. Nine SPI stations sampled in 2001; range of values shown.
[3] Ten reference stations sampled in 2003; average of values shown. Twenty SPI stations sampled in 2003; range of values shown.
[4] In order of decreasing abundance.

Sediments collected from the area adjacent to Site W in 2001 had a grain-size composition that was generally similar to that of the Site W stations. However, the area west and north of Site W that was sampled in 2003 had a somewhat different composition. Sediments were still primarily sandy (63 percent), but had a much higher fine fraction (30 percent), which may be related to the recent disposal of dredged material at Site W. TOC content among all sediments in and near Site W was very low, ranging from 0.3 to 0.8 percent.

SPI data were obtained from nine stations within Site W sampled in 2001 and several nearby stations sampled in 2001 and 2003. Analyses of the SPI data generally indicated that habitat quality in Site W and in the nearby area was moderately variable. Primary evidence for this conclusion was the variability in the average OSI values calculated for the site, ranging from 4.0 to 9.0 within the site, and from 3.0 to 10.0 in the area near the site (Table 3-12). The successional stages evident in the profile images showed that the communities within Site W and in the nearby area were similarly developed (primarily Stages I and I-III or II-III). No anoxic sediments or gas voids were found in the area.

Additional SPI data were derived from a survey conducted in Site W and the surrounding area in October 2003 (Corps, 2004a). This survey was part of a series of surveys designed to monitor the effects of the disposal of material dredged from the Providence River and Harbor on the benthic conditions in the site. Disposal of dredged material from Providence River and Harbor began in April 2003. The report documented the north-south disposal of material along the western side of Site W (from excavated CAD cell material used to build a containment ridge) and in the southeast quadrant of the site. Additional SPI data showed a disposal trail located about 450 m west of the site boundary, an area of fishing trawl scars to the west of Site W, and a sediment transition area to the north west of Site W.

Evidence of recently deposited dredged material was present in all 10 SPI stations sampled within Site W. The material was recognized as silty sand with interspersed white clay and black sulfidic mud. Several of the images showed an overlying layer of fine sand that was likely deposited during a hurricane that passed through the region in the early fall (Corps, 2004a). Average OSI values ranged from 2.0 to 8.5, with those at most stations being ≤6.0. The relatively high OSI values at stations where dredged material was recently deposited may have been related to the storm-deposited sand layer. These stations had deeper RPD depths than those Site W stations that consisted only of dredged material. Because the RPD depth is a key component of the OSI calculation, the deeper RPD depths associated with sands (physical diffusion is greater in sand than in mud) likely artificially inflated the OSI values. The successional state of the benthos in Site W primarily consisted of early colonizers (Stage I), although some later stage animals (Stage III) were occasionally present. Despite the recent disposal of dredged material, no low dissolved oxygen conditions or gas voids were found.

Samples collected from the disposal trail located west of Site W showed the presence of recently deposited dredged material (Corps, 2004a). The narrow (<35 m wide) disposal trail probably occurred as tugs left the disposal area before barges were completely closed. The material consisted of fine-grained silty sand with occasional patches of white clay. OSI values in this area ranged from 5.0 to 8.0. Most stations showed evidence of successional Stage I and Stage III organisms. No low dissolved oxygen conditions or gas voids were found in the trail. The effects of this disposal were also revealed by the infaunal community analyses as discussed below.

SPI data from trawl scars and in a transition area northwest of Site W showed that benthic habitats probably reflected normal ambient Rhode Island Sound conditions (Corps, 2004a). No dredged material was evident in either location. Average OSI values ranged from 5.7 to 11.0 in the trawl scar area and from 4.0 to 7.0 in the transitional area. Successional Stage I and Stage III organisms were present in both areas, and Stage II organisms also occurred in the trawl scars. No low dissolved oxygen conditions or gas voids were found in either area.

The infaunal communities found within Site W and in the nearby areas during the 2001 and 2003 sediment characterization surveys were very similar (Corps, 2002f; Corps, 2003f). The number of infaunal animals within each area was moderate to relatively high, with about 32,000 individuals/m^2 found within Site W, about 25,000 individuals/m^2 occurring among the stations just outside Site W that were sampled in 2001, and about 29,000 individuals/m^2 found in the area north and west of the site sampled in 2003 (Table 3-12). The average numbers of species found in the Site W samples (sampled in 2001), nearby samples (sampled in 2001), and samples to the north and west (sampled in 2003) were 53, 46, and 57, respectively. These sets of moderately high values were reflected in the moderately high Shannon-Wiener diversity (H') values calculated for the Site W and nearby area samples (Table 3-12). Evenness values were moderate at the Site W stations and at the nearby stations (0.6) (Table 3-12).

Two of the three most abundant species co-occurred at all three locations: the small clam *Nucula annulata* and the tube-dwelling amphipod *Ampelisca agassizi*. The relative contribution of these two taxa to the total abundance of the infauna (identified to species) was similar in 2001 (49 percent) to that in 2003 (48 percent). The density of *N. annulata* among all area samples was about 6,850 individuals/m^2 for samples collected in 2001 and about 8,450 individuals/m^2 for samples collected in 2003. Other numerically important species in 2001 were three polychaete worms (*Polygordius* sp. A, *Tharyx acutus*, and *Exogone hebes*) and small crustaceans such as *Byblis serrata* and *Eudorella pusilla.* In 2003, other common taxa included the crustaceans *Crassicorophium crassicorne, Eudorella pusilla*, and *Unciola irrorata*, and additional clam species (*Crenella decussata, Nucula delphinodonta*). In general, the infaunal community in Site W was very similar to that found in the nearby area and was typical of the open-water silty-sand/sand communities found in Rhode Island Sound. However, cluster analyses performed combining the 2001 and 2003 data (Corps, 2003h) indicated that eight of the samples collected west and north of Site W in 2003 were more similar to each other than to any of the other samples collected in 2001 or 2003. This probably reflects changes to the local infaunal community caused by the disposal of residual dredged material outside of Site W as barges departed the area (Corps, 2004a), rather than indicating effects directly related to the disposal of dredged material within Site W.

3.10 FISH [40 CFR SECTIONS 228.6(a)(2) AND 228.6(a)(9)]

Finfish species found within the ZSF can be divided into two categories: (1) bottom-dwelling, or demersal species, such as flounder and cod, and (2) pelagic species that live and feed in the water column, such as herring, squid, and bluefish. Finfish species present in the ZSF are discussed in this section. Squid, which are pelagic invertebrates, share similar habitats and behavior with finfish and are an important commercial fishery in the ZSF; therefore, they are also considered in this section. Shellfish and lobster, other key resources that support commercial fisheries within the ZSF, are discussed in Section 3.11 and Section 3.12, respectively.

The abundance and distribution of many fish species found within the ZSF change seasonally as water temperatures change. Some species migrate into and out of the ZSF, whereas others remain in the ZSF as year-round residents, although they may shift habitats from shallow to deeper areas as seasons change. As water temperatures increase during the spring, there is an influx of warm-water species such as bluefish, menhaden, weakfish, black sea bass, and alewife into the ZSF from the south (Grosslein and Azarovitz, 1982). At the same time, cold-water species such as Atlantic herring, mackerel, cod, and spiny dogfish begin leaving the area heading farther north. Many species, such as scup, butterfish, summer flounder, silver hake, red hake, and longfin squid, are found year-round in the ZSF; however, they also exhibit seasonal inshore-offshore migrations correlated with the temperature cycle. These migrations within the ZSF are generally inshore in April–May and offshore during winter months to avoid temperatures below 5 °C. There is, however, high variability from year to year in the local fish populations, which is reflected in the sizes of the stocks that are observed, particularly for commercially fished species.

3.10.1 Rhode Island Region ZSF

This section describes the commercial fishery data, long-term trawl data from research and monitoring studies, and data from recent trawl surveys conducted in support of this Final EIS. It also describes essential fish habitat (EFH) species and summarizes the life histories of key fisheries species found in the ZSF.

Data Sources Evaluated

Data from the following sources and programs were used to describe the finfish resources within the ZSF:

- **Data on commercial fisheries**: NMFS has long collected data on commercial fisheries throughout the country. This information is used to evaluate the type and respective weight (in pounds) of those species of fish that are harvested from the ocean and landed (reported) in a given region. For the RIR, data from 1994 to 2001 are used in this Final EIS. These data are discussed in the section "Commercial Fishery Data."
- **Data from long-term research trawl programs**: The University of Rhode Island–Graduate School of Oceanography (URI-GSO), Rhode Island Division of Fish and Wildlife (RIDFW), and Massachusetts Division of Marine Fisheries (MDMF) all conduct long-term research trawl surveys at locations within or adjacent to the ZSF. This information and NMFS research trawl data for 1990–2002 are discussed in the section "Long-Term Trawl Survey Data."
- **Data from recent trawl surveys**: Three trawl surveys were conducted within the central portion of the ZSF at sites that were considered as alternative disposal locations for the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2002g; Corps,

2003d; Corps, 2003i). This information is discussed under "Recent Trawl Surveys in Rhode Island Sound."

- **Site-specific data**: Site-specific trawl surveys were conducted in Site W (then called Site 69b) as part of the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2002g; Corps, 2003d; Corps, 2003i). Additional site-specific sampling was conducted in Sites E and W during the summer of 2003 (Corps, 2003j). These data are presented and discussed in Sections 3.10.2 and 3.10.3.

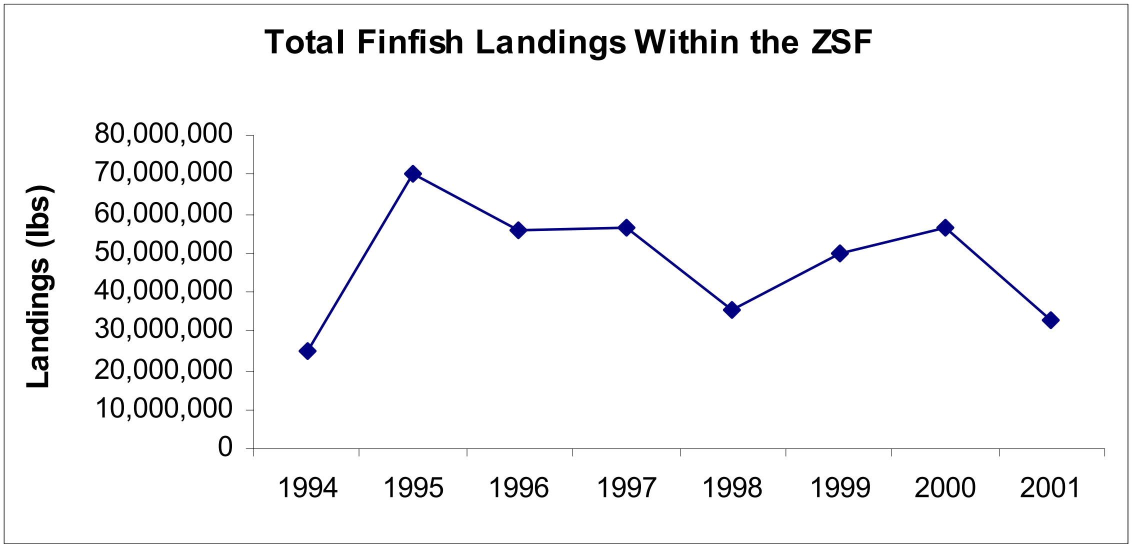
Commercial Fishery Data

In 1994, the NMFS instituted a mandatory reporting system to better monitor commercial landings. The system requires that commercial fishermen submit vessel trip reports (VTRs) identifying the date, time, general area fished, the species harvested, and the approximate total weight (in pounds) of the catch.

The VTRs required by NMFS since 1994 provide species information that can be used to describe the relative abundance of many commercially important finfish. Commercial VTR data from 1994 through 2001 were obtained from NMFS for the entire ZSF. VTR data included finfish and shellfish species (lobster and crab). The finfish species and squid were analyzed separately from the shellfish species.

Finfish landings from within the ZSF have fluctuated over the years, ranging from about 24 million pounds (lbs) in 1994 to about 69 million lbs in 1995 (Figure 3-38). During most years, five species made up more than 85 percent of the annual catch (see Appendix A-3). The most commonly caught species during each of these years were Atlantic herring, skates, silver hake, and either monkfish, squid, winter flounder, or spiny dogfish.

The annual landings for several species within the ZSF are presented in Figure 3-39. Squid landings declined from 1994 to 1995 and remained relatively consistent from 1995 through 2001. Scup landings declined from 1994 through 1998, then fluctuated through 2001. Silver hake and winter flounder landings were fairly constant from 1995 through 1999. Both species had peak landings in 2000, then declined in 2001. Butterfish and summer flounder landings fluctuated until 1998 but have gradually increased since then. Skate landings increased until 1997, and fluctuated slightly from year to year since then. Monkfish and spiny dogfish landings peaked in 1995. Monkfish landings fluctuated consistently following this peak, while spiny dogfish landings declined to very low numbers in 2000 and 2001. Like several of the other species, Atlantic herring landings peaked in 1995. Since 1995, however, Atlantic herring landings have shown a generally decreasing trend.

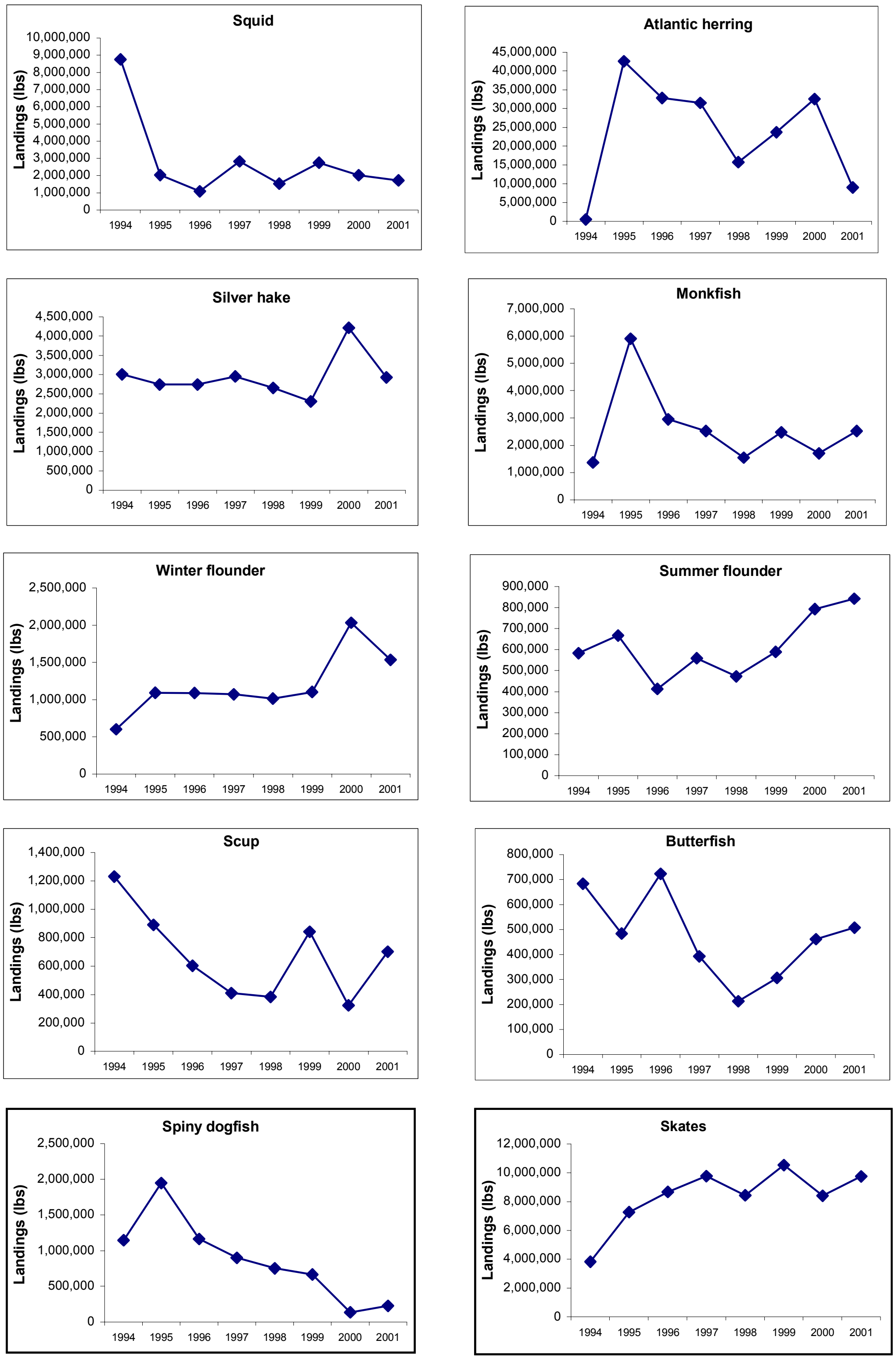


Source: NMFS VTR Data (1994 – 2001)

Figure 3-38. Total Annual Landings of Finfish from Within the ZSF Reported on VTRs (1994–2001).

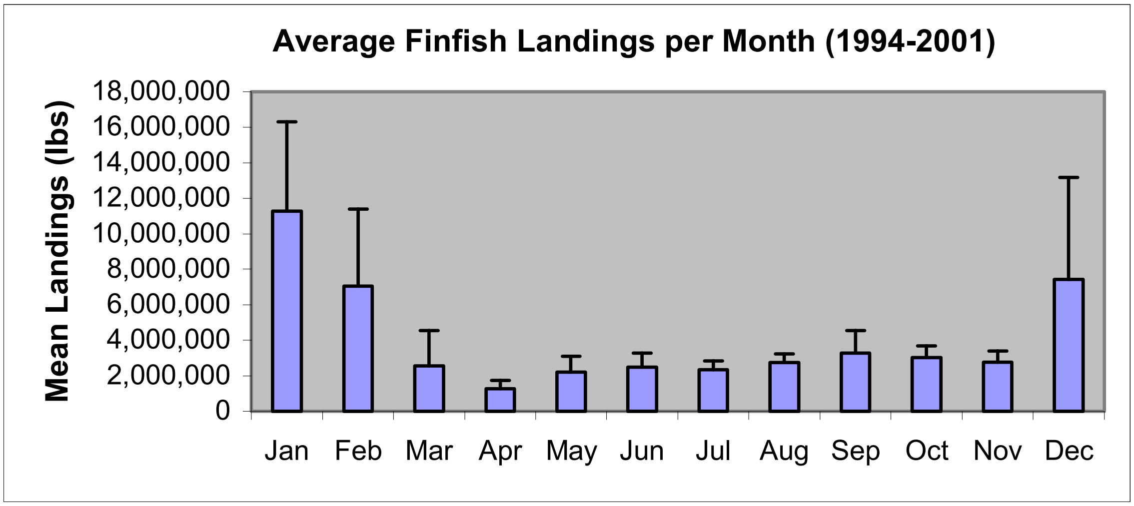
Seasonally, total finfish landings from the ZSF were high during the winter months of December, January, and February. Average January landings from the ZSF from 1994 through 2001 were slightly greater than 10 million lbs (Figure 3-40). The lowest landings from the ZSF occurred during April through August. The high landings during the winter months were attributable to very large catches of Atlantic herring from December through February (Figure 3-41). The Atlantic herring landings during these months were about seven times the landings of many of the other species during their respective peak seasons, thus biasing the overall finfish landings toward the winter months.

The other top commercial species from the ZSF are not often harvested in large numbers during the winter months (Figure 3-41). Although caught year round, the largest landings of winter flounder occurred in May and June. Large landings also occurred in November and December. Butterfish landings were high from late summer through early winter (August through December), and were substantially lower during late winter through mid-spring (January through May). For most of the other key commercial species, peak landings generally occurred in the warmer months from May (scup, monkfish, summer flounder) to September–October (squid, silver hake, spiny dogfish, skates).



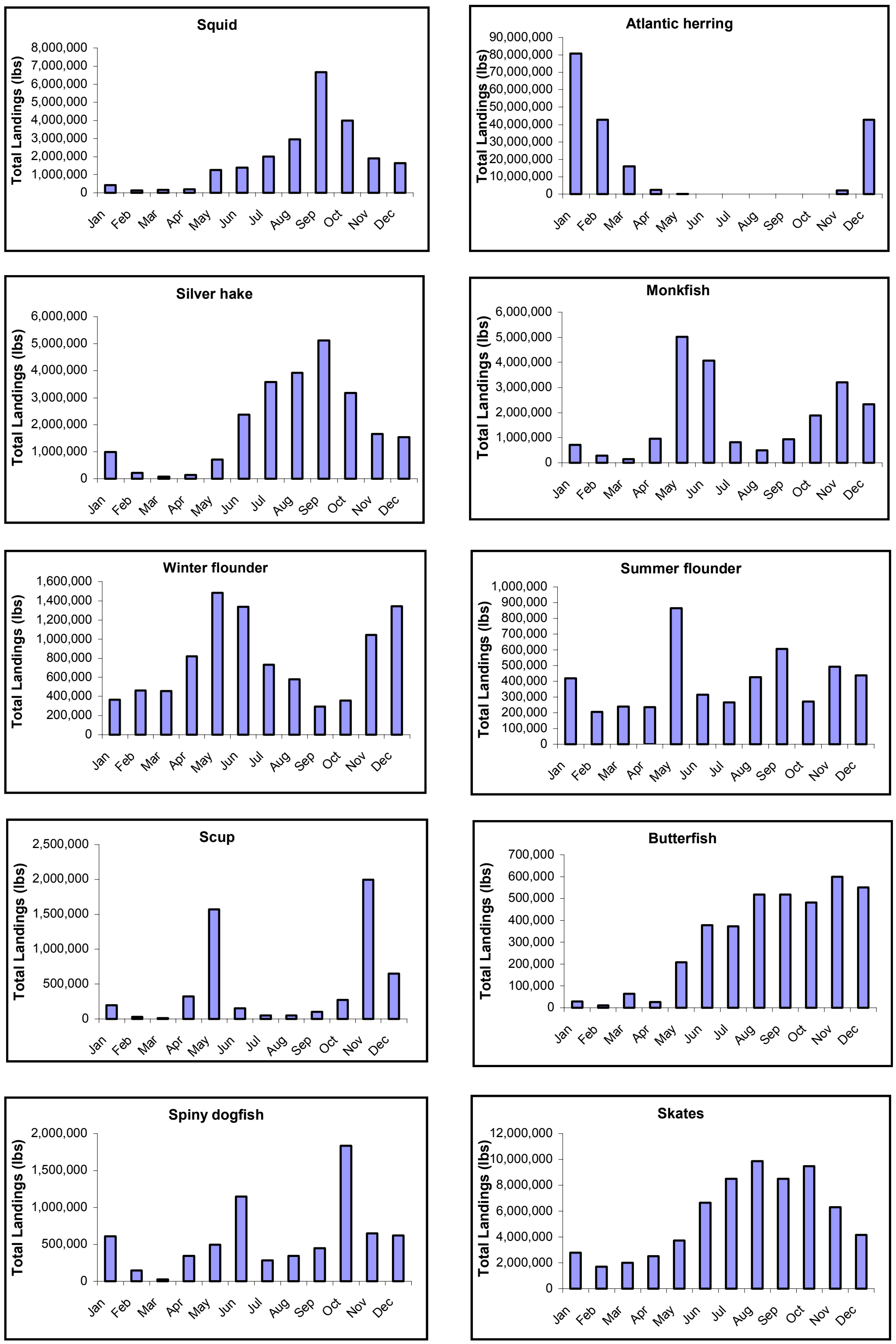
Source: NMFS VTR Data (1994 – 2001)

Figure 3-39. Annual Landings for Key Commercial Species Harvested from within the ZSF.



Source: NMFS VTR Data (1994 – 2001)

Figure 3-40. **Average Monthly Finfish Landings from Within the ZSF (1994 – 2001).**



Source: NMFS VTR Data (1994 – 2001)

Figure 3-41. Total Monthly Landings for Key Commercial Species Harvested from Within the ZSF (1994–2001).

Long-Term Trawl Survey Data

Figure 3-42 shows the locations within or adjacent to the ZSF where the URI-GSO, RIDFW, and MDMF have conducted long-term research trawl surveys since 1959 (URI-GSO) or 1979 (RIDFW, MDMF). Because data from within the ZSF are limited and fish are mobile organisms, data collected by these programs from areas within or adjacent to the ZSF are used to characterize the finfish resources and habitat use within the ZSF. Although the methods for the various long-term survey programs are similar, slight variations in fishing equipment and protocols make direct comparisons of catch numbers inappropriate. However, the species occurrence patterns, species dominance patterns, and general trends in abundance are comparable and are discussed in this Final EIS. In addition, the NMFS has collected data since 1990 from 102 stations within or adjacent to the ZSF.

The purpose of the evaluation performed for this EIS was to examine recent trends in fish populations in the ZSF and to characterize the fish communities inhabiting the alternative disposal sites, not to examine long-term fisheries trends. Therefore, the four long-term data sets were restricted to a common set of years encompassing the 1990s through the early 2000s. To compare the results from all four sources, the raw data were converted to an index called Catch-Per-Unit-Effort (CPUE). CPUE is a means of standardizing the information on the number of fish caught by dividing the catch by the amount of time a net was towed through the water. The various trawls that were evaluated for this EIS varied in length; therefore, all of the trawl CPUE data were calculated to be equivalent to 30-minute (min) tows and are expressed as fish/tow. An annual CPUE was standardized by averaging weekly catches to create monthly means, then summing the monthly means for a given year.

Catch-Per-Unit-Effort

The Catch-Per-Unit-Effort, or CPUE, is a common fisheries index that is used to standardize fishery data collected by a variety of similar catch methods. For example, fishery trawls of varying duration can be standardized by calculating the CPUE for a standard tow length (distance or duration). Thus, data from tows of varying duration or length can be directly compared. The CPUE is usually measured to estimate the total catch of species during a certain time or in a specific area, to determine the stock abundance for fishery species, or to estimate fishing success (Nielsen and Johnson, 1983). The CPUE is a ratio estimate and is usually calculated as an average of the effort (by number or weight) or as the total effort. Which one is used depends on the purposes of the sampling program.

CPUE data must be used carefully, especially when discussing data from a variety of programs. It is critical to ensure that the defining unit of effort is clearly stated for the programs being compared.

The text boxes on the following pages present the data from the URI-GSO, RIDFW, MDMF, and NMFS survey programs. In addition to evaluating the total finfish abundance for any given year (i.e., annual CPUE or seasonal CPUE over a given year), species-specific CPUE values were calculated for all species collected in each program. The species were then ranked in the order of their decreasing abundance, and the most abundant species for each long-term trawl survey program were listed. The proportion of the catch that was attributed to those species is also included. For the RIDFW, MDMF, and NMFS survey programs, the 25 most abundant species are listed; only 17 species are listed for the URI-GSO program.

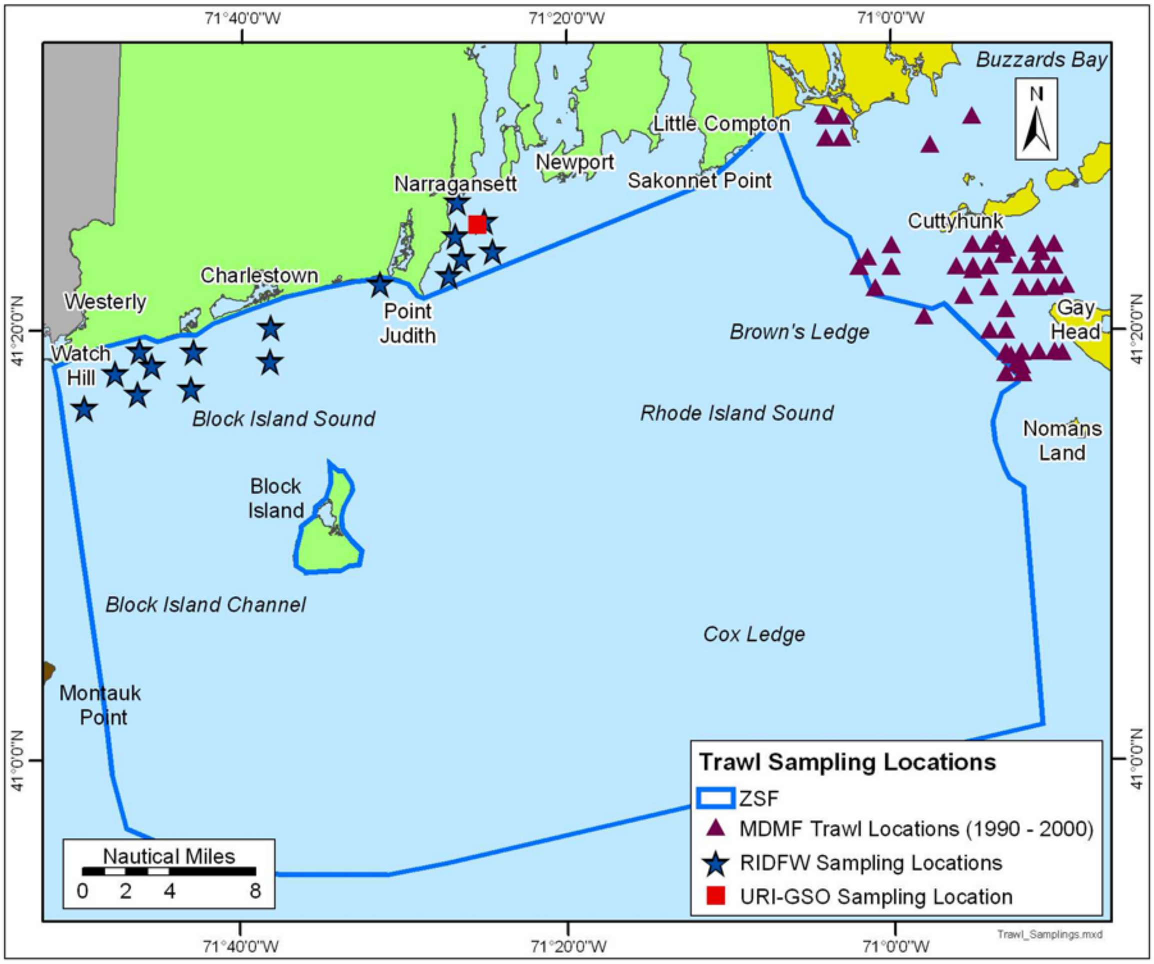


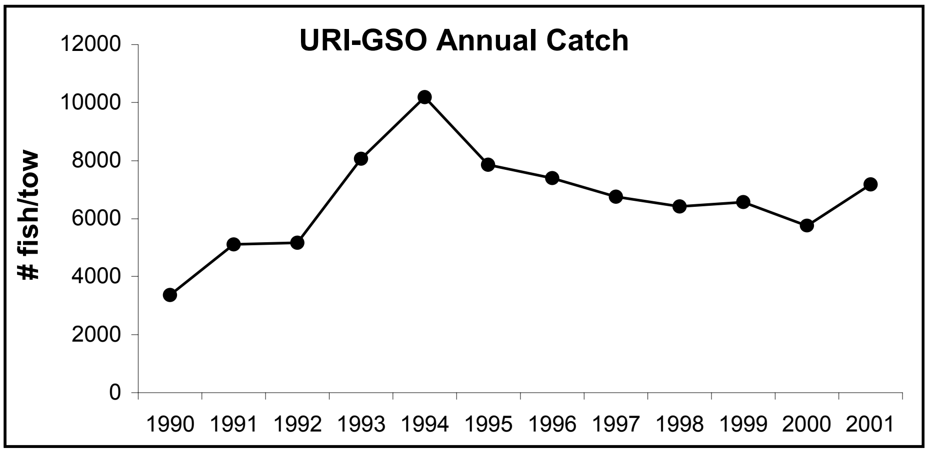
Figure 3-42. Location of URI-GSO, RIDFW, and MDMF Trawl Samplings.

URI-GSO Surveys

The URI-GSO has conducted weekly otter trawl surveys just offshore of Narragansett Bay in Rhode Island Sound since 1959 (Jeffries *et al.*, 1988). The survey location is just outside the northern boundary of the ZSF (see Figure 3-42). Data (number of fish per tow) from 1990 through 2001 were used to calculate an annual CPUE.

From 1990 to 1994, the annual catch by the URI-GSO surveys at the mouth of Narragansett Bay increased from approximately 3,300 fish/tow to slightly more than 10,000 fish/tow. Since 1994, the annual CPUE for these surveys has gradually declined.

Trends in Annual Fish Catch from a Single Location at the Mouth of Narragansett Bay (1990 – 2001).



Most Abundant Species

Abundance data from the URI-GSO dataset were available for the most abundant 17 species only.

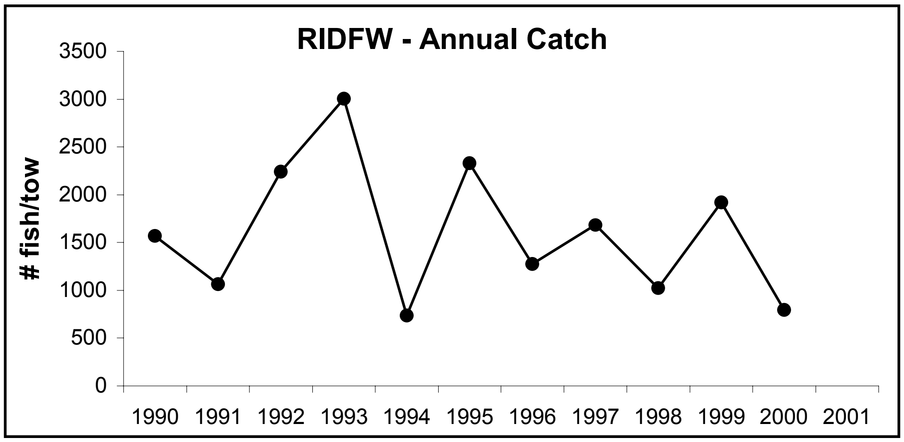
Species (% Total Catch) (1990–2001)

Butterfish (39.7)
Longfin squid (24.6)
Little skate (8.4)
Scup (8.1)
Winter flounder (5.9)
Silver hake (3.8)
Fourspot flounder (2.7)
Windowpane flounder (2.5)
Atlantic herring (2.2)
Red hake (0.8)
Summer flounder (0.5)
Northern searobin (0.4)
Longhorn sculpin (0.4)
Cod (0.1)
Ocean pout (<0.1)
Cunner (<0.1)
Tautog (<0.1)

RIDFW Surveys

Since 1979, the RIDFW has conducted a spring/fall trawl survey at six stations in nearshore Rhode Island Sound waters (near the mouth of Narragansett Bay) and at 10 coastal stations in Block Island Sound (see Figure 3-42). Only the 10 coastal stations located in Block Island Sound are within the ZSF. The six stations near the mouth of Narragansett Bay are slightly north of the ZSF. Unlike the sharp increase and steady decline in catch observed from the URI-GSO data, the finfish catches shown by the RIDFW data have fluctuated from year to year. An increase in the catch was observed from 1991 through 1993, but a sharp decline occurred in 1994, which was the lowest catch during the 11-year period.

Annual CPUE at 10 Locations in Block Island Sound and 6 Locations Near the Mouth of Narragansett Bay



Most Abundant Species
The 25 most abundant species for this survey program are listed.

Species (% Total Catch) (1990–2001)

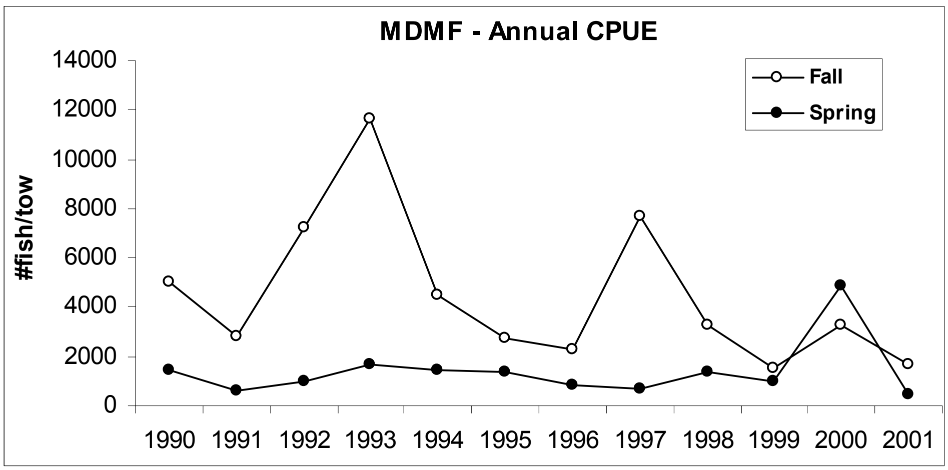
Scup (28.2)
Squid (23.9)
Butterfish (21.7)
Bay anchovy (17.7)
Skate (2.0)
Winter flounder (1.2)
Atlantic herring (0.6)
Alewife (0.5)
Silver hake (0.4)
Bluefish (0.4)
Weakfish (0.3)
Red hake (0.3)
Blueback herring (0.3)
Atlantic silverside (0.2)
Longhorn sculpin (0.2)
Northern searobin (0.2)
Windowpane flounder (0.2)
Black seabass (0.1)
Fourspot flounder (0.1)
Ocean pout (0.1)
Striped searobin (0.1)
Moonfish (0.1)
Menhaden (<0.1)
Rough scad (<0.1)
Cunner (<0.1)

MDMF Surveys

The MDMF has conducted long-term otter trawl surveys during the spring and fall since 1979 similar to those conducted by RIDFW. Since 1979, about 50 stations have periodically been sampled in the vicinity of the ZSF, generally along the northeast border (see Figure 3-42). An annual CPUE was calculated for each season by averaging the catch per tow for all locations within a particular season and year.

In the region surveyed by the MDMF, the data suggested that spring fish abundance remained relatively constant throughout the years, whereas fish abundance during the fall fluctuated. Fall catches in most years were also greater than those observed during the preceding spring. In 2000, the largest spring catch occurred and the catch slightly exceeded the fall catch for that year.

Trends in Annual Fish Catch During the Spring and Fall MDMF Trawl Surveys at Multiple Sites Within or Adjacent to the ZSF



Most Abundant Species

The 25 most abundant species for this survey program are listed.

Species (% Total Catch) (1990–2001)

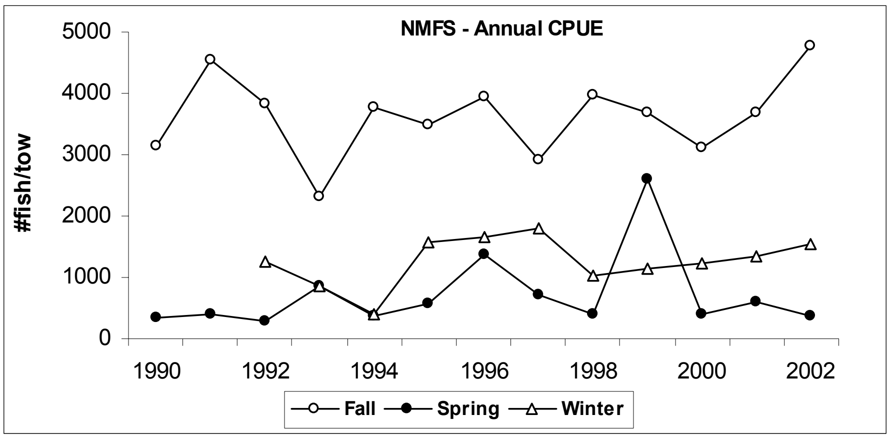
Scup (38.1)
Butterfish (30.5)
Longfin squid (7.3)
Little skate (4.9)
Winter flounder (4.4)
Silver hake (3.3)
Red hake (2.1)
Blueback herring (1.6)
Winter skate (1.0)
Longhorn sculpin (0.9)
Alewife (0.8)
Atlantic herring (0.7)
Fourspot flounder (0.7)
Northern searobin (0.5)
Black sea bass (0.4)
Pipefish (0.3)
Mackerel scad (0.3)
Ocean pout (0.3)
Spiny dogfish (0.3)
Windowpane flounder (0.2)
Anchovies (0.2)
Summer flounder (0.2)
Gulf stream flounder (0.1)
Spotted hake (0.1)
Cod (0.1)

NMFS Surveys

The NMFS uses a stratified random sampling design to identify tow locations to be sampled during the seasonal stock assessment trawl surveys it has conducted in the coastal waters off the United States since the late 1960s. Since 1990, NMFS has collected data at 102 stations within or adjacent to the ZSF. Originally, the trawls were conducted only in the spring and fall, but in 1992, winter surveys were added. Therefore, the data used for this analysis include spring and fall surveys from 1990 to 2002 and winter surveys from 1992 to 2002. An annual CPUE was calculated for each season by averaging the catch per tow for all locations within a particular season and year.

In general, the NMFS trawl data suggested that finfish abundance (as measured by CPUE) has varied from year to year regardless of season. During all years from 1990 through 2002, the abundance of finfish in fall was greater than that in either spring or winter. Spring abundances were often lower than or equal to those observed during the winter except for a peak in the spring of 1999.

Trends in Annual Abundance During the Spring, Fall, and Winter NMFS Trawl Surveys at Multiple Sites Within the ZSF



Most Abundant Species

The 25 most abundant species for this survey program are listed.

Species (% Total Catch (1990–2001)

Little skate (13.6)
Longfin squid (11.3)
Atlantic herring (10.5)
Butterfish (10.5)
Scup (10.1)
Silver hake (8.1)
Round herring (5.5)
Winter skate (3.4)
Ocean pout (2.6)
Atlantic mackerel (2.5)
Anchovies (2.3)
Alewife (2.1)
Winter flounder (2.1)
Spiny dogfish (1.7)
Longhorn sculpin (1.7)
Yellowtail flounder (1.5)
Windowpane flounder (1.2)
Gulf stream flounder (1.1)
Black sea bass (1.1)
Red hake (1.1)
Fourspot flounder (1.0)
Atlantic silverside (0.7)
Blueback herring (0.4)
Northern searobin (0.3)
Summer flounder (0.3)

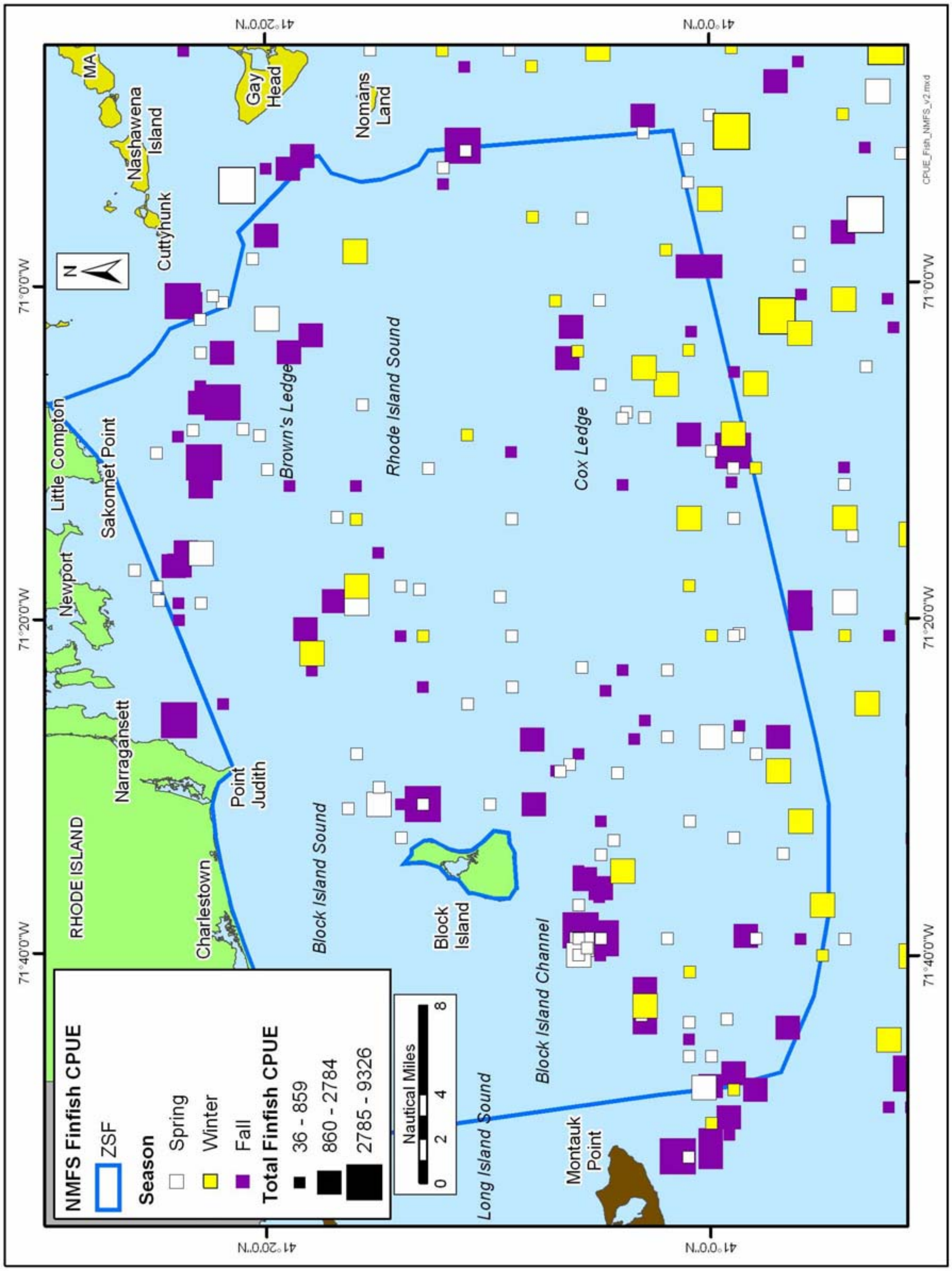
The four long-term fish trawl survey programs identified 116 species of fish that occurred within the ZSF (Appendix A-3). Forty-eight species were common among all surveys. Seven species appeared consistently as dominant species among the programs. These were scup, butterfish, longfin squid, little skate, winter flounder, silver hake, and red hake (Appendix A-3). Whether these were the most abundant species, or ranked lower, varied among the long-term trawl programs. As expected, surveys in nearshore waters contained more coastal species, which were not present, or were less abundant, in offshore waters.

The relative abundance of Atlantic herring, Atlantic mackerel, and ocean pout were greater in the NMFS long-term trawl survey than in the others; conversely, winter flounder was less abundant. These differences are most likely related to the greater offshore extent of the NMFS trawl surveys. The four most abundant species (longfin squid, butterfish, scup, little skate) accounted for greater than 80 percent of the total catch in the URI-GSO, RIDFW, and MDMF surveys, but only 45 percent of the total in the NMFS surveys. Some of the differences observed in species occurrence and abundance resulted from the varied seasonal sampling strategies and location within the ZSF (RIDFW, URI-GSO, MDMF surveys were inshore; NMFS surveys were more offshore). Some of the differences between the NMFS surveys and the other surveys were also attributed to the greater geographic area sampled in the NMFS surveys. Despite the differences, the combined results of the surveys indicated the demersal species most likely to occur within the ZSF.

The CPUE of the individual trawls making up the NMFS research trawl dataset were plotted within the ZSF by season (Figure 3-43). By evaluating the CPUE spatially, the specific areas within the ZSF were compared to determine if some areas had consistently higher productivity (as measured by CPUE), and therefore indicated better finfish habitats. All NMFS trawl data (from 1990–2002) were evaluated by using a statistical formula that identifies natural breakpoints in the data. These natural breakpoints served to rank the finfish catch into three levels indicating that the particular location was highly productive (CPUE $\geq$ 2,785), of medium productivity (860 $\leq$ CPUE $\geq$ 2,784) or of low productivity (CPUE $\leq$ 860) at the time of sampling.

In general, NMFS conducted more tows within the ZSF during the fall surveys than during the winter or spring surveys (Figure 3-43). The highest catches of fish occurred during the fall surveys at several locations throughout the ZSF. Three areas of generally high productivity (CPUE > 2,785 fish per tow) within general regions of medium productivity (CPUE = 860 to 2,784 fish per tow) were identified. One area was near the northern boundary of the ZSF (near the mouth of Narragansett Bay), the second was southwest of Block Island, and the third was near the southeast boundary of the ZSF. Tows conducted in the central portion of the ZSF suggested that this was an area of low productivity relative to other areas sampled in the ZSF (CPUE < 860).

Most winter tows were near the southern boundary of the ZSF (Figure 3-43). Several locations immediately inside the ZSF in this southern boundary region showed areas of medium productivity, whereas locations slightly to the north showed lower productivity. The few winter tows conducted in the central portion of the ZSF also showed medium or low productivity.



Note: CPUE Data for NMFS winter trawls are from 1992 – 2002 only.

Figure 3-43. Distribution of Finfish CPUE Observed During NMFS Trawl Surveys in the Fall, Winter, and Spring (1990–2002).

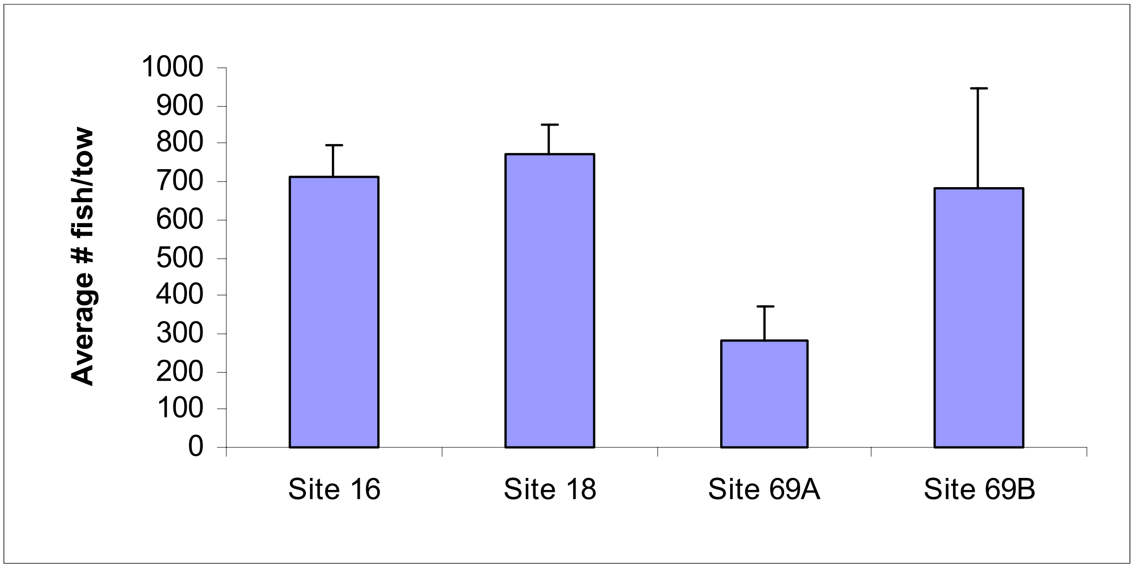
Most spring tows conducted within the ZSF (Figure 3-43) had relatively low CPUE values (<860 fish per tow). Several regions showed high productivity in the fall (e.g., southwest and east of Block Island) and medium productivity in the spring (April and May). In regions that had medium productivity in the fall, productivity was generally lower in the spring. The migration of many species into the ZSF may not occur until later in May, when water temperatures are more suitable. Therefore, the low productivity observed during the spring surveys suggests that migration of many species may not have occurred prior to the surveys.

Recent Trawl Surveys in Rhode Island Sound

In support of this Final EIS, trawl surveys were conducted at several locations within the ZSF in September 2001 (Corps, 2002g), June 2002 (Corps, 2003i), November and December 2002 (Corps, 2003d), and July 2003 (Corps, 2003j). In June 2002, a series of otter trawls were conducted at four locations, three of which (Site 18, Site 69A, and Site 69B, which is now called Site W) were evaluated as alternative dredged material disposal sites in support of the Providence River and Harbor Maintenance Dredging Project EIS. The fourth site sampled (Site 16) was the historic disposal site at Brenton Reef, which is located near the northern boundary of the ZSF. In July 2003, several otter trawls were conducted at areas in and near each of the two alternative sites evaluated in this Final EIS (Corps, 2003j). These sites are located in the central portion of the ZSF. The methods used for these surveys differed slightly from those conducted by NMFS and the other agencies conducting long-term trawl survey programs within the area. Thus, results cannot be directly compared to the other programs. The results can, however, discriminate differences in catch among the specific sites surveyed.

The June 2002 otter-trawl survey collected 22 species at four locations in the north-central portion of the ZSF (Corps, 2003i). Species composition was similar among all locations surveyed; however, more species were observed at Site 16 (16 species) and Site 69B (15 species) than at Site 18 (11 species) and Site 69A (12 species). The overall catch (measured as mean CPUE) differed among the sites (Figure 3-44). The largest catches (680 to 771 fish/tow) occurred at Sites 18, 16, and 69B, and the smallest catch (279 fish/tow) occurred at Site 69A. The NMFS tows also suggested low to moderate populations of fish in the general vicinity of the sites; however, CPUE values cannot be directly compared because of the variations in sampling gear between the surveys.

Additional finfish sampling was conducted in November and December 2002 (Corps, 2003d) in response to Rhode Island commercial fishermen suggestions that (1) bottom topography (i.e., sharp changes in bathymetric contours) was critical to the fish communities in Rhode Island Sound (Petruny-Parker *et al.*, 2003), and (2) in this region, the finfish are most often caught from topographic depressions that are bordered by shallower waters. The fishermen indicated that some fish species congregate at the boundaries between these topographic depressions and surrounding shallower waters and that these topographic depressions serve as migratory routes for fish species during seasonal movements into and out of Narragansett Bay and more coastal waters.



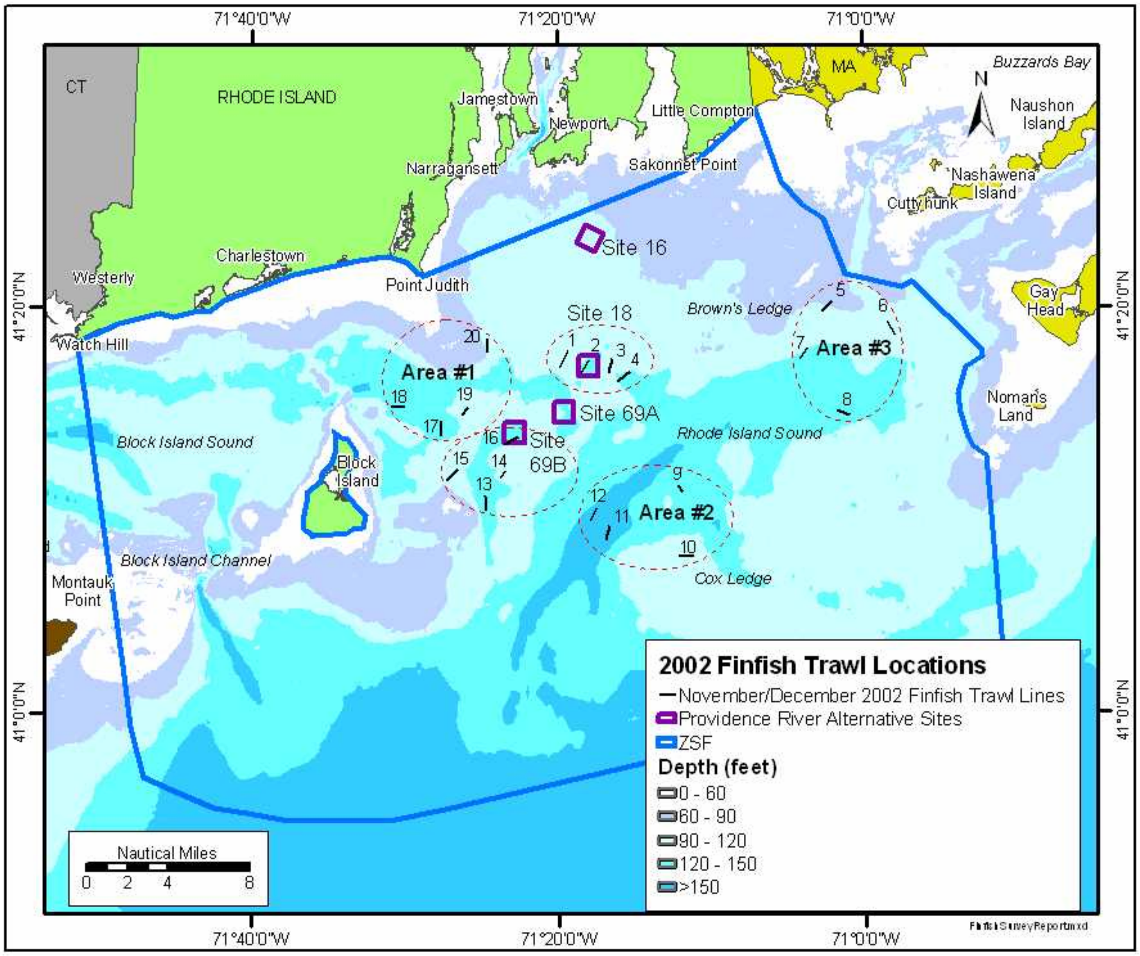
Source: Corps, 2003i
Note: Error bars represent one standard deviation from mean.

Figure 3-44. Average CPUE per 30-min Tow at Four Locations Sampled in June 2002.

To evaluate whether fish congregate in the topographic depressions, several otter trawls were conducted in five regions within the ZSF identified by the fishermen as critical fishing locations (Figure 3-45). Two tows in the deep hole/trench areas (water depths > 120 ft) and two tows in surrounding shallower waters (water depths < 120 ft) were conducted within each of the five regions (Corps, 2003d).

No clear pattern of habitat use emerged from the study. In November 2002, the CPUE for deep areas was greater than the CPUE for shallow areas for two locations (Site 18 and Site 69B), whereas the reverse occurred for three locations (Areas #1, #2, and #3) (Figure 3-46). However, the single shallow tow in Area #2 included a very large school of spiny dogfish, which likely overestimated the shallow habitat CPUE for the location. During December 2002, when it was likely that the fall migrations were completed, the deep habitat CPUE again was greater at the Site 69B and Area #2 locations. However, at the other three locations, the deep- and shallow-habitat CPUE values were similar (Figure 3-46).

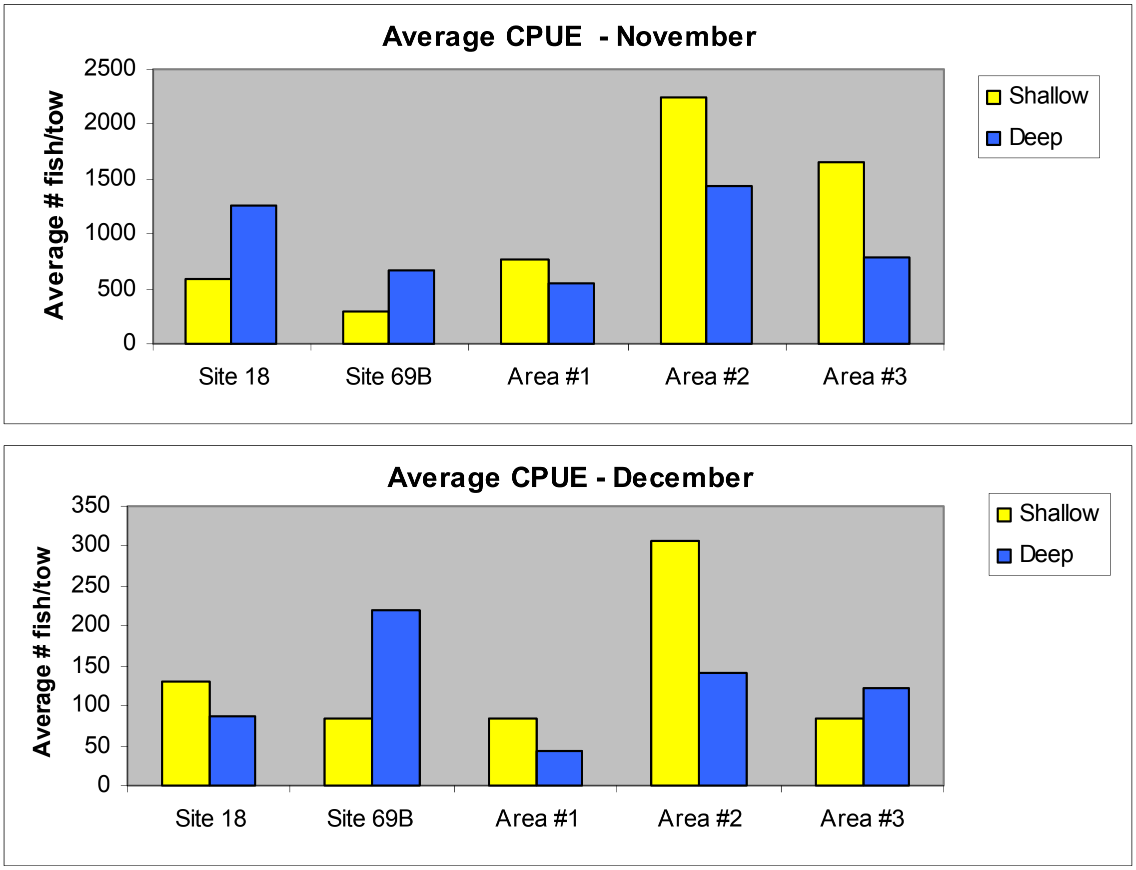
The numbers of species collected in the deep-water (27) and shallow-water (28) tows were similar (Appendix A-3). Each habitat (deep versus shallow) had five or six species not collected elsewhere. The four-bearded rockling, sea raven, spot, tautog, and weakfish were caught only in the deep-habitat tows. Blueback herring, cunner, rough scad, round herring, sea scallops, and silverside were caught only in the shallow-habitat tows.



Note: dashed lines represent areas where comparative trawls were taken

Figure 3-45. Finfish Trawl Locations in Relation to Depth during Surveys Conducted by Battelle in 2002.

Scup, butterfish, squid, spiny dogfish, and various skate species were the most abundant species collected from both habitats. However, the most abundant species in the shallow habitats (butterfish) differed from that in deep habitats (scup). Several species had similar CPUE in deep and shallow areas (e.g., yellowtail flounder, ocean pout, longhorn sculpin). Winter flounder, spiny dogfish, and skate CPUE values were greater in the shallow tows, whereas summer flounder, four-spot flounder, and lobster CPUE values were greater in the deep tows.



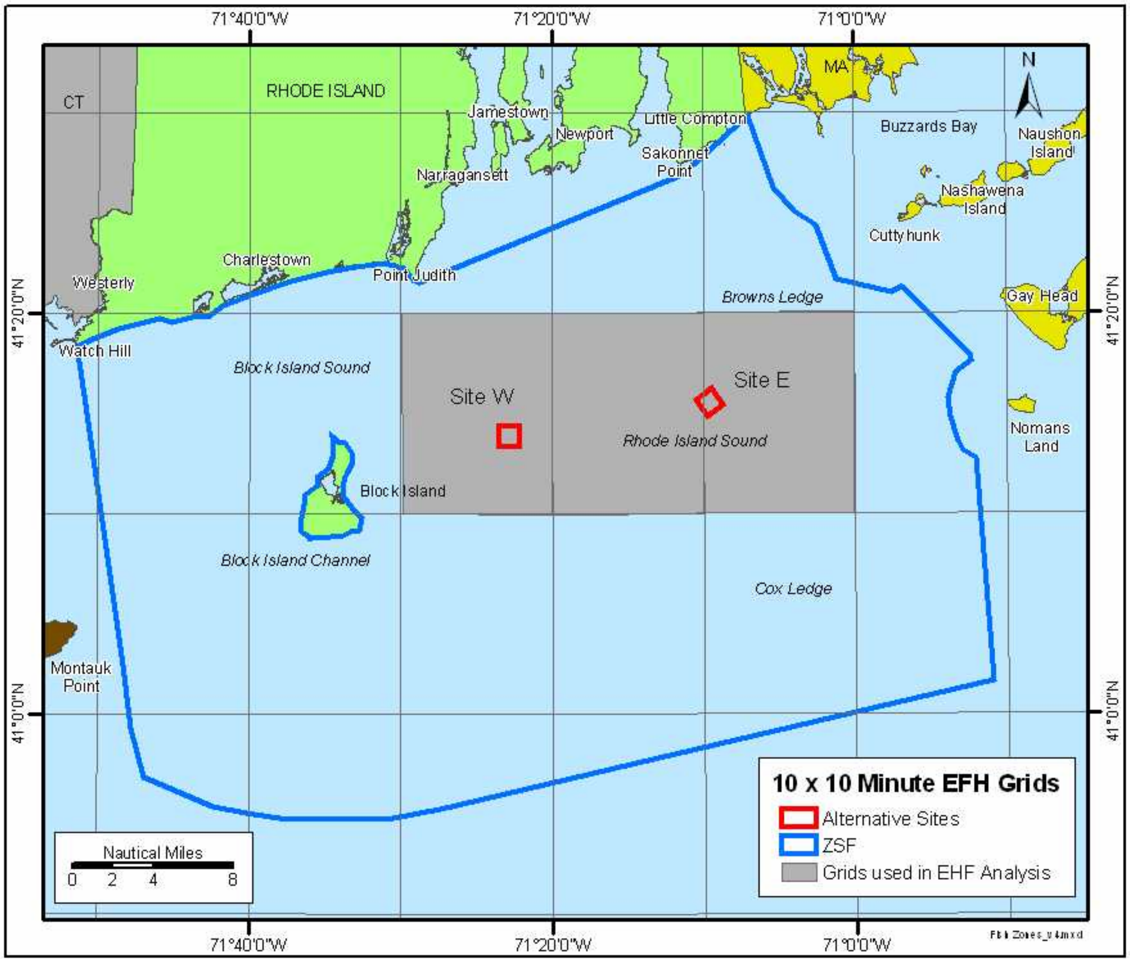
Source: Corps, 2003d

Figure 3-46. Average CPUE per 15-min tow in Shallow-Water and Deep-Water Tows in November and December 2002.

Essential Fish Habitat (EFH)

Many marine habitats are critical to the productivity and sustainability of marine fisheries. The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires that an EFH consultation be conducted for any activity that may adversely affect important habitats of Federally managed marine and anadromous fish species. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). "Waters" in the above definition refers to the physical, chemical, and biological properties of aquatic areas that are currently being used or have historically been used by fish. "Substrate" refers to sediment, hard bottom, or other underwater structures and their biological communities. The term "necessary" indicates that the habitat is required to sustain the fishery and support the fish species' contribution to a healthy ecosystem.

The U.S. Department of Commerce designates EFH. These designations have been identified on mapped grid squares of 10- by 10-minutes covering the marine habitat along the U.S. coast. The ZSF lies within 24 of these 10- by 10-minute squares (Figure 3-47). Thirty-eight finfish species (9 sharks, 2 skates, 27 boney fishes) and five invertebrate species have EFH designated within



Source: NOAA, 2003a

Figure 3-47. 10- by 10-Minute Grids defining EFH Within the ZSF.

the ZSF (Appendix A-4). The American lobster is not one of the species managed under the authorizing EFH legislation and does not have designated EFH. Nineteen of these species have EFH designated for the egg stage of their development, and 30 species have EFH designated for their larval stages. Thirty-eight and 37 species have EFH designated for their juvenile and adult stages, respectively. The specific habitat requirements for any given EFH species may not exist universally at all locations within each grid square or the entire ZSF.

Life History Characteristics of Key Finfish

Many of the finfish found within the ZSF are permanent residents but migrate to more inshore waters or farther offshore in response to changes in temperature (e.g., summer flounder, winter flounder). Several species observed in the ZSF are highly migratory pelagic species that move from areas in the Caribbean to the waters of southern New England during the warmer months. These include the mackerels (King and Spanish), cobia, and several shark species. Table 3-13

Table 3-13. Life History Characteristics of Several Finfish Species Observed in the ZSF.

Species	Distribution	General Habitat	Bottom Type	Migrations	Spawning	Eggs and Larvae	Food
Demersal - Flounders							
Summer flounder (*Paralichthys dentatus*)	Gulf of Maine to South Carolina	Bays and estuaries, continental shelf waters	Mud or sand	Move offshore in fall	Fall and early winter	Pelagic eggs and larvae	Small fish, shrimp, crustaceans squid, mollusks, worms, sand dollars
Windowpane flounder (*Scophthalmus aquosus*)	Gulf of St. Lawrence to Florida	Large estuaries	Sand, mixtures of sandy silt or mud	Not likely to undergo inshore – offshore migrations	Late spring and summer	Pelagic eggs and larvae	Squid, crabs, small mollusks, worms
Winter flounder (*Pseudopleuronectes americanus*)	Labrador to Georgia	Bays, estuaries, continental shelf waters from tide mark to 420 ft	Muddy sand with patches of eelgrass, sand, clay, gravel or cobble	Generally localized small scale migrations inshore in winter	February – June	Demersal eggs, pelagic larvae	Mollusks, crustaceans, worms, sea cucumbers
Witch flounder (*Glyptocephalus cynoglossus*)	Gulf of St. Lawrence to North Carolina	Outer edge of continental shelf	Mud, clay, mud-clay-sand mixtures	Not likely to undergo inshore – offshore migrations	Late spring and summer	Pelagic eggs and larvae	Small crustaceans, mollusks, worms
Yellowtail flounder (*Pleuronectes ferruginea*)	Labrador to Chesapeake Bay	Continental shelf waters from 98–295 ft	Sand or sand and mud mixtures	Not likely to undergo inshore – offshore migrations	Spring and summer	Pelagic eggs and larvae	Small bivalves, crustaceans, shrimp, worms
Demersal - Groundfish							
Atlantic cod (*Gadus morhua*)	Greenland to North Carolina	Continental shelf waters from 131–426 ft	Rocky slopes or ledges, rock, gravel, mud, sand, clay	Extensive migrations with seasons, and in response to food	November through May	Pelagic eggs and larvae	Extensive diet but mainly mollusks, crabs, lobsters, shrimp, brittle stars
Black sea bass (*Centropristis striata*)	Maine to Florida	Bays, estuaries and continental shelf waters to 328 ft	Structured hardbottom (shellfish beds, pilings, wrecks, offshore ledges, reefs)	Move inshore during spring and summer	May through July	Pelagic eggs and larvae	Crabs, lobsters, shrimp, mollusks
Haddock (*Melanogrammus aeglefinus*)	Greenland to North Carolina	Continental shelf waters from 148–443 ft	Sand, rock, pebbles, broken shell	May move in response to food	January through June	Pelagic eggs and larvae	Extensive diet of crustaceans, mollusks, worms, shrimp

Source: Bigelow and Schroeder, 1953; Cross *et al.*, 1999; U.S. Fish and Wildlife Service, 1978

Table 3-13 (continued). Life History Characteristics of Several Finfish Species Observed in the ZSF.

Species	Distribution	General Habitat	Bottom Type	Migrations	Spawning	Eggs and Larvae	Food
Monkfish (*Lophius americanus*)	Gulf of St. Lawrence to North Carolina	Continental shelf waters from tideline to >2,190 ft	Hard sand, sand-shell mix, mud gravel, algae covered rocks	Moves inshore in fall in Rhode Island waters	Spring, summer and early fall	Pelagic egg veils and larvae	Fish, invertebrates, sea birds
Ocean pout (*Macrozoarces americanus*)	Labrador to Delaware	Continental shelf waters 33–262 ft	Sand-mud, sticky sand, gravel, rocks	Changes habitats when seasons change: winter-spring in sand-gravel areas; summer-fall in rocky area	September and October	Demersal eggs and larvae	Shelled mollusks, crustaceans, echinoderms
Red hake (*Urophycis chuss*)	Gulf of St. Lawrence to Virginia	Continental shelf waters from tide mark to 984 ft	Soft mud and silt (juveniles near shellfish beds)	Extensive seasonal migrations – inshore in spring and summer and offshore in winter	May through November	Pelagic eggs and larvae	Shrimp, crustaceans, squid, small fish
Scup (*Stenotomus chrysops*)	Massachusetts to North Carolina	Continental shelf waters from shoal areas (~3 ft) to deeper waters (591 ft)	Rocky bottoms	Move inshore in spring-summer and offshore in winter	Summer	Pelagic eggs and larvae	Crustaceans, worms, hydroids, sand dollars, young squid
Whiting (*Merluccius bilinearis*)	Newfoundland to South Carolina	Continental shelf waters from tide mark to 1066 ft	All substrate types	Move inshore in spring and offshore in fall – vertical migrations in response to prey	Late spring and early summer	Pelagic eggs and larvae	Herring, other small schooling fish
Pelagic							
Atlantic butterfish (*Peprilus triacanthus*)	Newfoundland to Florida	Coastal waters to continental shelf waters (420 m)	Surface waters over sand bottoms	Move offshore and south during winter	June through August	Pelagic eggs and larvae	Small fish, squid, amphipods, shrimp
Atlantic mackerel (*Scomber scombrus*)	Gulf of St. Lawrence to North Carolina	Continental shelf waters	Not dependent on coastline or bottom	Highly migratory – appear near coast in spring – disappear in fall	Spring and early summer	Pelagic eggs and larvae	Copepods, pelagic crustaceans, small fish

Source: Bigelow and Schroeder, 1953; Cross *et al*., 1999; U.S. Fish and Wildlife Service, 1978

Table 3-13 (continued). Life History Characteristics of Several Finfish Species Observed in the ZSF.

Species	Distribution	General Habitat	Bottom Type	Migrations	Spawning	Eggs and Larvae	Food
Atlantic sea herring (*Clupea harengus*)	Labrador to North Carolina	Continental shelf waters in large schools	Only during spawning – in gravel, cobble, sand substrates	May migrate to inshore areas during spawning	July through November	Demersal eggs, demersal, then pelagic larvae	Plankton (larval snails, diatoms, crustaceans)
Bluefish (*Pomatomus saltatrix*)	Maine to Florida	Continental waters (~80 nmi offshore) in schools	Juveniles may occur along beaches, estuaries, tidal creeks over sand and gravel	Migrate north in spring and south in fall	Summer months in the mid-Atlantic Bight	Pelagic eggs and larvae	Fish, crustaceans
Cobia (*Rachycentron canadum*)	Massachusetts to Argentina	Open waters, bays, harbors, tidal creeks	Reefs, oyster beds, pilings, buoys and wrecks	Highly migratory (solitary) south in fall and north and inshore in spring	July through August in Chesapeake Bay	Pelagic eggs and larvae	Fish, crustaceans
King mackerel (*Scomberomorus cavalla*)	Maine to Brazil	Coastal waters	All substrate types	Highly migratory – north in the spring and south in the fall	July through September	Pelagic eggs and larvae	Fish, crustaceans
Spanish mackerel (*Scomberomorus maculatus*)	Maine to Gulf of Mexico	Shallow coastal waters and tidal estuaries	All substrate types	Highly migratory (schools) – north in spring and south in fall	August through September in tidal estuaries	Pelagic eggs and larvae	Fish, crustaceans
Spiny dogfish (*Squalus acanthias*)	Labrador to Florida	Coastal waters and shelf edge waters	All substrate types	Move into coastal waters during spring and fall and to edge of shelf during summer			Fish, crustaceans
Invertebrate							
Longfin squid (*Loligo pealeii*)	Newfoundland to Venezuela	Continental shelf and slop waters	All substrate types	Move inshore during spring and summer and offshore in fall and winter	Year-round	Benthic eggs (attached to substrate) and pelagic larvae	Small planktonic prey, crustaceans, small fish

Source: Bigelow and Schroeder, 1953; Cross *et al*., 1999; U.S. Fish and Wildlife Service, 1978 summarizes the life history characteristics of several key finfish species, including their overall distribution in the northwest Atlantic, habitat and bottom type preferences, spawning periods, egg and larval habitats, and food preferences. This table lists the most commonly observed species in the ZSF; all of the species with EFH are listed in Appendix A.

In summary, the finfish resources within the ZSF are spatially and temporally variable, primarily because fish are mobile, moving between different locations within the ZSF in search of prey or better habitat. Several species that migrate in conjunction with temperature changes also contribute to this variability. The NMFS surveys provide the best indication of the spatial variability of the fish resources in the ZSF. Areas of relatively high fish abundance occur in the northeast, southwest, and southeast regions of the ZSF, whereas lower abundances occur within the more central portions of the ZSF (Figure 3-43). In general, the finfish resource in the ZSF can be characterized as of medium to low productivity, with most samples having calculated CPUE values < 2,785 fish per trawl. The NMFS and MDMF studies provide an indication of temporal variability in the finfish resource within the ZSF. Both studies indicate that fish populations in the ZSF in the fall are larger than during other seasons of the year. Furthermore, the NMFS surveys of the species they catch indicate that the fish populations in the fall are about three to four times larger than those found in other seasons.

The four major sampling programs conducted in and near the ZSF yielded 114 finfish species, of which 48 were collected by all four programs. Nearshore populations were characterized by relatively high abundances of a few species, whereas offshore population abundances were more evenly spread among the more common species. The primary species occurring in the nearshore waters of, or immediately adjacent to, the ZSF were scup, longfin squid, and butterfish, which accounted for about 75 percent of the total catch in coastal waters. Offshore catches were characterized by little skate, longfin squid, Atlantic herring, butterfish, and scup, which accounted for 56 percent of the total NMFS catch from 1991 to 2001. Fish species typically found in the ZSF are wide-ranging species found throughout the coastal northwest Atlantic. There are no unique species, habitats, or fishery resource use patterns within the ZSF. The ZSF provides EFH for 36 finfish and 5 invertebrate species managed under the Magnuson – Stevens Act, mostly for adult and juvenile lifestages. All of the species occur along the northeastern Atlantic coast of the United States and have EFH designated for waters other than those within the ZSF (see Appendix A-4). A recent study attempted to assess whether fish use topographic depressions preferentially during these migrations. This remains unclear, although various long-term finfish trawl monitoring and commercial fish landings from the region have shown that the topographic depressions and surrounding shallow areas can support, differentially, various finfish species throughout the year.

The ZSF provides EFH for 38 finfish and 5 invertebrate species, mostly for adults and juveniles. All of the species occur along the northeastern Atlantic coast of the United States and have EFH designated for waters other than those within the ZSF.

3.10.2 Site E

Although the four long-term trawl survey programs described above have conducted many tows in or near the ZSF, only those in the NMFS program have occurred near the two alternative sites. Therefore, most of the information about fish populations in or near the sites is derived from the series of surveys conducted in support of the Providence River and Harbor Maintenance Dredging Project EIS and this Final EIS. The few trawls conducted by NMFS, standardized to equal 30-min tows, within about 4 nmi of Site E yielded relatively low CPUE values (270 to 651 fish/tow) compared to most of the ZSF sampled by NMFS.

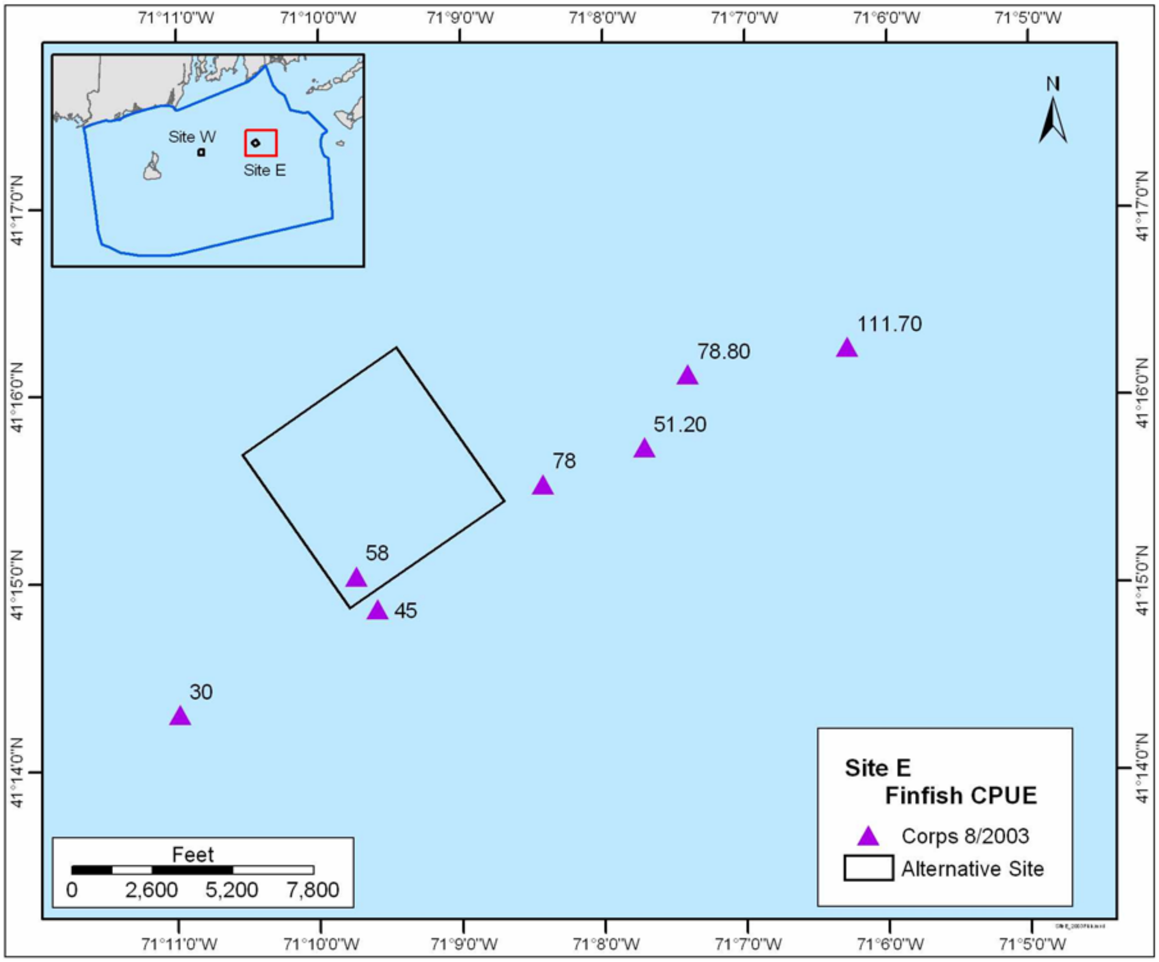
In July 2003, seven 15- to 18-min otter trawls were conducted in and near Site E (Figure 3-48); all CPUE values were standardized to equal a 30-min tow (Corps, 2003j). Because of the rocky seafloor to the north and east of Site E, most of the tows were conducted just southeast of this area. CPUE values from Site E and the surrounding area ranged from 30.0 to 111.6 fish/tow, with an average of 64.5 fish/tow (Figure 3-48; Table 3-14). Fifteen species were caught in the trawls from Site E and the surrounding area. Unidentified skate species were the most abundant fish caught (Table 3-14). Winter flounder, silver hake, Atlantic butterfish, and spiny dogfish were the four next most abundant species. Five species collected, but uncommon, at Site E were not caught at Site W. These were smooth dogfish, haddock, yellowtail flounder, blueback herring, and an unspecified species of dogfish.

Only one tow was directly within Site E boundaries. The CPUE for this tow was 58.0 fish/tow and included seven species. The four most common species caught on this tow were the same as those listed for the entire area sampled. One tow occurred just beyond the southeastern boundary of Site E. This tow had a CPUE of 45.0 fish/tow and caught nine species.

The recent Site E trawl results, and data collected by NMFS in the general vicinity of Site E, indicated that the site is within a region of the ZSF that has relatively low fish productivity. The most common species found at the site were similar to those found elsewhere in the central region of the ZSF.

As described above for the ZSF in general, the "National Marine Fisheries Service Guide to Essential Fish Habitat website (http://www.nero.nmfs.gov/ro/doc/webintro.html) was used to determine which species have designated EFH in Site E. The coordinates of the 10– by 10-minute squares that are representative of the geographic area surrounding the Site E are listed in Table 3-15. Two contiguous grid regions were used to characterize Site E.

Twenty-nine finfish species (6 sharks, 2 skates, 21 boney fish) and one invertebrate species (longfin squid) have EFH designated within Site E (Appendix A-4). Ten species have EFH designated for all four life stages. These are Atlantic mackerel, Atlantic cod, cobia, king mackerel, ocean pout, Spanish mackerel, whiting, windowpane flounder, winter flounder, and yellowtail flounder. The life-history characteristics of these species are summarized in Table 3-13.



Source: Corps, 2003j

Figure 3-48. Mean Finfish CPUE for 30-Min Tow for Site E and the Surrounding Area.

Table 3-14. Mean CPUE and Mean Length for Species Collected in Seven Otter Trawls from Site E and the Surrounding Area, July 2003.

Species Name	N[2]	CPUE [1]		Length (cm)	
		Mean	StDev	Mean	StDev
Skate	106	27.8	16.3	45.3	7.5
Winter flounder	42	10.7	9.3	25.8	6.5
Silver hake	32	8.4	5.0	18.3	3.5
Atlantic butterfish	18	4.9	2.6	10.1	3.1
Spiny dogfish	14	3.3	3.4	80.6	4.7
Fourspot flounder	10	2.5	4.2	21.4	10.9
Summer flounder	8	2.1	2.2	29.1	20.5
Squid	7	1.8	2.3	–	–
Smooth dogfish	3	1.1	1.0	92.7	19.1
Haddock	2	0.5	0.9	9.5	0.7
Yellowtail flounder	2	0.5	0.9	24.5	12.0
American lobster	1	0.3	0.8	9.0	–
Blueback herring	1	0.3	0.7	15.0	–
Dogfish-not specified	1	0.3	0.8	67.0	–
Red hake	1	0.3	0.7	16.0	–
Site Total Catch	248	64.6	27.1	–	–
Site Species Numbers	15	8.0	1.3	–	–

StDev = standard deviation.
[1] Calculated to equal a 30-min tow.
[2] N = sum of all fish caught in the seven trawls.

Table 3-15. Latitude And Longitude Coordinates of the NMFS 10– by 10-Minute Squares Used to Determine the Species Having Designated EFH in the Geographic Area Surrounding Site E And Site W.

Site	North	East	South	West
E	41º20.0’ N	71º00.0’ W	41º10.0’ N	71º10.0’ W
E	41º20.0’ N	71º10.0’ W	41º10.0’ N	71º20.0’ W
W	41º20.0’ N	71º20.0’ W	41º10.0’ N	71º30.0’ W

3.10.3 Site W

Five trawls conducted by NMFS, standardized to equal 30-min tows, within about 4 nmi of Site W yielded relatively low CPUE values (217 to 725 fish/tow). However, three trawls conducted about 4 nmi northeast of Site W yielded medium CPUE values (988–1,396 fish/tow).

Several trawl surveys were conducted at Site W during a recent evaluation of the site for the Providence River and Harbor Maintenance Dredging Project EIS. The trawls at Site W were conducted at different times of the year (June, November, and December) than more recent tows conducted west and north of Site W (July 2003). The CPUE for three tows at Site W in June

2002 ranged from 288 fish/tow to 1,322 fish/tow, with a mean CPUE of about 680 fish/tow (Figure 3-44). Fifteen species were caught at Site W during this survey. Squid (unidentified species) comprised the largest portion of the catch (101 to >1,170/30-min tow). Little skate, spiny dogfish, Atlantic butterfish, and winter flounder were the next most abundant species.

In July 2003, three 11- to 15-min otter trawls were conducted west or north of Site W (Corps, 2003j) (Figure 3-49). CPUE values (standardized to equal 30-min tows) for the tows near Site W ranged from 50.0 to 82.0 fish/tow, with a mean CPUE of 70.8 fish/tow (Table 3-16). Thirteen species were caught in the trawls near Site W. Unidentified skate species were the most abundant fish caught (Table 3-16). Atlantic butterfish, winter flounder, spiny dogfish, and red hake were the four next most abundant species.

Three species collected, but uncommon, at Site W were not caught at Site E. These were scup, sea raven, and white hake. The CPUE values calculated for tows near Site W in July 2003 were substantially lower than those obtained for the site (as Site 69B) during previous surveys. However, the predominant species were generally similar among all surveys at the two sites.

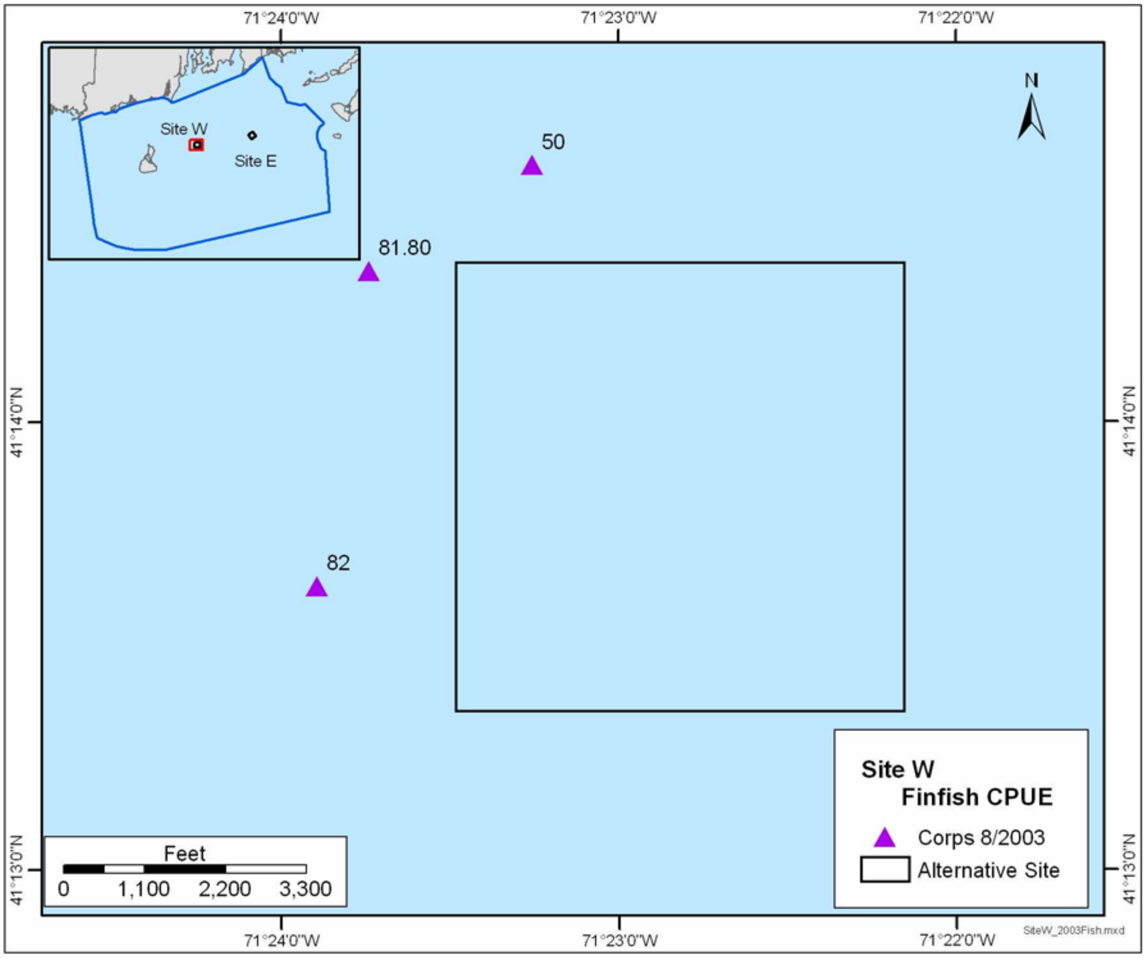
The recent Site W trawl results, and data collected by NMFS in the general vicinity of Site W, indicated that the site is within a region of the ZSF that has relatively low fish productivity. The most common species found at the site were similar to those found elsewhere in the central region of the ZSF.

The National Marine Fisheries Service Guide to Essential Fish Habitat website (http://www.nero.nmfs.gov/ro/doc/webintro.html) was used to determine which species have designated EFH in Site W. The coordinates of the 10– by 10-minute squares that are representative of the geographic area surrounding Site W are listed in Table 3-15. One grid region was used to characterize Site W.

Thirty-one finfish species (7 sharks, 2 skates, 22 boney fish) and one invertebrate species (ocean quahog) have EFH designated within Site W (Appendix A-4). Seven species have EFH designated for all four life stages. These are cobia, king mackerel, ocean pout, Spanish mackerel, whiting, windowpane flounder, and winter flounder. The life-history characteristics of these species are summarized in Table 3-13.

3.11 SHELLFISH [40 CFR SECTIONS 228.6(a)(2) AND 228.6(a)(9)]

Several commercially harvestable species of shellfish occur in the ZSF and are discussed in this section. The life history, habitat, and distribution of ocean quahogs, Atlantic surf clams, sea scallops, whelks, northern quahogs, blue mussels, and razor clams are discussed in this section and summarized in Table 3-17. Lobsters are discussed in Section 3.12. Other, smaller infaunal invertebrates that occur in the ZSF but are not commercially fished are discussed in Section 3.9, Benthic Invertebrates.



Source: Corps, 2003j

Figure 3-49. Mean Finfish CPUE per 30-Min Tow for the Area Surrounding Site W.

Table 3-16. Mean CPUE and Mean Length for Species Collected in Three Otter Trawls near Alternative Site W, July 2003.

Species Name	N [2]	CPUE [1]		Length (cm)	
		Mean	StDev	Mean	StDev
Skate spp.	28	19.4	14.7	40.2	11.2
Atlantic butterfish	20	16.2	16.4	13.7	3.5
Winter flounder	14	10.5	4.0	24.8	8.1
Spiny dogfish	12	9.2	4.0	82.1	6.0
Red hake	5	3.6	2.1	19.4	3.4
Silver hake	4	2.9	3.0	19.5	1.3
Squid spp.	4	2.9	1.0	–	–
Fourspot flounder	3	2.2	0.4	29.3	2.1
Scup	2	1.3	2.3	21.0	1.4
Sea raven	1	0.9	1.6	52.0	–
American lobster	1	0.7	1.2	9.0	–
Summer flounder	1	0.7	1.2	12.0	–
White hake	1	0.7	1.2	32.0	–
Site Total Catch	**96**	**70.8**	**27.0**	**–**	**–**
Site Species Numbers	**13**	**9.0**	**0**	**–**	**–**

[1] Calculated to equal a 30-min tow.
[2] N = sum of all fish caught in the three trawls.

The data presented here are from several studies of shellfish in the ZSF that were conducted more than 20 years ago and from more recent studies that focused on specific locations. The results of the earlier studies are used to describe the historical distributions and general characteristics of shellfish populations in the area; however, these descriptions should be used with caution because shellfish distributions may have changed since the studies were completed.

3.11.1 Rhode Island Region ZSF

The four commercially harvestable shellfish species—ocean quahogs, Atlantic surf clams, sea scallops, and whelks, which are found in the ZSF in their preferred habitats—are discussed in the general ZSF section with life history and distribution information for each species. Northern quahogs, blue mussels, and razor clams are also found in the ZSF but are limited in distribution to the coastal, nearshore areas of the northern portion of the ZSF and are discussed at the end of the general section in limited detail.

Table 3-17. Life History, Distribution, and Habitat of Shellfish Species in the ZSF.

Species	Distribution	Depth	Sediment Type	Feeding Strategy	Spawning	Larvae	Distribution within ZSF
Ocean quahog *Arctica islandica*	Newfoundland to North Carolina	30-480 ft	Fine sand	Filter feeder	Summer through fall	Planktonic	Patchy areas of high densities and low densities or none
Atlantic surf clam *Spisula solidissima*	Continental shelf waters from Gulf of St. Lawrence to North Carolina	< 240 ft	Medium sand	Filter feeder	Summer and early fall	Planktonic	Sparse
Sea scallop *Placopecten magellanicus*	Continental shelf waters from Newfoundland to North Carolina	132-660 ft	Sandy	Filter feeder	Late summer and early fall	Planktonic	Southeastern area (Cox Ledge)
Whelks *Busycotypus canaliculatus*, *Busycon carica*, *Busycon contrarium*	Cape Cod to Northern Florida	Shallow intertidal to continental slope	Sand or mud	Carnivore	Spring	Gelatinous egg mass and planktonic larvae	Nearshore areas
Northern Quahog *Mercenaria mercenaria*	Gulf of St. Lawrence to Florida	Intertidal zone to 50 ft	Sand, mud or cobble	Filter feeder	Spring, Summer, early fall	Planktonic	Shallow coastline and Narragansett Bay
Blue mussel *Mytilus edulis*	Artic to South Carolina	Attached to rocks, pilings and other solid objects	Intertidal and shallow sub-tidal	Filter feeder	Almost year-round with peaks in summer	Planktonic	Shallow coastline areas
Razor clam *Ensis directus*	Labrador to Florida	Sand and sandy mud	Bays, estuaries, shallow areas	Filter feeder	Summer through fall	Planktonic	Shallow coastline areas

Ocean Quahog

The ocean quahog, *Arctica islandica*, is a large shallow-burrowing bivalve that occurs in cold North Atlantic waters from Newfoundland to North Carolina and in Europe (Abbott, 1974). Ocean quahogs typically live in fine-sand sediments at depths of 30 to 480 ft (Abbott, 1974) and rarely occur where bottom water temperatures exceed 16 ºC. Ocean quahog distribution may be correlated with sediment organic carbon content (Bearse, 1976). Ocean quahogs feed by pumping water through a short siphon over the gills to filter food material from the water. They are important prey for juvenile and adult cod (Arntz, 1974; 1978).

Ocean quahogs grow slowly and live more than 100 years, possibly more than 200 years. Growth is very slow after clams reach 20 years of age (Weinberg, 2001). Food availability and water temperature affect growth rates, which may vary geographically. Commercial size (greater than 50 mm in shell length) may not be reached until clams are 9 to 17 years old (Murawski *et al.*, 1982) because ocean quahogs grow slowly. Ocean quahogs become reproductive at about 26 years of age, when shell length reaches about 70 mm. Spawning generally occurs from summer through autumn, resulting in planktonic larvae that develop slowly (> 30 days until settling), and thus may drift far from their spawning source. Cold winter water temperatures may severely limit larval development (Mann, 1982). Larval settlement is the most important mechanism by which new recruitment to an area may occur because ocean quahogs, although capable of burrowing, are fairly sedentary (Mann, 1990).

The fishery in southern New England began to rise in the late 1970s and reached a peak in 1994 (60,426 lbs landed) but has declined since 1994. In 1999, 76 percent of the catches were from Long Island and southern New England regions (Northeast Fisheries Science Center, 2000).

Fogarty (1979, 1981) used a hydraulic clam dredge to sample 212 stations in Rhode Island Sound. Ocean quahogs occurred at 139 stations (66 percent) and were distributed in relatively large-scale aggregations. Ocean quahog densities were highest in sediments with high amounts of medium sand and shell fragments and lowest in high silt/clay or coarse sand-gravel sediments (Fogarty, 1981). Some areas of the ZSF supported very dense populations of ocean quahogs, whereas others did not. Dense populations occurred in the southeast quadrant of the ZSF, southwest of Gay Head, and in the north-central part of the ZSF, generally from Block Island northeast to Nashawena Island (Figure 3-50). Clam distribution was very patchy and densities varied considerably over relatively small spatial scales (i.e., about the scale between tows, perhaps as small as 1 nmi).

NOAA/NMFS sampled several locations on the continental shelf from Georges Bank to Cape Hatteras in 1989 (Steimle, 1990a), although only two stations were located within the ZSF. Ocean quahogs were relatively common at a station, characterized by silty-very fine sands and strong tidal currents, located in the north-central area of the ZSF. No ocean quahogs were found at the other NOAA station, characterized as silty muds in a coastal-active area influenced by upwelling, located at the mouth of Narragansett Bay.

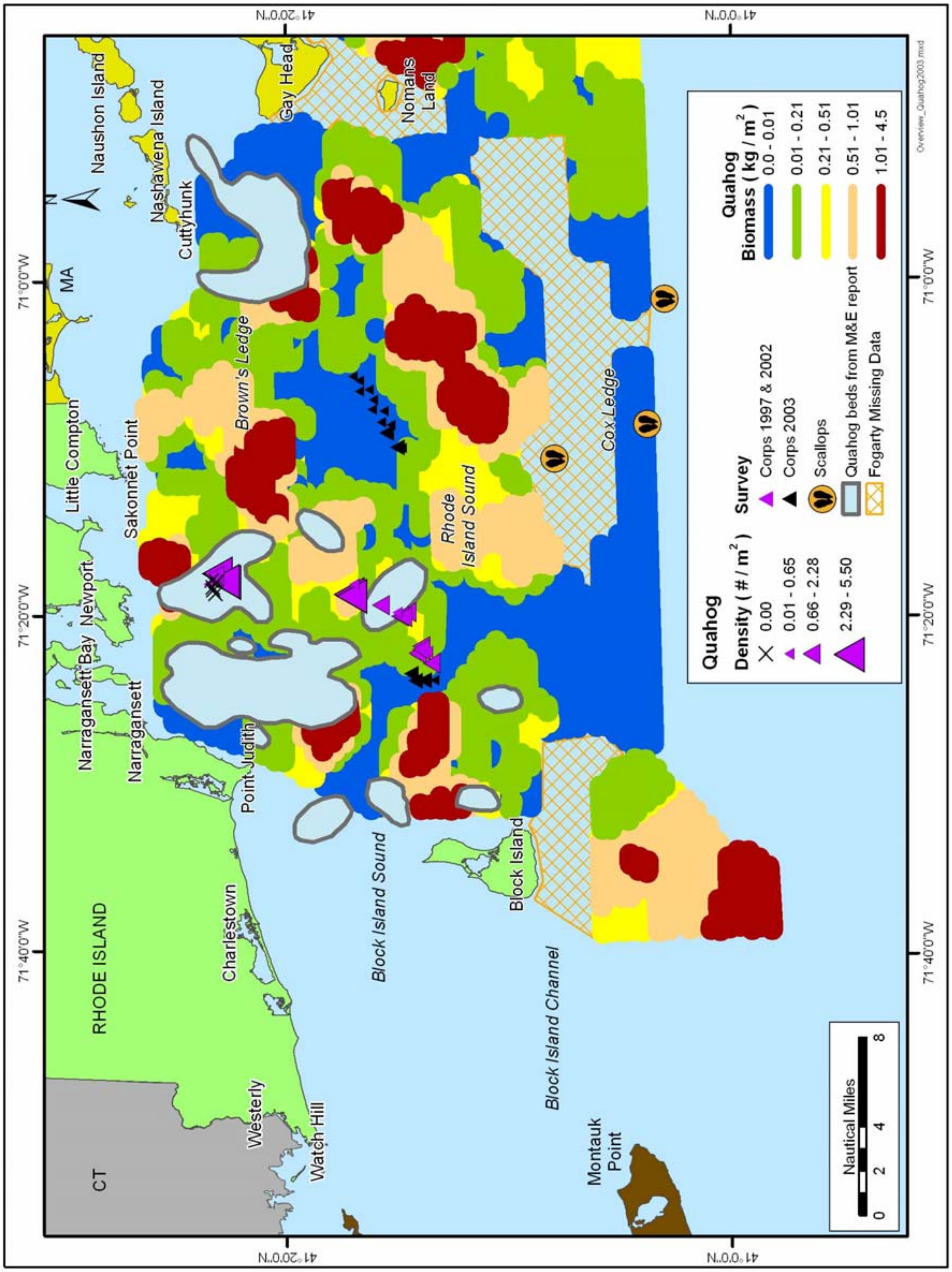
A study to determine the sediment types and organisms found at four areas of Rhode Island Sound (Site 16, Site 18, Site 69A, and Site 69B) was conducted in 1997 in support of the EIS for the Providence River and Harbor Maintenance Dredging Project (Corps, 1998b). Tows in the northwestern portion of Site 16, which contained considerable amounts of rock, mud, and clay, yielded only one ocean quahog. In the southeastern and southern part of the site, considerable numbers of ocean quahogs were collected (Figure 3-50). The October 1997 survey showed that at least part of Site 16 contained a potentially valuable ocean quahog resource historically and that other areas of Site 16 were possibly impacted by past dredged material disposal activities at the site.

The area around Site 18 was about one-third covered by hard sand (predominantly fine sand) and about two-thirds covered by unconsolidated sediments (predominantly soft silty sediments). Only one tow was possible in the October 1997 survey; it yielded the highest abundance of ocean quahogs in an area characterized as unconsolidated fine sand/silty sediments (Figure 3-50). It is probable that at least the western portion of this site contains a significant ocean quahog resource.

The survey of Site 69A showed that unconsolidated fine sand/silty sediment was predominant, but some fine sand areas were also present at this site. Three tows were taken at this site, with variable and low clam yields (Figure 3-50).

Sediments from Site 69B were predominantly unconsolidated fine sand/silt in the west-northwest part of the site and hard, fine sand areas in the east-southeast one-third of the site. Four tows were conducted in 2003 just outside of Site 69B to the north and west, in an area that was not sampled in 2002. These four tows all yielded very similar sediment (large amounts of rocks and cobbles in the southwestern corner) and ocean quahog catches (Figure 3-50). The presence of the rocky habitat and the low ocean quahog densities in these four tows indicate that the potential value of the site as an ocean quahog resource is low.

Fogarty's studies (1979, 1981) correlated habitat with distribution of ocean quahogs in Rhode Island Sound. These findings indicated that ocean quahogs were most likely to be found in sandy sediments and were unlikely to be associated with silty sediments. The 1997 study (Corps, 1998b) indicated that this is generally true with the exception of Site 18, which was characterized as having unconsolidated sediments (predominantly soft silty sediments) and had the highest abundance of ocean quahogs. Similar habitats generally have similar animal communities; however, other factors, such as food availability, predation, and competition, also influence species density and community.



Source: Fogarty, 1979; Corps, 1998b; Corps, 2003g; Corps, 2003k

Figure 3-50. Density (Individuals/m^2) and Biomass (Kilogram [kg]/m^2) of Ocean Quahog and Anecdotal Information of Scallop Beds Located in the ZSF.

The NMFS Northeast Fisheries Science Center conducts clam surveys every 3 years in continental shelf waters from Cape Hatteras, North Carolina, to Georges Bank, Massachusetts. The results of random tows in 1999 and 2002 within the ZSF showed several locations with ocean quahog populations, but their actual abundance was difficult to determine because of the large abundance range reported (populations are predominantly in the range of 101 to 1,000 each year).

Atlantic Surf Clam

The Atlantic surf clam, *Spisula solidissima*, inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Cargnelli *et al.*, 1999). The largest concentrations of Atlantic surf clams usually occur in well-sorted, medium sand but may also occur in fine sand and silty-fine sand. Surf clams inhabit waters from the surf zone to a depth of 420 ft but are more common at depths less than 240 ft. Areas of coarse grain size (i.e., pebbles or cobbles) are virtually devoid of surf clams (Murawski, 1979). Atlantic surf clams are planktivorous filter feeders that pump water through their siphons over the gills to trap food. Many predators, including snails, shrimp, crabs, and fish (haddock and cod), feed on surf clams (Cargnelli *et al.*, 1999).

Nine research surveys were conducted during 1969–1982 (Murawski and Serchuk, 1983) at 219 stations from east of Montauk Point, New York, to Cape Cod, Massachusetts. Surf clams were virtually absent at stations deeper than 180 ft. The highest proportion of clam catches and the highest catch rates (mean catch per station) occurred in the relatively shallow survey strata around the periphery of Nantucket Shoals (30– to 90-ft depth contour), which is to the east of the ZSF. Very few clams with a shell length of less than 120 mm were captured in any of the deep strata, indicating that recruitment in the 5 to 6 years before the survey was relatively poor. Most clams were about 130 to 170 mm in shell length, with the largest clams occurring at shallower depths to the east of the ZSF.

The NMFS Northeast Fisheries Science Center found sparse populations of Atlantic surf clams within the ZSF area during bottom trawl surveys conducted from Georges Bank to Cape Hatteras, North Carolina, from 1980 to 1997 (Cargnelli *et al.*, 1999). A few locations in the ZSF had surf clams larger than 120 mm in shell length, but most surf clams occurred off of the New Jersey coast and south and in the relatively shallow waters of Nantucket Shoals east of Nantucket Island (Cargnelli *et al.*, 1999). A small population was found off the southeastern coast of Connecticut in the northwest corner of the ZSF (Murawski, 1979).

Sea Scallop

The sea scallop, *Placopecten magellanicus*, occurs in the western North Atlantic continental shelf waters from Newfoundland to North Carolina (Hart, 2001). South of Cape Cod, sea scallops are normally found at depths between 132 and 660 ft (Hart, 2001) and are most often associated with sandy sediments.

The commercial fishery for scallops occurs year round, with dredges and otter trawls used as the primary harvesting equipment. Sea scallops are most heavily fished on Georges Bank and off the New Jersey coastline between 132 and 330 ft in waters cooler than 20 ºC (Hart, 2001), but anecdotal information from local fisherman suggests that a few areas within the southern area of the ZSF support commercial harvests of scallops (Figure 3-50).

The NMFS Northeast Fisheries Science Center surveys scallop populations each summer by collecting population estimates using standard scallop dredge tows of the seafloor from the Delmarva Peninsula to Georges Bank. Although no tows are conducted directly in the ZSF area, these surveys, conducted over the last 3 years, indicated that the depth and substrate at the southern boundary of the ZSF may contain scallops, which is consistent with anecdotal information from the local fishermen that scallop beds are located in the southeastern area of the ZSF.

Whelks

Three species of whelks (or conchs) are commercially harvested in the ZSF: the channeled whelk (*Busycotypus canaliculatus*), the knobbed whelk (*Busycon carica*), and the lightning whelk (*Busycon contrarium*). Generally, the channeled whelk and the knobbed whelk are more common in the colder waters of southern New England, while the lightning whelk is most common from North Carolina to Florida. These species occur on many bottom types but are most common on sandy bottoms in shallow waters (<60 ft) (Pratt, 1973). They are common from intertidal regions to the continental slope (Davis and Sisson, 1988). Whelks are voracious carnivores, feeding on dead fish, gastropods, annelids, and bivalves, and are relatively mobile, with the potential to travel 590 ft in 12 hours (Davis and Sisson, 1988). For more than 140 years, whelks have been considered pests because they prey on clams and oysters in nearshore habitats.

The channeled whelk, which grows up to 18 cm long, occurs from intertidal habitats to those just below low-tide level. Channeled whelks are abundant in the shallow bays of southern New England and in Long Island Sound (Page, 2002). They are primarily nocturnal during warmer months, diurnal and nocturnal in the spring and fall, and primarily diurnal in winter. Channeled whelks lay eggs only in spring.

The knobbed whelk, which grows up to 20 to 23 cm long, occurs along the coast from Massachusetts to northern Florida and is highly migratory, occurring in deep or shallow water (depending on the time of year) (Page, 2002). Knobbed whelks migrate to the deeper offshore waters during the extreme weather conditions prevalent during the summer and winter months. A second migration, to the shallow waters of nearshore mud flats, usually occurs during the spring and fall months. While on these mud flats, whelks prey on oysters, clams, and other marine bivalves. Mating and egg-laying occur during the spring and fall migrations.
The lightning whelk, *Busycon contrarium*, primarily ranges from North Carolina to Florida (Page, 2002) and are less common in northern waters. Lightning whelks usually grow to about 38 cm in shell length. Lightning whelks migrate into the intertidal mud flats to feed on marine bivalves. Lightning whelks are diurnal and prey on clams and oysters.

In the early 1900s, whelk landings for Massachusetts were reported to be 20,000 lbs and valued at $5,000 (Davis and Sisson, 1988). In Massachusetts, Rhode Island, and eastern Connecticut coastal waters, the whelk fishery has supplemented fisheries for lobster and finfish as a large ethnic market for whelks has developed (Davis and Sisson, 1988).

Davis and Sisson (1988) indicated that between May and November, channeled whelks are usually caught in baited traps that are hauled at regular intervals. Channeled whelks and knobbed whelks are also caught by using trawls. In 1981, landings for whelks in southern New England exceeded 1 million lbs of processed meats, much greater than the 300,000 lbs landed 2 years earlier (Davis and Sisson, 1988). Landings peaked at about 1.4 million lbs in 1984 and decreased to 500,000 lbs in 1987 (Davis and Sisson, 1988). In Rhode Island, whelk landings increased dramatically from 1978 to 1987, averaging 223,900 lbs of meats (Davis and Sisson, 1988). Since then, the landings have followed the marked decline of other regions. The lightning whelk is primarily harvested as incidental catch in crab pots.

Other Shellfish Species

The northern (or bay) quahog, *Mercenaria mercenaria,* has a habitat range that extends from the Gulf of St. Lawrence to the Gulf of Mexico and from the intertidal zone to depths exceeding 50 ft. This species is found on a variety of bottom types, including sand, mud, and cobble. Because of its shallow habitat, northern quahogs generally occur only along the shallow coastlines and in estuaries and rivers, such as Narragansett Bay (RIDEM, 1999).

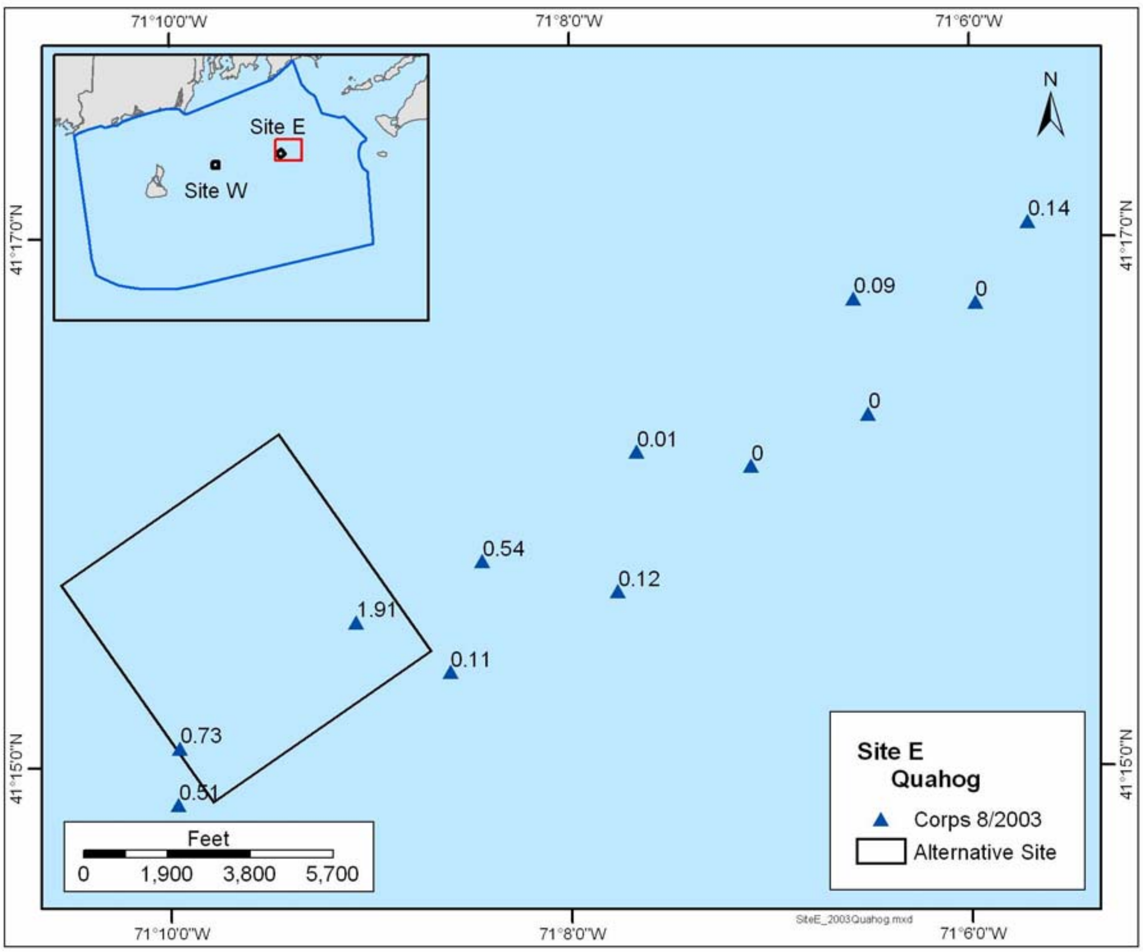
Blue mussels, *Mytilus edulis*, are harvested commercially from Maine to Long Island, New York (Maine Department of Marine Resources [MEDMR], 2003) and have been recorded by NMFS to occur in the ZSF. They are abundant in the intertidal and shallow, subtidal areas. Mussels have fibers called byssal threads (also commonly called the beard) that are used to anchor to rocks, pilings, or other mussels. Mussels can be harvested year round and are usually taken by hand with a rake or from a boat with a drag. Blue mussels typically do not occur in offshore waters.

Razor clams, *Ensis directus*, are generally found in intertidal to subtidal areas from Labrador to Florida. They are very proficient at digging into the sand to avoid predation. Only the top part of the quickly retractable siphon of the clam is exposed to filter food particles from the water. Along with blue mussels, razor clams have been recorded and commercially harvested from shallow waters in the ZSF but do not typically occur in offshore waters.

In summary, the ZSF contains several commercially important molluscan shellfish species. The most important of these is the ocean quahog, *Arctica islandica*. Ocean quahogs occur primarily in sandier sediments and show very patchy distributions in the ZSF, with pockets of high and low densities intermixed at relatively small scales. Information about the populations and distribution of the other commercial shellfish species, mainly sea scallops and whelks, is very limited, and it is not possible to evaluate these species at very site-specific scales in the ZSF; both live on the surface of the sediment and are mobile.

3.11.2 Site E

The ocean quahog population at Site E was evaluated by using data collected with a commercial clam dredge on August 13, 2003 (Corps, 2003k). These commercial clam dredges are designed to allow undersized clams to filter through the dredge and not be retained for collection. The targeted sampling locations were distributed across Area E in order to characterize the entire area and to evaluate the placement of Site E as a possible alternative location. Ocean quahogs were collected in only two tows within Site E boundaries: one station in the southwest corner and one station in the southeast corner (Figure 3-51). The average length of these two tows was 527 ft and resulted in a mean of 265 ocean quahogs collected (135 quahogs in southwest corner station and 394 in southeast corner station). The average length of the ocean quahogs collected was 93.5 mm, and the average density was 1.32 individuals/m^2. The estimated weight of the ocean quahogs collected from these two tows in Site E was 37 kilograms (kg) and 108 kg. An average biomass was calculated for these two tows in Site E (0.36 kilograms per square meter [kg/m^2]) to be used to compare to historical data collected by Fogarty (1979). In this area, Fogarty calculated an ocean quahog biomass density in the range of 0 to 0.1 kg/m^2 (Figure 3-50). The habitat type in Site E ranges from coarse to medium sand in the southwest portion of the area to silty-fine sand along the southern portion of the area.



Source: Corps, 2003k

Figure 3-51. Mean Density Values (Individuals/m^2) for Ocean Quahog for Site E and the Surrounding Area.

The recent density assessment results are relatively consistent with the Fogarty (1979, 1981) field study data demonstrating that ocean quahogs are generally associated with sediments composed of high amounts of medium sand and shell fragments. The ocean quahog population in this region has appeared to increase in the last two decades, but it is still not at ecologically or commercially important levels, or as productive, as other areas of the ZSF.

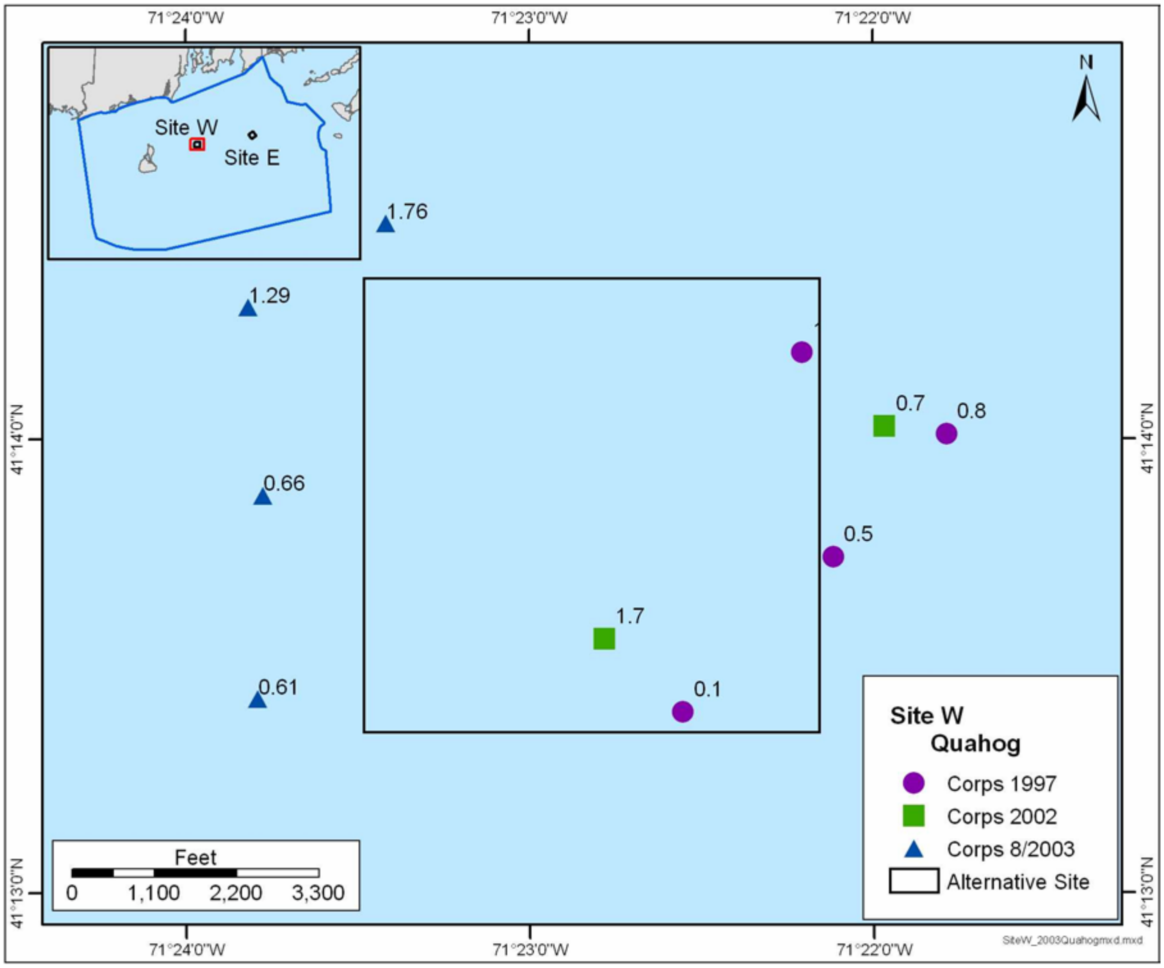
In 2003, 10 shellfish harvesting tows were conducted in the vicinity of Site E to characterize that area of the ZSF; two tows were located just outside the southwest and southeast corners of Site E, and eight tows were located to the east of Site E (Figure 3-51). The habitat type varied from silty-fine sand along the southern portion of the area to significant surface expressions consisting of rocks and boulders comprising the northern and eastern portion of the area (see Section 3.2 for more details). The density results of these 10 tows reflected the changes in habitat type. The areas of medium sand had the highest densities (0.51 to 0.54 individuals/m^2 for Tows 7 and 3, respectively), and the areas of silty/fine sand had the lowest densities or no ocean quahogs (Figure 3-51). Grab samples collected for the analysis of infaunal communities can be used to estimate the juvenile populations of commercial clam species. Samples collected within Site E yielded a juvenile ocean quahog density of about 110 individuals/m^2, whereas samples collected near Site E yielded about 73 individuals/m^2 (Corps, 2003h). Therefore, while Site E and the surrounding area support an ocean quahog population, these areas are still not as productive as other areas of the ZSF.

No sea scallops, surf clams, or whelks were collected during the dredge surveys to collect ocean quahogs. Two small surf clams, one small scallop, and no whelks were collected during the infaunal survey in and near Site E. Based on this information, Site E does not support an important resource concentration of any of these three shellfish groups.

3.11.3 Site W

The habitat type in Site W consists of an unconsolidated soft bottom with very fine sand mixed with silt-clay. Areas of fine rippled sand habitat are found in the northern, eastern, and southern sections of the site (Corps, 2001a). Ocean quahog densities at the three stations within Site W where the clams were collected in 1997 and 2002 (Figure 3-52) ranged from 0.1 individuals/m^2 in the southeastern part of Site W to 1.7 individuals/m^2 in the south-central portion of Site W (Corps, 1998b; Corps, 2003g). The four tows conducted in August 2003 (Corps, 2003k) to the west of Site W yielded from 0.61 individuals/m^2 in the silty/fine sand to 1.76 individuals/m^2 in the coarse sand (Figure 3-15). Historical data collected in 1997 to the east of Site W yielded clam densities of $<$1.0 individuals/m^2.

The Fogarty (1979) biomass data in the general area of Site W ranged from 0 to 0.21 kg/m^2 (blue and green coloration) (Figure 3-50). The average estimated total weight of the ocean quahogs that were collected in the 2003 study located to the west of Site W was 73.14 kg, and the average biomass was 0.26 kg/m^2, which is similar to the Fogarty results. Grab samples collected for the analysis of infaunal communities usually include juvenile ocean quahogs that are not generally retained in gear targeting shellfish, as was used in the 2003 ocean quahog survey of adult ocean quahogs. As a result, the benthic grabs can be used to estimate the juvenile populations of commercial clam species. Samples collected within and near Site W in 2001 yielded a juvenile ocean quahog density of about 34 individuals/m^2 (Corps, 2002f), while samples collected near Site W in 2003 yielded about 48 individuals/m^2 (Corps, 2003h). Therefore, the area in and



Source: Corps, 1998b; Corps, 2003g; Corps, 2003k

Figure 3-52. Mean Density Values (Individuals/m^2) for Ocean Quahog for Site W and the Surrounding Area.

around Site W supports an ocean quahog population that has remained fairly stable through the last two decades, but one that is not as prolific as the populations in other areas of the ZSF.

No sea scallops, surf clams, or whelks were collected during the dredge surveys to collect ocean quahogs. No small surf clams, small scallops, or whelks were collected during the infaunal survey in and near Site W. Therefore, Site W does not appear to support an appreciable concentration of any of these three shellfish groups.

3.12 LOBSTER [40 CFR SECTIONS 228.6(a)(2) AND 228.6(a)(9)]

The American lobster, *Homarus americanus*, is an important ecological and economic resource throughout the northwest Atlantic Ocean from Labrador to North Carolina (Cobb and Phillips, 1980). Like many other marine crustaceans, the life history of this animal includes several phases, each having specific habitat requirements. Spawning generally occurs from May to October and peaks in July, when water temperatures reach approximately 20 ºC. Eggs are carried by the female for 9 to 12 months and then hatch into a prelarval stage before metamorphosing through four planktonic larval stages. The planktonic larval stages remain adrift in the water column, feeding on other plankton before metamorphosing to a juvenile early benthic lobster form and settling to the seafloor (Harding, 1992). Newly settled juvenile lobsters are generally found in self-dug burrows in substrates of mud/silt, mud/rock, or sand/rock, or in crevices created by cobble and bedrock/rock (Cobb and Phillips, 1980).

Smaller juveniles do not venture far from their burrows to feed. As the individuals increase in size, they begin to range more widely, moving farther from their burrows in search of prey and more suitable shelter. Juvenile and adult lobsters are omnivorous (i.e., they will eat whatever food is available) and forage mainly at night (Harding, 1992). Their diet generally includes a variety of bottom-dwelling invertebrates such as crabs, polychaetes, mussels, periwinkles, sea urchins, and sea stars.

The American lobster is common throughout Rhode Island and Massachusetts waters. Lobsters have been found to occur from the intertidal zone offshore to water depths of 2,360 ft (MacKenzie and Moring, 1985). In Rhode Island and southeastern Massachusetts, lobster populations exist in inshore and offshore waters. The inshore areas include the upper and lower reaches of Narragansett Bay, Block Island Sound, Buzzards Bay, the New Bedford region, and the ZSF within Rhode Island Sound. The southern boundary of the ZSF in Rhode Island Sound is likely a transition region from the inshore population to the more residential, offshore population. The offshore areas include the outer continental shelf and upper slope, as well as Block and Hudson Canyons.

Molting (i.e., shedding of the external shell) is the process that allows lobsters to grow. With each molt, a lobster increases in size; however, as lobsters get older, molting becomes less frequent and growth is less with each molt. In general, lobsters living in the offshore areas are larger and grow more with each molt than those in inshore areas (MacKenzie and Moring, 1985).

During the spring and summer (May through September), about 30 to 50 percent of the offshore lobster population moves into shallow water to molt and mate (Cobb and Phillips, 1980). This migration behavior is probably initiated by temperature, since the shallower bottom waters in the inshore areas provide more suitable water temperatures for molting and mating than the cooler waters over the outer shelf and upper slope. Estrella and Morrissey (1997) also observed that sublegal (<83.3 mm carapace length [CL]) and legal size (>83.3 mm CL) females with no eggs moved significantly less than egg-bearing female groups, suggesting that egg-bearing female lobsters need to migrate to, and stay in, shallow warmer waters to provide the appropriate temperatures for egg development. In late fall and early winter, when inshore water temperatures cool, the offshore migrants return to the outer continental shelf.

3.12.1 Rhode Island Region ZSF

This section describes the commercial fishery data, long-term trawl data from research and monitoring studies, and data from recent lobster surveys conducted in support of this Final EIS and the Providence River and Harbor Maintenance Dredging Project EIS.

Data Sources Evaluated

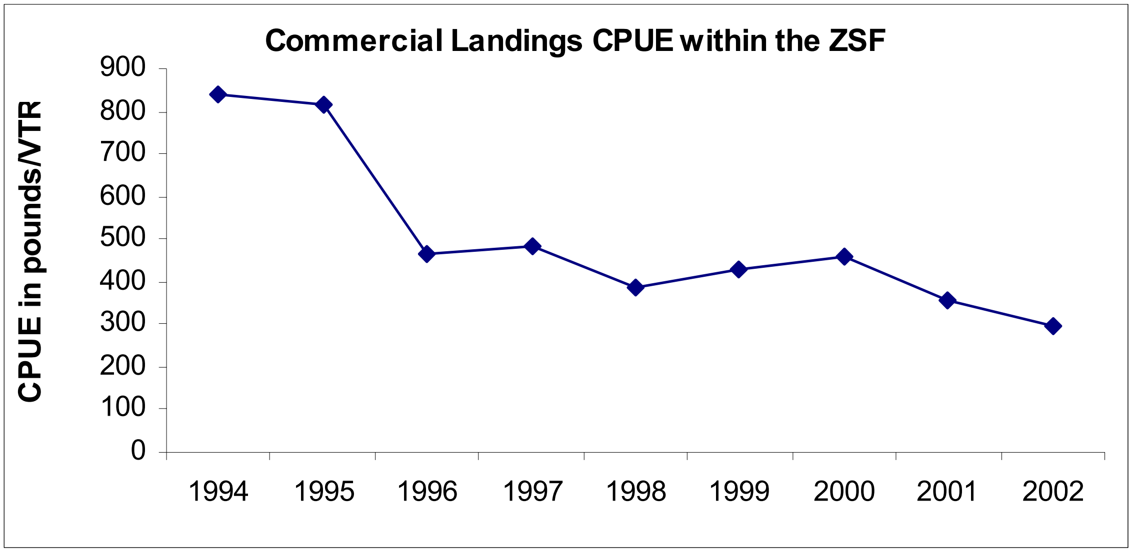
Data from the following sources and programs were used to describe the lobster resources within the ZSF.

- **Data on commercial fisheries**: NMFS has long collected data on commercial fisheries throughout the country. This information is used to evaluate the weight (in pounds) of lobsters that are harvested from and landed (reported) in a given region. For the RIR, data from 1994 to 2002 are used in this Final EIS. These data are discussed in the section "Commercial Fishery Data."
- **Data from long-term research trawl programs**: The URI-GSO and the RIDEM conduct long-term research trawl surveys at locations within or adjacent to the ZSF. This information and NMFS research trawl data for 1990–2002 are discussed in the section "Long-Term Trawl Survey Data."
- **Data from recent lobster surveys**: Lobster surveys were conducted in 1999 in support of the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a) and in 2002 and 2003 in support of this EIS (Corps, 2003l; Corps, 2003m). The surveys included data from in and near Site W. This information is discussed under "Recent Trawl Surveys in Rhode Island Sound."
- **Site-specific data**: Site-specific trawl surveys were conducted in Sites E and W during the summer of 2003 (Corps, 2003n). These data are presented and discussed in Sections 3.12.2 and 3.12.3.

Commercial Fishery Data

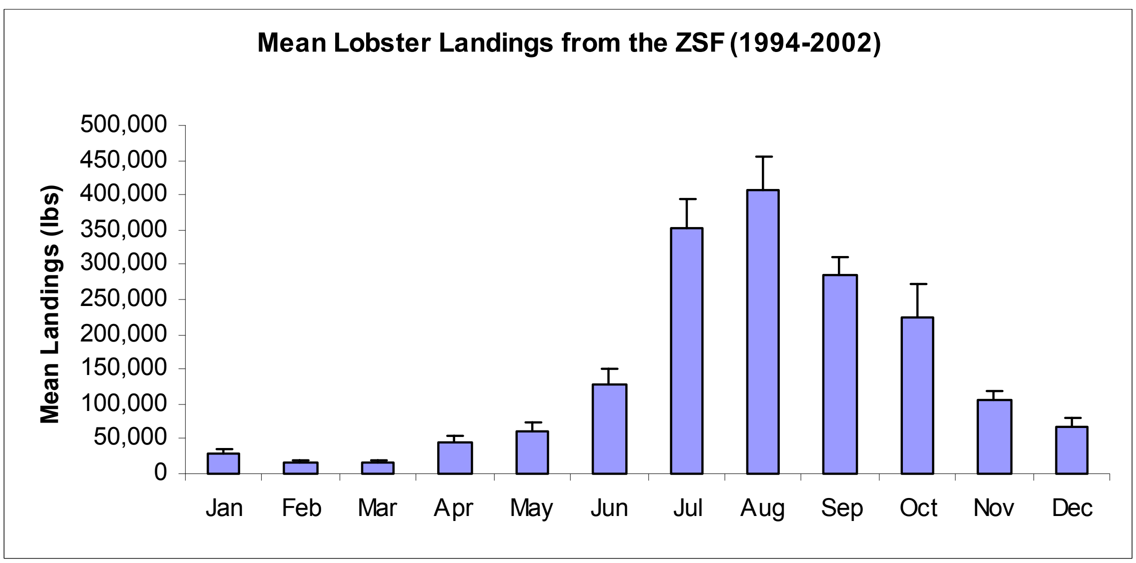
As discussed in Section 3.10.1, NMFS maintains information on VTRs submitted by commercial fishermen. Commercial lobstermen are also required to submit VTRs for the lobsters they harvest. Monthly lobster VTR data for the period 1994–2002 were obtained from commercial lobstermen and reviewed to estimate the commercial landings of lobster from the ZSF. A CPUE was calculated as the total pounds of lobsters landed within a given year divided by the number of VTRs for that same year (Figure 3-53) to provide some information on annual trends for the lobster fishery. The landings can also be summarized on a monthly basis to provide some information on the seasonal status of the fishery (Figure 3-54).

Annual trends in the commercial lobster fishery suggest that lobster landings have been declining since 1995. The number of lobsters reported per VTR has declined from greater than 800 lbs/trip in 1994 and 1995 to a low of 300 lbs/trip in 2002. Seasonally, lobster landings were highest during the summer and early fall. From 1994 through 2002, the largest landings were observed during August (average = 406,130 lbs), July (average = 351,103 lbs), and September (average = 284,595 lbs) (Figure 3-54). The lowest landings were observed during winter and early spring. These seasonal patterns support the lobster migratory movements into and out of the ZSF during the summer and fall months. During spring and summer, lobsters are more mobile and may undertake longer migrations into the ZSF from offshore regions. During the fall, as inshore waters cool, lobsters move out of the ZSF for the deeper waters offshore. It is during these migrations that many lobsters are harvested.



Source: NMFS VTR Data (1994–2002)

Figure 3-53. Annual Lobster Landings Within the ZSF (1994–2002).



Source: NMFS VTR Data (1994–2002)
Note: Error bars represent standard error from mean.

Figure 3-54. Average (± standard error) Monthly Lobster Landings within the ZSF (1994–2002).

Long-Term Trawl Survey Data

The text boxes on the following pages present the data results from the URI-GSO and NMFS survey programs. Although otter trawls tend to collect various finfish species, lobsters are also routinely collected in the trawls. The data from these research programs cannot be directly compared to commercial harvests or to sampling conducted by using lobster pots, because otter trawls and lobster pots collect organisms differently. The harvesting of lobsters by otter trawl is not the preferred commercial method of collection, and CPUE values calculated from otter trawls are often lower than those from lobster pots. Therefore, although CPUE values cannot be directly compared between these two methods, the landing values can be compared among themselves. The different gear types normally show similar trends in catch.

The NMFS survey data also permit analysis of broad-scale geographic and temporal patterns. The calculated CPUE values for lobsters within the ZSF for the fall, winter, and spring trawls varied geographically (Figure 3-55). Lobster catch data from all trawls were evaluated by using a statistical formula that identifies natural breakpoints in the data. These natural breakpoints served to rank the lobster catch into three levels indicating that a particular location at the time of sampling was highly productive (CPUE $\geq$ 114), of medium productivity (CPUE $\geq$ 31 $\leq$ 113) or of low productivity (CPUE $\leq$ 30). Locations where tows were conducted but where no lobsters were harvested were also reported.

Several locations within the ZSF were sampled during the fall (Figure 3-55). The north-central region of the ZSF near Site 16, Site 69A, and the Browns Ledge area provided the largest catches of lobsters throughout the ZSF. Several sampling stations in this region had CPUE values greater than 114 lobsters/tow. No lobsters, or very small CPUEs, were recorded from tows conducted in the southwest region of the ZSF. Likewise, small catches were made at the southern boundary of the ZSF and in the offshore areas outside the ZSF. The northeast corner of the ZSF had low to medium lobster abundance in the areas sampled. No tows were conducted in the area northwest of Block Island.

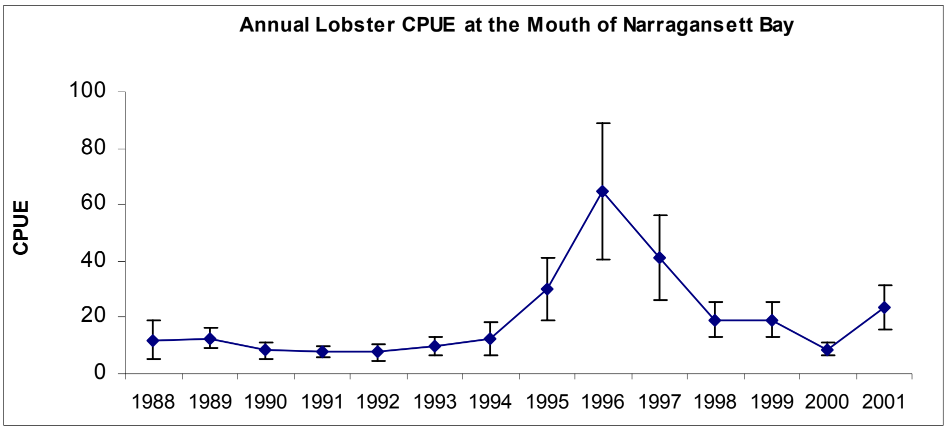
Fewer locations were sampled during the winter trawl surveys (Figure 3-55) than during the fall or spring surveys. Similar to the fall surveys, however, the central area of the ZSF around Site 69A had the largest lobster catches during the winter, but catches in the winter did not exceed 113 lobsters/tow, suggesting that use of this area may be lower in the winter than during the fall. Although fewer locations along the southern border, in the southwest region of the ZSF, and outside the ZSF were sampled in the winter, the catches were small and similar to those observed during the fall surveys in the area.

The spring surveys again showed the highest densities of lobsters occurring in the more central region of the ZSF (Figure 3-55). The deep trench area south of Sites 69A and 69B had large catches, while medium catches were observed north of the trench and in close proximity to Site 69A. In the southwest region and along the southern boundary of the ZSF, no lobsters were observed except in a few locations, but even these areas had low densities.

URI-GSO Surveys

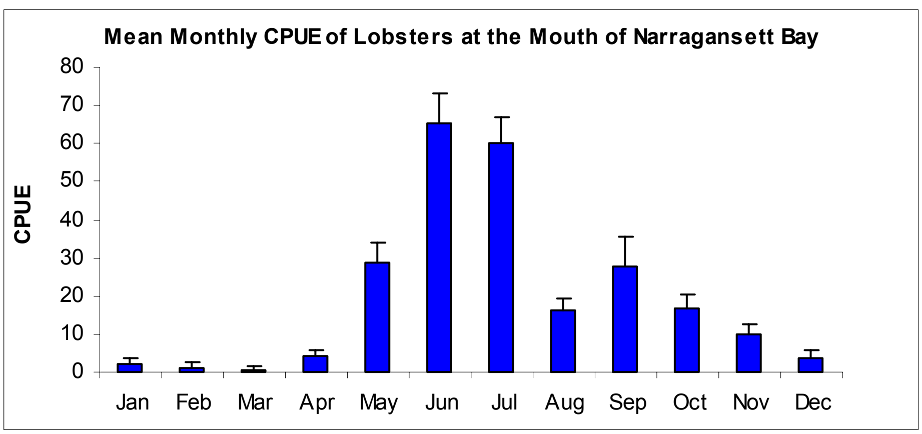
The URI-GSO has conducted weekly otter trawl surveys at two locations in Narragansett Bay since 1959. Trawls conducted at the mouth of Narragansett Bay provide a valuable record for lobster resources at the northern edge of the ZSF. Because these trawls were conducted weekly at the same location, annual trends are represented by at least four trawls for each month of the year.

The annual trends for 1988–2001 suggest that abundance was relatively constant at the mouth of Narragansett Bay (i.e., northern boundary of the ZSF) from 1988 until 1994, then peaked in 1996 (top chart). Lobster abundance dropped back to the levels observed in 1994. Monthly data suggest that the lobster catch is higher during the summer months and early fall than during winter and early spring (bottom chart).



Note: Error bars represents standard error from mean

Mean (± standard error) Annual CPUE of Lobsters at the Mouth of Narragansett Bay



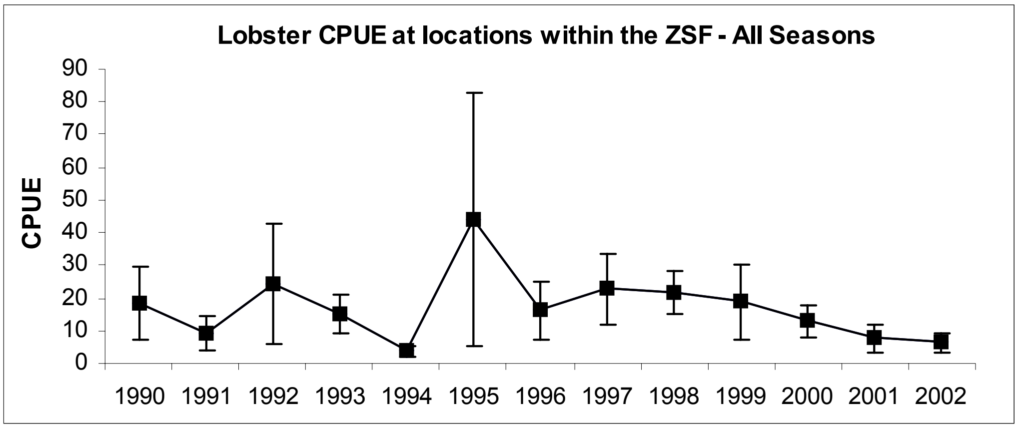
Note: Error bars represents standard error from mean

Mean (± standard error) Monthly Catch of Lobsters at the Mouth of Narragansett Bay, 1988–2001

NMFS Surveys

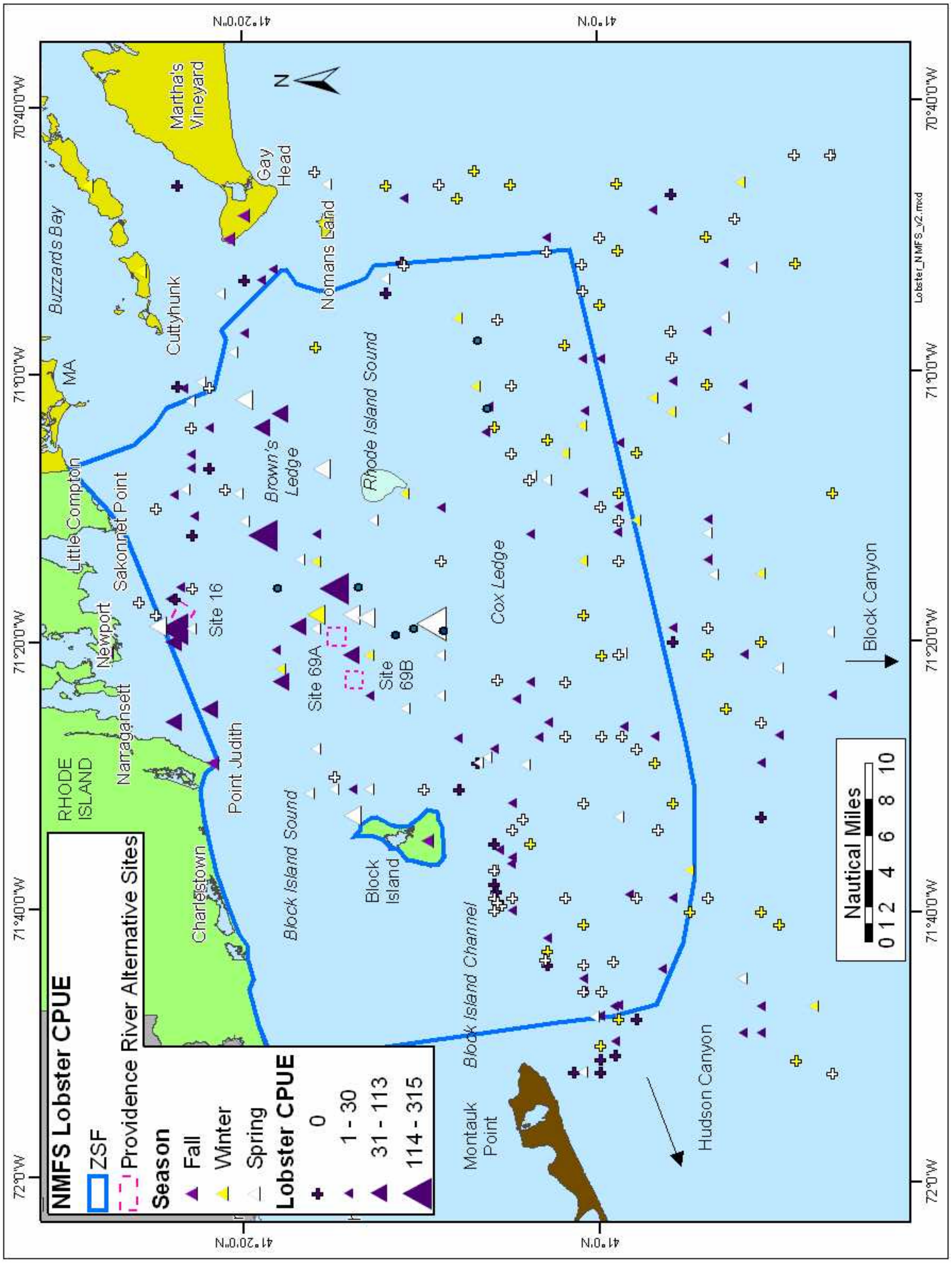
The NMFS research trawl surveys conducted during the spring (March and April), fall (September and October), and winter (February) also harvested lobsters. The NMFS research trawl data can be used to estimate lobster abundance directly within the ZSF. Data from these surveys from 1990 through 2002 were used to calculate a CPUE (mean number of lobsters per trawl for a given year) for any given trawl location.

Although there is considerable variation in the data, some annual trends can be observed. Lobster abundance within the ZSF fluctuated during the period 1990–1995, reaching a peak in 1995. Abundance declined in 1996, then remained relatively constant through 1999, but recently has shown a declining trend.



Note: Error bars represents standard error from mean

Mean (± standard error) Lobster CPUE at Various Locations Within the ZSF During the Spring, Fall, and Winter (1990–2002)



Source: NMFS Research Trawl Data (1990–2002)

Figure 3-55. Lobster CPUE Data From NMFS Surveys Within the ZSF During the Fall, Winter, and Spring (1990–2002).

Because lobstering is an economically important fishery in Rhode Island, RIDEM conducts a long-term monitoring program to gather a variety of biological information about the resource. RIDEM samples inshore and offshore areas of the Rhode Island commercial trap fishery and uses information from the commercial fishery to evaluate the status of the stock. Several inshore areas sampled by RIDEM are within the ZSF. One area is due north of Block Island, and two additional areas are located east of Block Island, near Site 69B, Site 18, Site 69A, and near the Cox Ledge region. The offshore areas sampled include the area in and around Hudson Canyon, which is outside the ZSF (approximately 108 nmi from Block Island).

The information gathered by RIDEM suggests that the inshore and offshore populations are distinct, with only a modest amount of intermingling. Individuals (male and female) from the inshore population are smaller (Angell and Olszewki, 2002); they grow less each year because they are relatively inactive during the colder months of the year, whereas offshore lobsters feed and grow during most of the year. Molting in the winter appears to be virtually nonexistent in the inshore population (Cobb and Phillips, 1980).

RIDEM biological sampling showed that female size at maturity also varies between inshore and offshore populations. Female lobsters from inshore sampling locations reach sexual maturity at 76.3 mm CL, whereas those females in the offshore areas mature at 81.0 mm CL. Size at sexual maturity has critical implications for the well-being of the population and management of the fishery, because the number of eggs produced during spawning is exponentially related to the size of the female (Harding, 1992). This relationship has been used in the Gulf of Maine lobster fishery in conjunction with a tail V-notching program. Female lobsters of certain sizes, when caught, are notched in the tail and returned to the ocean. These lobsters, if subsequently landed, cannot be retained. The notch lasts for several molts, allowing the protected females the opportunity to reproduce several times before being harvested, thereby providing a pool of brood stock individuals capable of maintaining the population at a good size and ensuring the stability of the fishery. After the 1996 North Cape oil spill, the V-notch program was adopted for use in Rhode Island waters, including the ZSF, as a method for restoring lobsters lost in the accident.

In the last decade, the incidence of shell disease in crustaceans has increased, particularly in the nearshore populations and within the ZSF. The disease is characterized by the deterioration of the lobsters' chitinous

Lobster Shell Disease (Chitinoclasia)

The incidence of shell disease among lobsters is determined by estimating the range of disease symptoms on each lobster. Gross signs of the disease include an exoskeleton that is pitted and marred with necrotic lesions and weak or soft parts found on an otherwise apparently healthy lobster's shell. A shell disease index was developed in the year 2000 by RIDEM (Angell, 2002). This index is based on the percent shell coverage of disease symptoms (pitting, erosions, lesions) on the total surface area of the lobster. The index includes these categories:

0 = No shell disease symptoms;

1 = Shell disease symptoms on 1 to 10 percent of the shell surface;

2 = Shell disease symptoms on 11 to 50 percent of the shell surface;

3 = Shell disease symptoms on more than 50 percent of the shell surface; and

OLD = New shell shows scars of a shell erosion from the previous shell.

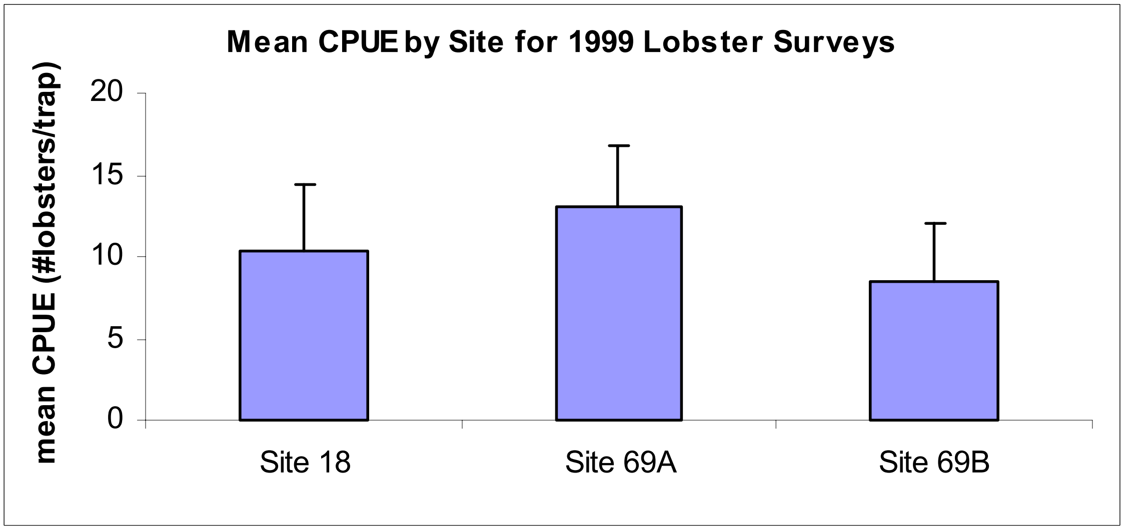
exoskeleton by microorganisms that gradually pit and erode the shell, creating lesions and disfiguring the shell (Estrella, 1991). Shell disease (chitinoclasia) is not inevitably fatal, and infected lobsters may survive for several months or overcome the disease by molting. RIDEM began recording shell disease in 1996. Within the ZSF, the incidence of shell disease increased from 1.5 percent of the lobsters observed in 1997 to 17.1 percent of the lobsters observed in 2001. The highest infection rates were for egg-bearing females, with more than 80 percent displaying signs of shell disease in 2001. In the offshore Hudson Canyon region (outside of the ZSF), the incidence of shell disease may be increasing (the sample size is too small to have confidence that a change is occurring), but it has increased (2.2 percent in 2001) relative to that observed in the inshore population.

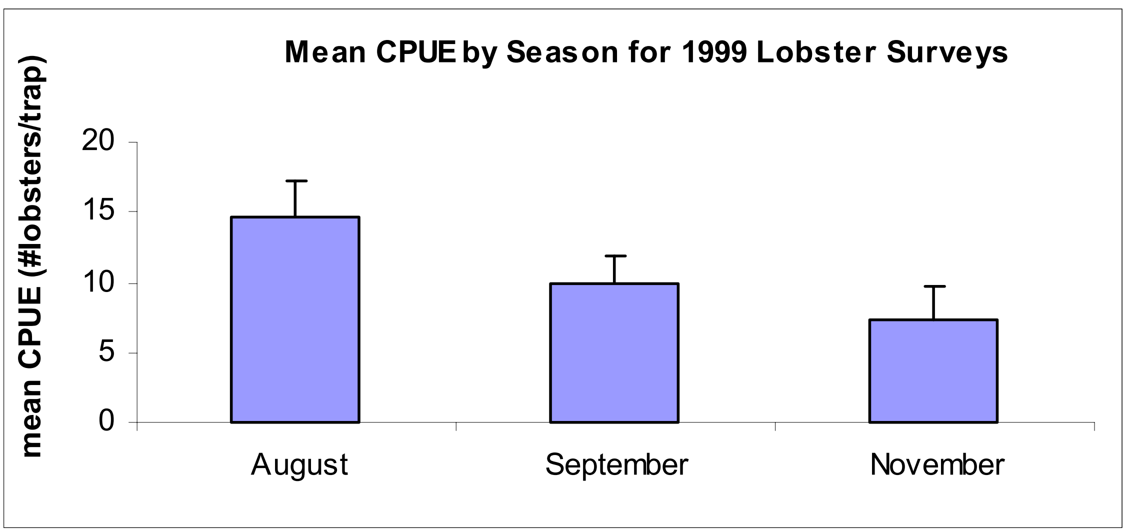
An assessment of the lobster stock by RIDEM in 2002 stated that the lobster resource in Rhode Island coastal waters, including Narragansett Bay, Rhode Island Sound, and offshore canyon regions, is overexploited and at a medium level of abundance. As shown above with the NMFS commercial landing records, the fishery landings have declined continuously since 1995. Declines in the Rhode Island lobster population may be attributable to several factors, including overfishing, the loss of approximately 10.3 million juvenile lobsters resulting from the North Cape oil spill (French, 1998), and a possible increase in natural mortality from diseases such as chitinoclasia and from global warming causing a shift in habitat use patterns. The recovery of lobster predators, such as the striped bass, could possibly affect the lobster population as well (Lindsay, 2003).

Recent Lobster Surveys

In August, September, and November of 1999, lobster pots were used to sample the lobster population at three locations (Site 18, Site 69A, and Site 69B) that had been proposed as alternative dredged material disposal sites in support of the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a). The mean CPUE values from this study (Figure 3-56) suggested that Site 69A had significantly more lobsters (13 lobsters/trap) than either Site 18 (10.3 lobsters/trap) or Site 69B (8.6 lobsters/trap) (Corps, 2001a). Across all sites, the largest catches of lobsters occurred during August (14.6 lobsters/trap), and the smallest catches during November (7.3 lobsters/trap) (Figure 3-56). Of the sites sampled, Site 69B appears to have a lower use pattern.

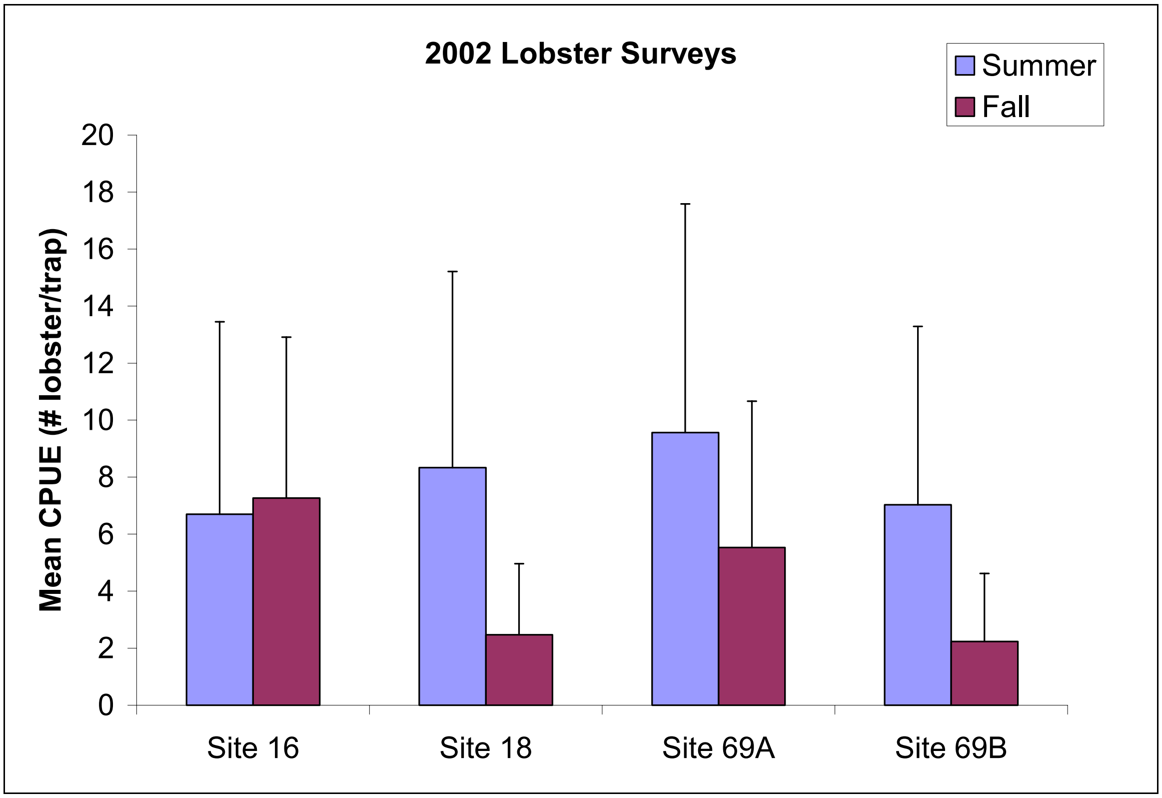
These locations were sampled again in 2002 in support of this Final EIS (Corps, 2003l; Corps, 2003m). Site 16, the historic disposal site, was also sampled. Surveys were conducted in August and October using the same methods as the 1999 surveys. The lobster catch was greater during the summer survey (August) than during the fall (October) in this sampling effort for all the sites except Site 16 (Figure 3-57). During the summer, there was no difference in the lobster catch among the sites. However, in the fall there was a statistically significant difference in mean lobster catch among the sites. The catch at Site 16 was greater than the catch at the other sites.





Source: Corps, 2001a
Note: Error bars represent one standard deviation from mean.

Figure 3-56. Average Lobster Catch (CPUE) by Site and by Season.



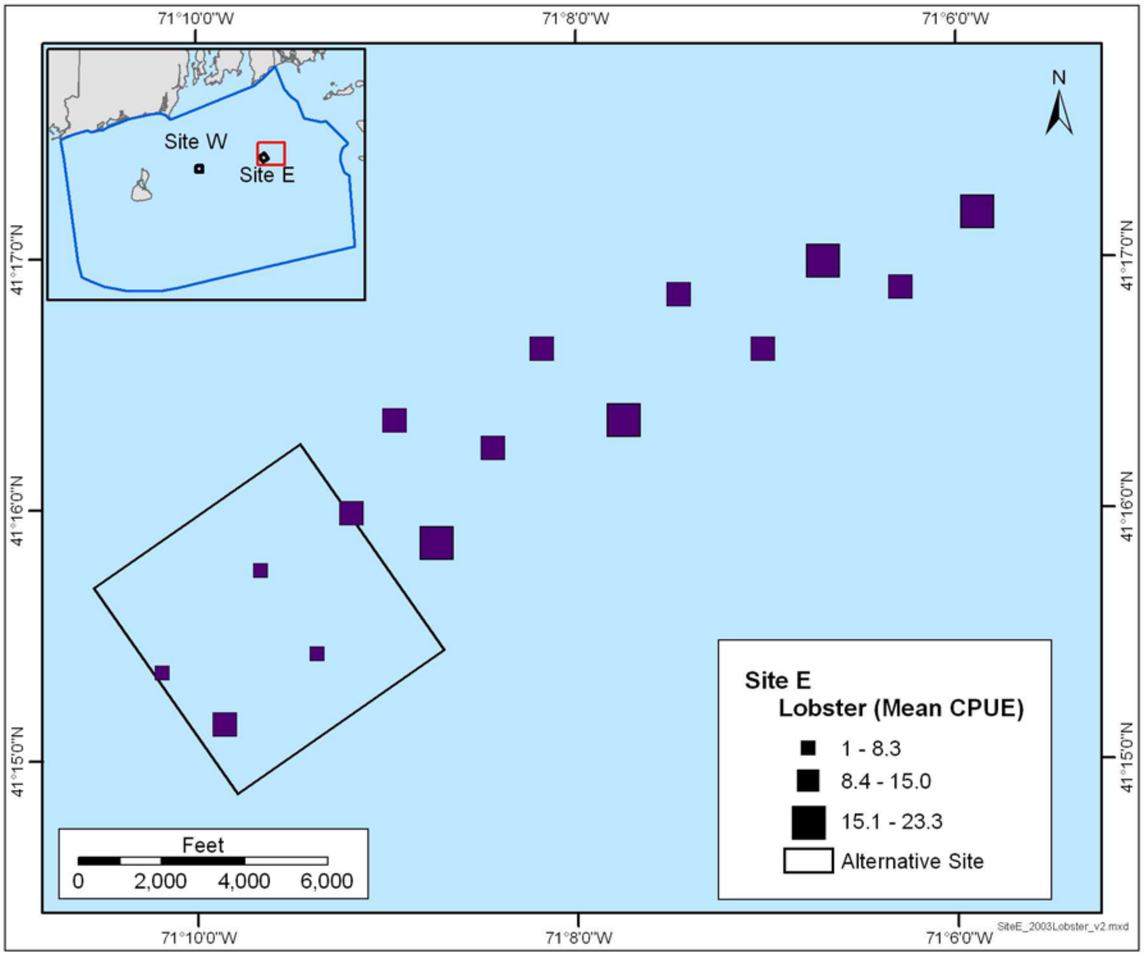
Source: Corps, 2003l; Corps, 2003m
Note: Error bars represent one standard deviation from mean.

Figure 3-57. Average Lobster Catch (CPUE) from Locations Sampled During August (Summer) and October (Fall) 2002.

In summary, the ZSF does support a valuable lobster population; however, that population appears to be in decline. Recent data suggest that lobsters in the area do make seasonal movements between inshore locations within Narragansett Bay and the more northern and central reaches of the ZSF to locations in the southern region of the ZSF and much further offshore. Fishing pressure, the unknowns associated with shell disease, and natural mortality remain concerns for the lobster population in this area.

3.12.2 Site E

During the summer of 2003, a survey was conducted in and near Site E (Figure 3-58) to characterize the abundance, size, sex ratio, and shell condition of the lobster resources in the area (Corps, 2003n). Deployment logistics and duration of this survey were similar to past studies in the ZSF (Corps, 2001a; Corps, 2003l; Corps, 2003m).



Source: Corps, 2003n

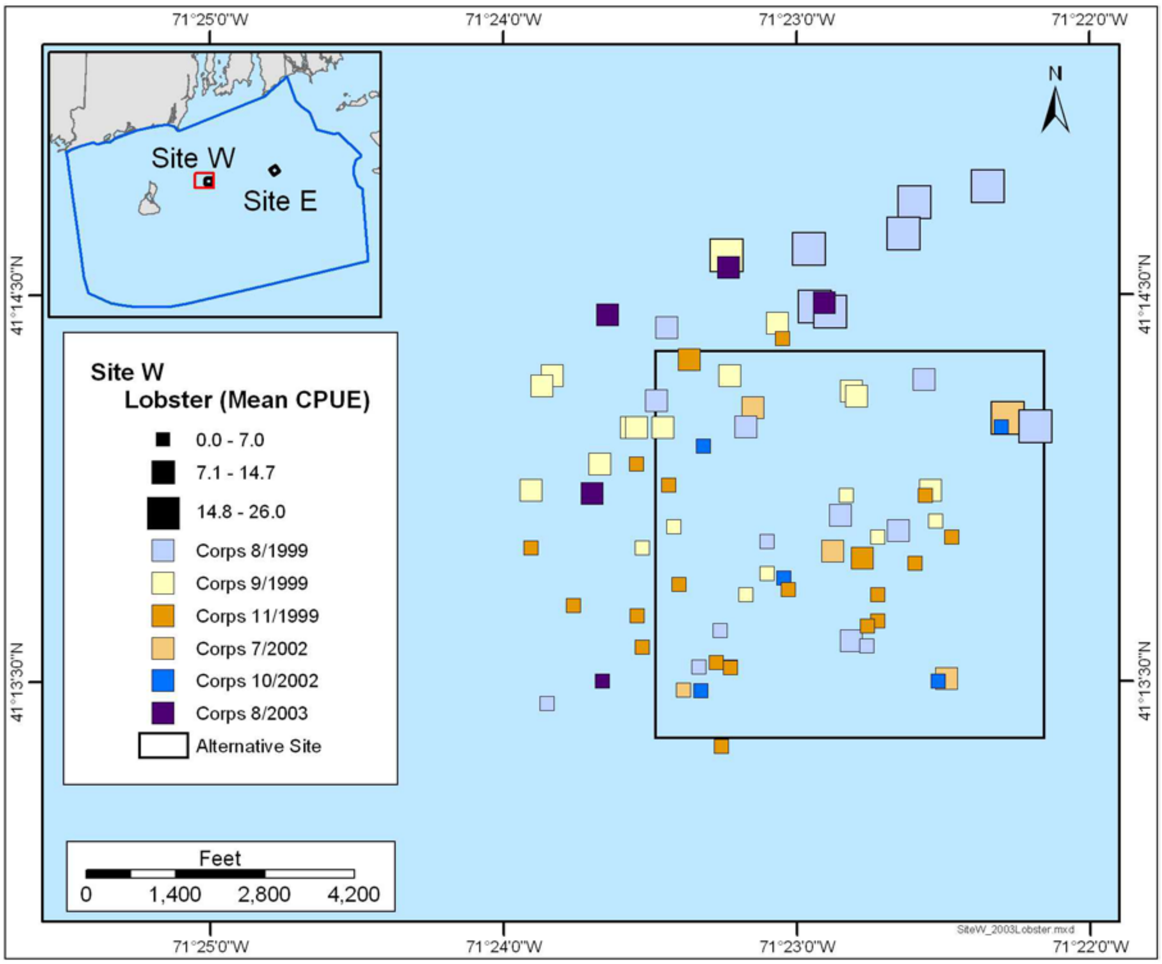
Figure 3-58. Mean CPUE (lobster/trap) for Unvented Lobster Pots for Site E and the Surrounding Area.

In addition to the pot data for the five locations sampled inside the Site E boundaries during July 2003, 10 more locations were sampled in the surrounding area to the north and east of Site E using pot lines (see Figure 3-58). The habitat within Site E consists of coarse to medium sand, and the area outside the Site E boundary ranges from silty-fine sand along the southern portion of the area to significant surface expressions consisting of rocks and boulders mixed with gravel pebbles comprising the northern and eastern portion of the area. Overall, larger CPUE values were found at the northeast stations, consistent with the preferred habitat of lobsters (i.e., mixed bottom type of harder material, including significant surface expressions). The ratio of unvented to vented mean CPUE data for each location is larger (ranged from 3.7 to 21) in the areas with mixed bottom type and surface expressions, indicating that more juvenile lobsters may be in those locations or enter the traps more readily. Site E appears to have a smaller lobster population than the surrounding areas, which can be explained by the fact that the sediments are not conducive to burrowing or affording lobster other shelter. The habitat to the north and east is more conducive, and the lobster population presence reflects the topography of those areas.

3.12.3 Site W

Six surveys have been conducted since 1999 to assess the lobster population in and around Site W (Figure 3-59). Twenty lobster pots were deployed for each survey conducted in August, September, and November 1999.

Two surveys were conducted in 2002 to characterize the lobster resources in Site W, one in July and another in October. For each survey, 30 traps were deployed at five locations in Site W (Figure 3-59), one pot line with six traps for each location. Again, each pot line was rigged with alternating vented and unvented traps. In the summer of 2003, one pot line with six pots was deployed at three locations to the west and two locations to the north of Site W (Figure 3-59), for a total of 15 vented and 15 unvented pots.



Source: Corps, 2001a; Corps, 2003l; Corps, 2003m; Corps, 2003n

Figure 3-59. Mean CPUE (lobster/trap) for Unvented Lobster Pots for Site W and the Surrounding Area.

Figure 3-59 presents the relative mean CPUE values from vented pots from the six surveys that were conducted in 1999, 2002, and 2003 in and near Site W. The vented pots from the 2002 and 2003 surveys yielded lower numbers of lobsters than the corresponding unvented pots, because the juvenile lobsters were able to escape through the vents. CPUE values were greater for the summer surveys than for the fall surveys, which is consistent with the lobster population migrations inshore to warmer waters during the summer months to molt and mate. The areas to the north of Site W with coarse sand and rocks yielded slightly higher CPUE values than the areas within Site W that are mostly silty fine sand. The mean CPUE data from the six surveys conducted from 1999 to 2003 within the same season and general location were very similar.

3.13 MARINE AND COASTAL BIRDS [40 CFR SECTION 228.6(a)(2)]

3.13.1 Rhode Island Region ZSF

Many different types of resident, migratory, and coastal birds may potentially use the ZSF as a feeding habitat or resting area. In general, the shallow open-water areas within the ZSF provide feeding habitat for many wading birds. The deeper open-water areas may provide resting and feeding habitat for several species of waterfowl and waterbirds such as cormorants, grebes, and loons.

For over 100 years, the Audubon Society Christmas Bird Counts (National Audubon Society, 2002) have identified and recorded many species along the Rhode Island coastline and from Block Island. Appendix A-5 lists the coastal and marine birds that have been recorded in the ZSF from these surveys. These birds are classified by their marine habitat as pelagic, shorebirds, waterfowl, colonial water birds, raptors, and marsh birds and are discussed in the following sections. Three birds likely to occur around the waters of the ZSF are listed on both the Federal and state endangered or threatened species list: the bald eagle, piping plover, and roseate tern. Five birds are designated as birds of special concern by the Commonwealth of Massachusetts (Massachusetts Fish and Wildlife Service [MAFWS], 2002): the Leach's storm-petrel, common loon, common tern, arctic tern, and least tern. The State of Rhode Island does not list species of special concern, other than endangered or threatened species. These rare, threatened, and endangered avian species, as well as species of special concern, are discussed in more detail in Section 3.15.

Pelagic Birds

Several species of pelagic birds have been identified in the ZSF, including Leach's storm-petrel, the more "duck-like" common loon, and the red-throated loon. These birds are classified as generally open ocean birds during the winter in tropical seas and do not come near the coast except when nesting or breeding in the spring and summer. Prey for pelagic birds include those organisms that may be collected in the open ocean waters, including fish, crustaceans, shellfish, and plankton. Foraging strategies (i.e., feeding techniques) vary from skimming over the surface and plucking small organisms from the water, to diving to great depths for extended periods to gather fish, shrimp, or benthic organisms such as crabs and shellfish. The common loon has been documented as being caught in fishing nets at 200 ft below the water's surface.

Shorebirds

Although many of the birds identified in the ZSF nest on coastal shore areas, those known as shorebirds are unique in that they also forage in these shoreline areas. Shorebirds inhabit coastlines, open beaches, tidal flats, and marshes. The only shorebird identified in the ZSF is the piping plover, based on the Audubon's bird count classification scheme. Shorebirds such as the plover will run along the sand or mud and stop to probe the substrate for worms, snails, or small crustaceans living in the substrate. The piping plover is listed as a threatened and endangered species and is discussed in more detail in Section 3.15.

Waterfowl

Many different waterfowl species have been identified and recorded in the ZSF, including bufflehead ducks, the common goldeneye, hooded- and red-breasted mergansers, the ruddy duck, the American black duck, the greater scaup, common eider, harlequin duck, surf scoter, white-winger scoter, and black scoter. Waterfowl are migratory and spend the majority of the time on the water searching for food such as invertebrates, plants, and small fish. Most of these species breed in coastal waters of northern Canada and winter along the Atlantic coast and have been recorded in the ZSF. Waterfowl come ashore to breed in inland regions or along the coastlines. Many of these species have been observed diving and swimming at great depths underwater for prey. Diving ducks, such as scaup, can dive to 25 ft to forage for clams, invertebrates, fish, and underwater plants. Sea ducks, such as scoters and eiders, have been observed diving to depths over 100 ft to feed on shellfish such as mussels and crustaceans.

Colonial Water Birds

This category of birds is characterized by the colonies of nests that they build along the coasts. Colonial water birds generally inhabit sandy or rocky islands, coastal beaches, salt marshes, bays, and estuaries. These birds have a variety of feeding techniques ranging from wading through the water grabbing fish and invertebrates to hovering over the water surface and diving into the water to catch fish. Most of the colonial water birds feed in the coastal areas with shallow water depths in search of small fish. Some species, such as the sooty shearwater and the northern gannet, are also found on the open ocean diving for fish. The diet of most coastal water birds includes fish, various crustaceans, mollusks, and plankton. Several colonial water birds have been observed in the coastal areas of the ZSF, including the common tern, arctic tern, least tern, sooty shearwater, northern gannet, double-crested cormorant, great cormorant, great blue heron, great egret, Bonaparte’s gull, herring gull, great black-backed gull, laughing gull, ring-billed gull, black-legged kittiwake, and razorbill. The roseate tern is also a colonial water bird. This particular species is listed as Federally threatened and endangered and is discussed in more detail in Section 3.15.

Raptors

Raptors are birds of prey that are classified as hunting birds that search for food while in flight. Their diet may consist of fish, other birds, and even small mammals. The bald eagle and ospreys are two examples of raptors that are observed in the ZSF. These birds generally nest and perch in the upland habitat of tall trees to survey their area and use the shoreline and open ocean for feeding. The bald eagle is listed as threatened on the Federal and state lists and is discussed in Section 3.15.

Marsh Birds

Marsh birds are found in shallow estuaries, coastal bays, and marshes, where they feed and breed. Examples of marsh birds observed in the coastal areas of the ZSF include the horned grebe, red-necked grebe, mute swan, American coot, pie-billed grebe, eared grebe, and American bittern. Many of these species move to the coastal areas during the fall and winter. Marsh birds exhibit a variety of feeding techniques, including swimming and diving or wading and grabbing prey. Diets for these birds generally consist of fish, crustaceans, and aquatic plants. Marsh birds are also common in freshwater ponds and rivers.

3.13.2 Alternative Sites

Sites E and W are located in areas of the ZSF that have water depths of approximately 120 to 130 ft. These areas are each located at least 8 to 10 nmi from the closest land mass (including coastal areas of Rhode Island, Cape Cod, Martha's Vineyard, Nantucket Island, and Block Island). Therefore, shorebirds and marsh birds are unlikely to be found at these locations. No direct observations or specific data has been documented for Site E and Site W. However, pelagic birds, waterfowl, colonial water birds, and raptors could all possibly use these alternative areas for resting or foraging as often as any other area of the ZSF.

3.14 MARINE MAMMALS AND REPTILES [40 CFR SECTION 228.6(a)(2)]

All marine mammals in U.S. waters are protected under the Marine Mammal Protection Act of 1972 (MMPA), most recently reauthorized in 1994. The MMPA established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and on the taking of marine animals by U.S. citizens on the high seas. The term "take" is statutorily defined to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal." The moratorium also prohibits the importation of marine mammals and marine mammal products into the United States. The NMFS has responsibilities under MMPA that include monitoring populations of marine mammals to ensure that they stay at optimum levels. If a population falls below its optimum level, it can be designated as "depleted," and a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

3.14.1 Rhode Island Region ZSF

The waters of the ZSF are on the migratory pathway of several marine mammal species; therefore, these species may be found at one time or another within the proposed ZSF. These species include the harbor seal, harp seal, hooded seal, white-sided dolphin, harbor porpoise, and minke whale. Each species is briefly discussed below. Additional marine mammals and reptiles that may possibly be found in the ZSF and are listed as Federally threatened or endangered are discussed in Section 3.15.

*Harbor Seal (*Phoca vitulina concolor*)*

The harbor seal, also known as the common seal, is found throughout coastal waters of the Atlantic Ocean from Canada to southern New England and New York and adjoining seas (Waring *et al,*. 2001) above 30° N latitude. Coast-wide aerial surveys conducted off the coast of

Maine during pupping season counted a minimum of 30,990 harbor seals in 1997; at present, this count is considered the best available minimum estimate of the harbor seal population along the New England coast (Waring *et al.,* 2001), which includes the ZSF. Harbor seals spend the late spring, summer, and early fall between New Hampshire and the Arctic, where they breed and care for newly born pups. A general southward movement from the Bay of Fundy to southern New England waters occurs in fall and early winter, mostly consisting of juveniles and sub-adults. Whitman and Payne (1990) have suggested that this age-related dispersal may reflect the higher energy requirements of younger individuals. After overwintering in southern New England and New York coastal waters (including the ZSF), the vast majority of the population migrates to the northern waters of New Hampshire, Maine, and Canada in the spring for the pupping season. No pupping areas have been identified in the ZSF.

Harbor seals in Rhode Island waters were observed hauled out at Block Island, at Horseneck Rock Piles near Narragansett Bay, and at Seal Rocks off Newport during aerial surveys conducted in 1999 and 2000 (Table 3-18). Harbor seals were present at these locations in late winter and early spring months. By May, these seals were no longer present and likely migrated north to breeding and pupping grounds. Actual migration paths of harbor seals along the coastlines are not documented or are not available.

Table 3-18. Recent Harbor Seal (*Phoca vitulina concolor*) Counts in Rhode Island Waters.

Survey Location	Survey Date				
	February 1999[1]	April 1999[1]	May 1999[1]	March 2000[2]	May 2000[2]
Block Island	25	0	0	20	Not surveyed
Horseneck Rock Piles, Narragansett Bay	0	40	0	Not surveyed	Not surveyed
Seal Rocks, off Newport	84	91	0	49	0

[1]Barlas, 1999
[2]Waring, unpublished data

Harbor seal strandings occurred in southern New England during the winter period and have been attributed to vessel strikes, fishing gear entanglement, entrainment in power plant intakes, oil spills, storms, abandonment, and disease (Waring *et al.,* 2001). At present, mortality levels attributable to deliberate shooting of seals by fishermen and aquaculture farmers, who view seals as pests since they compete for the same valuable fish stocks or farmed fish, are unknown (Waring *et al.,* 2001). Major causes of human-induced harbor seal mortality include marine pollution and habitat destruction; however, mortality mainly stems from drowning in active or abandoned fishing nets. In the last decade or so, harbor seal mortality has been related to the Northeast multispecies sink gillnet fishery, as well as the Gulf of Maine, the southern New England, and the Mid-Atlantic coastal gillnet fishery. From 1995 to 1999, an estimated average of 893 harbor seals were killed or seriously injured in the Northeast multispecies sink gillnet fishery. Gillnetting is one type of commercial fishing method used by fisherman to collect multiple species, some target and some non-target species. The gillnet is a curtain of netting that hangs in the water, suspended from floats, and is virtually invisible to marine life. The harbor seal is not listed as threatened or endangered under the Endangered Species Act (ESA), and it is not considered a strategic stock (i.e., a stock whose mortality is at a level that will destroy the population) by NMFS.

*Harp Seal (*Phoca groenlandica*)*

The harp seal occurs throughout much of the north Atlantic and Arctic Oceans. In recent years, harp seals have been sighted in the winter and spring months at the extreme southernmost reaches of its range from mid-Atlantic waters through New England (Waring *et al.,* 2001). Abundance of harp seals in Canadian waters is estimated at 5.2 million. Existing data are insufficient to estimate harp seal abundance in U.S. waters (Waring *et al.,* 2001). The literature search conducted for this Final EIS did not find any information on harp seals in waters of the ZSF. However, these waters are within the migratory range of harp seals during winter and spring, and thus there is a potential for this species to occur within the ZSF. In the last decade, numbers of sightings and strandings of harp seal have been increasing from Maine to New Jersey (Waring *et al.,* 2001).

From 1995 through 1999, the total estimated human-related mortality for harp seals was approximately 321,000 animals. This estimate was derived from commercial harvesting by Canada and Greenland, from incidental bycatch of the Newfoundland lumpfish fishery, and from the Northeast multispecies sink gillnet fishery (Waring *et al.,* 2001). Annual harp seal strandings are increasing. Several harp seals (51 of 224 animals) were stranded in Massachusetts in 1997 and 1998 (Waring *et al.*, 2001). The harp seal is not listed as threatened or endangered under the ESA, and it is not considered a strategic stock (a stock whose mortality is at a level that will destroy the population) by NMFS.

*Hooded Seal (*Cystophora cristata*)*

The hooded seal occurs throughout much of the north Atlantic and Arctic Oceans, preferring deeper water and occurring farther offshore than harp seals are typically found. Hooded seals are highly migratory and have been sighted during the winter and spring months (between January and May) with increasing frequency in waters from Maine to Florida (Waring *et al.,* 2001). Abundance of hooded seals in Canadian waters is estimated at 400,000. Existing data are insufficient to estimate hooded seal numbers in U.S. waters (Waring *et al.,* 2001).

From 1992 through 1996, the total annual fishery-related mortality or serious injury estimate for hooded seals in U.S. waters was approximately 5.6 animals. Incidental bycatch of hooded seals has been observed in the Northeast multispecies sink gillnet fishery (Waring *et al.,* 2001). Hooded seals are also taken in the Canadian lumpfish fishery and groundfish gillnet and trawl fisheries, but removal estimates were not available. In 1997, commercial harvest of hooded seals was estimated at 7,058 seals from an allowable 8,000 seals. Approximately 50 hooded seals have stranded each year during the period of 1994 to 1997 (Waring *et al.,* 2001). Some of these strandings occurred in Massachusetts, Connecticut, and New York. The increase in the number of strandings of hooded seals may indicate a possible shift in distribution or range expansion southward into U.S. waters and, if so, fishery interactions may increase (Waring *et al.,* 2001). The hooded seal is not listed as threatened or endangered under the ESA and is not considered a strategic stock by NMFS. The literature search conducted for this Final EIS did not find any information on hooded seals specifically in ZSF waters. However, the ZSF is within the migratory range of hooded seals, and thus there is a potential for this species to occur in these waters.

*White-sided Dolphin (*Lagenorhynchus acutus*)*

The white-sided dolphin occurs in temperate and polar waters in the North Atlantic Ocean, typically over the continental shelf to the 330-ft depth contour. An abundance of 28,600 white-sided dolphins was estimated from aerial surveys conducted from 1978-1982 on continental shelf and shelf-edge waters between Cape Hatteras, North Carolina, and Nova Scotia, Canada. The best available estimate for the abundance of the Gulf of Maine stock of white-sided dolphins is 51,640, from a July to August 1999 survey that is the most recent (Waring *et al.,* 2001). Some white-sided dolphin strandings have occurred in Virginia and North Carolina; this area likely represents the southernmost extent of its range (Waring *et al.,* 2001). NMFS survey data contained no sightings of white-sided dolphins in the ZSF, although the surveys did not focus specifically on this area.

From 1995 through 1999, the total annual fisheries-related mortality for white-sided dolphin was estimated at 136 animals (Waring *et al.,* 2001). Incidental bycatch has been observed in the Northeast sink gillnet fishery, the mid-Atlantic coastal gillnet fishery, the pelagic drift gillnet fishery, the North Atlantic bottom trawl fishery, and the Atlantic squid, mackerel, and butterfish trawl fisheries (Waring *et al.,* 2001). Mass strandings of white-sided dolphins are common, and a stranding event may involve over 100 animals. While several mass strandings have occurred from Maryland to Maine during January to August and including Massachusetts waters and outer Cape Cod area (Waring *et al.,* 2001), none are reported from Rhode Island waters. Causes of these strandings are not known. The white-sided dolphin is not listed as threatened or endangered under the ESA and is not considered a strategic stock by NMFS. The habitat range of the white-sided dolphin is generally in deeper waters of the continental shelf and therefore would likely rarely occur in the ZSF, except possibly along the southernmost areas of the ZSF.

*Harbor Porpoise (*Phocoena phocoena*)*

The harbor porpoise is primarily an inshore species. During the summer, harbor porpoises are concentrated in the northern Gulf of Maine and the southern Bay of Fundy region, generally in waters less than 490 ft deep. This stock of harbor porpoises migrates south into the mid-Atlantic region during the fall and spring months; they are widely distributed from New Jersey to Maine. Low densities of harbor porpoises are found in waters off New York and north to Canada in the winter. No specific migratory routes to the Gulf of Maine/Bay of Fundy region have been identified. The best estimate for the abundance of the Gulf of Maine/Bay of Fundy population is 89,700 animals, with a minimum population estimate of 74,695 (Waring *et al.,* 2001).

In 1999, the average annual mortality estimate of harbor porpoises attributable to U.S. fisheries was 381 animals. This value was down significantly from previous years following the implementation of a take reduction plan for the U.S. Atlantic gillnet fishery (Waring *et al.,* 2001). Recent mortality has occurred in the U.S. northeast sink gillnet fishery, the mid-Atlantic coastal gillnet fishery, and the Canadian Bay of Fundy groundfish sink gillnet and herring weir fisheries. Other human-induced mortality may occur from hunting in some areas of the western

North Atlantic. During the period of 1994 to 1999, 691 harbor porpoise strandings were reported from Maine to North Carolina, with only 26 strandings in 2000. During 1999 and 2000, over half of the strandings occurred on beaches of Massachusetts and North Carolina. No specific information on locations in Massachusetts was available. NMFS considers the Gulf of Maine/Bay of Fundy harbor porpoise stock as a strategic stock, though the stock has preliminarily been removed from the ESA candidate species list by the NMFS (Waring *et al.,* 2001). The preferred nearshore habitat of the harbor porpoise makes it a potential species to be found in the ZSF, although no documentation of this occurrence has been found to date.

*Minke Whale (*Balaenoptera acutorostrata*)*

Minke whales occur throughout polar, temperate, and tropical waters. The minke whale is the third most abundant great whale in the Atlantic Ocean within 200 nmi of the U.S. coastline (Winn, 1982). Minke whales off the east coast of the Unites States are part of the Canadian east coast population, one of four minke populations recognized in the North Atlantic. The range of this population extends south from Canada to the Gulf of Mexico, but distribution is primarily concentrated in New England waters, with most sightings occurring in the spring and summer months. Based on surveys conducted in 1995 and 1999, the best available current abundance estimate for minke whales in the western North Atlantic is 4,018 animals, with a minimum estimate of 3,515 animals (Waring *et al.,* 2001). This species is found in open seas primarily over continental shelf waters, but it occasionally enters bays, inlets, and estuaries. Minke whales may occasionally visit the ZSF, as is made evident by two recent minke whale mortality reports. In 1999, two minke whales were found dead at the Sakonnet River in Narragansett Bay and at Point Judith Light, respectively. Both whales were found with stretched mesh tightly wrapped around or embedded in their rostrums (Waring *et al.,* 2001).

Incidental catches of minke whales have been observed in the mid-Atlantic coastal gillnet fishery, the Gulf of Maine and mid-Atlantic lobster trap/pot fishery, and the Atlantic tuna purse seine fishery. However, not all incidental catches have resulted in mortality. The annual mortality estimate from these fisheries for the period of 1995 to 1998 is 2.4 animals (Waring *et al.,* 2001). Other human-induced mortality occurred from hunting in some areas of the North Atlantic and from collisions with vessels. The minke whale is not listed as threatened or endangered under the ESA, as depleted under the MMPA, or as a strategic stock by NMFS.

Several other marine mammals and sea turtles that are listed on the threatened and endangered species list may be possible visitors to the ZSF. Section 3.15 presents the specific information for these species.

3.14.2 Alternate Sites

Sites E and W are located approximately 8 to 10 nmi from land in waters approximately 120 to 130 ft deep. The conditions at these two sites are typical of the general ZSF, with no specific data or marine mammal observations documented or available for these specific areas. Marine mammal species and their potential for occurrence in the ZSF are summarized below.

- Harbor seals have been observed in the ZSF area hauled out on the mainland and island shorelines of the ZSF in the fall through early spring before migrating north during spring and summer to breeding and pupping grounds.
- Harp seals and hooded seals have not been documented as occurring in the ZSF, but these waters are within their migratory ranges; therefore, there is a probability that these species can be found in the ZSF.
- White-sided dolphins are generally found in deeper waters beyond the continental shelf and have not been documented by NMFS as occurring in the ZSF. However, the surveys did not specifically focus on this area. Several mass strandings of white-sided dolphins have occurred in Massachusetts waters, with no specific location identified, but none are reported from Rhode Island waters.
- Harbor porpoises are primarily an inshore species found in waters less than 490 ft and are most commonly found in nearshore, shallow water, bays, and harbors. During the fall and spring months, they are widely distributed from New Jersey to Maine. They feed on schooling fish less than 41 cm long such as herring, capelin, sprat, and silver hake. The ZSF area could possibly support harbor porpoise during their migration or while feeding, but none have been documented in this area to date.
- Minke whales are common in New England waters in the spring and summer months with no specific locations identified in the literature. They are generally found in the open seas primarily over continental shelf waters but may occasionally visit areas such as the ZSF or bays, inlets, or estuaries.

In all, these species may be found transiting or feeding on local concentrations of prey items within the area; however, the ZSF is not a specific destination or concentration area for any of the marine mammals identified above.

3.15 RARE, THREATENED, ENDANGERED SPECIES AND SPECIES OF SPECIAL CONCERN [40 CFR SECTION 228.6(a)(9)]

Endangered species are native species that are in danger of extinction throughout all or part of their range, or that are in danger of extirpation (MAFWS, 2002). Threatened species are native species that are likely to become endangered in the foreseeable future, or that are declining or rare. Species of special concern are native species that have experienced a decline which, if continued unchecked, could threaten the species, or that are so restricted in abundance, distribution, or specialized habitat requirements that they could easily become threatened.

Section 7 of the ESA of 1973 (ESA, P.L. 93-205) requires that all Federal agencies ensure that any action they authorize, fund, or carry out will not jeopardize the continued existence of any Federally endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species. The EPA, as the lead Federal agency for this project, is mandated by Section 7 of the ESA to consult with the Department of Commerce (typically via NMFS) and the Secretary of Interior (typically via the U.S. Fish and Wildlife Service [FWS]) to determine if any Federally protected species may be affected by a project. This consultation may include preparation of a Biological Assessment to determine if the proposed action is likely to result in adverse effects to threatened or endangered species. Accordingly, the Corps, acting on behalf of EPA, has initiated consultations with NMFS and FWS to determine the presence of any Federally protected species that may coincide with the proposed ZSF.

3.15.1 Rhode Island Region ZSF

In correspondence with NMFS and FWS (Appendix B), the Corps was notified of the following federally endangered or threatened marine mammals, reptiles, birds, and insects. In addition, several species were also identified by the individual states of Massachusetts and Rhode Island as endangered, threatened, or a species of special concern. Table 3-19 lists each species and the federal and state status.

Each of these 16 federally protected species, as well as five species of special concern, is discussed briefly in this section. Detailed information on the population status and trends, seasonal distribution, food and feeding behaviors, and known disturbance and mortality factors for these species is included in the Biological Assessment (see Section 6.3).

Mammals

Humpback Whale (*Megaptera novaeangliae*): Humpback whales occur in all oceans of the world, except possibly the Arctic (NMFS, 1991). Until the early 20th century, humpback whales were an important commercial species throughout most of their range, including New England waters (Allen, 1916), and some taking of the species occurred in northwest Atlantic waters until the mid-1950s. The International Convention for the Regulation of Whaling (adopted in 1946) afforded the North Atlantic population of humpback whales full protection in 1955 (Best, 1993). Humpback whales were afforded endangered species status in the United States in 1970 (USFWS, 1986). The best abundance estimate currently available for humpbacks in the Gulf of Maine is 902 whales, with a minimum population estimate of 647 individuals (Waring *et al.,* 2002).

The humpback whale is a migratory species that spends the summer in highly productive northern latitude feeding grounds (40° to 75° N latitude) (NMFS, 1991). Humpback whales regularly visit the waters of southern New England, including the deeper, continental shelf areas of Massachusetts and Rhode Island, where they are present in greatest abundance between June and September. One of the primary feeding grounds is Stellwagen Bank, located off the coast of Massachusetts. Most whales are found in areas where their primary food sources occur in large numbers and can be easily located. Humpback whales are the top carnivores in a relatively simple food chain consisting of phytoplankton, zooplankton, small forage fish, and crustaceans. While the ZSF does contain some of the bathymetric and oceanographic features that favor dense aggregations of food desired by humpbacks, these features are not developed to the extent that they are farther north. Humpback whales regularly migrate through the ZSF en route to feeding grounds in the north and to tropical breeding grounds in the south, although very few whales have been reported within the ZSF itself.

Table 3-19. List of Federal and State Endangered or Threatened Species.

Species	Federal Status – NMFS[1]	Federal Status – FWS[2]	MA status[3]	RI status[3]
Blue Whale (*Balaenoptera musculus*)	NA	Endangered	Endangered	NA
Finback Whale (*Balaenoptera physalus*)	Endangered	Endangered	Endangered	Endangered
Humpback Whale (*Megaptera novaeangliae*)	Endangered	Endangered	Endangered	Endangered
Right Whale (*Eubalaena* spp. – all species)	Endangered	Endangered	Endangered	Endangered
Sei Whale (*Balaenoptera borealis*)	NA	Endangered	Endangered	NA
Sperm Whale (*Physeter catodon*)	NA	Endangered	NA	NA
Green Turtle (*Chelonia mydas*)	Endangered	Threatened	NA	NA
Hawksbill Turtle (*Eretmochelys imbricata*)	NA	Endangered	Endangered	Endangered
Leatherback Turtle (*Dermochelys coriacea*)	Endangered	Endangered	Endangered	Endangered
Loggerhead Turtle (*Caretta caretta*)	Threatened	Threatened	Threatened	Threatened
Atlantic Kemp's Ridley Turtle (*Lepidochelys kempii*)	Endangered	Endangered	Endangered	Endangered
Bald Eagle (*Haliaeetus leucocephalus*)	NA	Threatened	Threatened	Threatened
Piping Plover (*Charadrius melodus*)	NA	Threatened	Threatened	Threatened
Roseate Tern (*Sterna dougallii dougallii*)	NA	Endangered	Endangered	Endangered
American Burying Beetle (*Nicrophorus americanus*)	NA	Endangered	NA	Endangered
Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*)	NA	Threatened	Threatened	NA
Common Loon (*Gavia immer*)	NA	NA	Species of special concern	NA
Common Tern (*Sterna hirundo*)	NA	NA	Species of special concern	NA
Arctic Tern (*Sterna paradisaea*)	NA	NA	Species of special concern	NA
Least Tern (*Sterna antillarum*)	NA	NA	Species of special concern	NA
Leach's Storm-Petrel (*Oceanodroma leucorhoa*)	NA	NA	Rare/seriously declining in MA	NA

Source: [1]NMFS, 2002a; [2]USFWS, 2003a; [3]http://ecos.fws.gov/ecos/reports.do

Fin Whale (*Balaenoptera physalus*): Fin whales are present in all major oceans of the world, from the Arctic to the tropics, with greatest numbers in temperate and boreal latitudes (Evans, 1987). Fin whales were identified as endangered throughout their range in 1970. Because of their high cruising speed, fin whales were not harvested commercially in large numbers until other species, such as slow-moving right whales, were depleted and whalers developed high-speed boats (Leatherwood *et al.*, 1976). A fishery for this species existed in Nova Scotia from 1964 to 1972 (Mitchell, 1974), and commercial harvesting of fin whales elsewhere in the world continued at least into the early 1990s. For the western North Atlantic fin whale population, the best estimate of abundance is 2,814, with a minimum population estimate of 2,362 (Waring *et al.,* 2001). Because of the fin whale's extended distribution and poorly understood population structure, this is considered to be an extremely conservative estimate.

Fin whales are commonly seen on the continental shelf in waters less than 328 ft (100 m) deep. New England waters are important summer feeding grounds for fin whales, and the species is most abundant off of the Massachusetts coast along the 130- to 165-ft depth contour, particularly in the Great South Channel east of Cape Cod, across Stellwagen Bank, and northeastward to Jeffreys Ledge (north of Cape Ann, Massachusetts) (Hain *et al.*, 1992). During the fall and winter, the majority of these whales migrate south to wintering grounds offshore of the Delmarva Peninsula and the Outer Banks of North Carolina (Winn, 1982; EPA, 1988). Others concentrate at the mid-shelf region east of New Jersey as well as areas on Stellwagen Bank and Georges Bank. Year after year, juveniles will return to the same feeding areas they first visited with their mothers (Seipt *et al.*, 1990; Clapham and Seipt, 1991). The fin whales' preferred feeding grounds in the coastal areas (130- to 165-ft depth contour) indicate that these whales may be found in the southern areas of the ZSF, although no specific documentation for this Final EIS has been identified.

Northern Right Whale (*Eubalaena glacialis*): The northern right whale was a prime target of early whale fisheries along the coast of the eastern United States from the 1600s through the early 1900s, due to its coastal distribution, slow swimming speed, high oil yield, and characteristic of floating when dead (Brown, 1986; Aguilar, 1987). Due to intense exploitation, it is now the rarest of the large whales and is in danger of extinction. The northern right whale was classified as endangered in 1970 (35 FR 8495). Three areas have been designated as critical habitat for the northern right whale: the Great South Channel, Cape Cod Bay, and southeastern U.S. waters 13 nmi offshore from the Alameda River, Georgia to Sebastian Inlet, Florida.

The western North Atlantic population will be considered "recovered" when it reaches 60 to 80 percent of its pre-exploitation number (NMFS, 1991), or about 7,000 animals. The 2001 population estimate was 291 individuals (Kraus *et al.,* 2001). Despite the cessation of whaling and the implementation of the MMPA (1972) and the ESA (1973), the population of northern right whales appears to be growing at a very slow rate.

Generally, right whales are found along the east coast of North America (Winn, 1982). Some female right whales have been observed to migrate more than 1,600 nmi from their northern feeding grounds to the southern calving/wintering grounds (Knowlton *et al.,* 1992). Despite the fact that some New England waters are important feeding and nursery grounds for right whales, this species is rarely seen in the ZSF, which is inshore of migration paths. Most whales are found in areas where their primary food sources, including copepods and juvenile euphasiids, can be easily located, and the ZSF does not normally support these food sources because of its relatively shallow waters and sandy bottom. However, juvenile male right whales have been congregated, on occasion, in the southern portion of the ZSF when food sources were abundant, particularly in the spring. No documented feeding grounds for right whales in the ZSF have been identified in the literature.

The most significant human impacts to right whales are collisions with vessels and entanglement in fishing gear. Habitat change is believed to be another cause of decline in right whale populations. Anthropogenic sources of change include pollution, oil and gas exploration, sea-bed mining, wastewater discharges, dredged material disposal, and a general increase in coastal activities due to an increase in human population along the U.S. east coast (NMFS, 1991; Steinback *et al.*, 1999; EPA, 1993).

Sperm Whale (*Physeter macrocephalus*): Sperm whales are generally found on the continental shelf edge, over the continental slope, and into mid-ocean regions and are listed as endangered under the ESA. This offshore distribution is more commonly associated with the Gulf Stream edge and other features as suggested by Waring *et al.*, 1993. The best available abundance estimate for sperm whales is from two studies that encompass the area from the Gulf of St. Lawrence to Florida, which estimate the population to be approximately 4,702 individuals.

The sperm whale is the deepest diver of the great whales; it can descend to depths of over 3,300 ft and stay submerged for over an hour. Average dives are 20 to 50 min long to a depth of 980 to 1,970 ft (American Cetacean Society [ACS], 2003a). In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the distribution shifts northward to east of Delaware and Virginia and is widespread throughout the central portion of the mid-Atlantic bight and the southern portion of Georges Bank. There are reportings of sperm whale in the area of Block Canyon, which is located approximately 71 nmi from the southern boundary of the ZSF in approximately 656-ft-deep water, in pursuit of migrating squid in the southern New England continental shelf waters (CETAP, 1982; Scott and Sadove, 1997). In summer, the distribution is similar to the spring but also includes areas east and north of Georges Bank and onto the continental shelf of New England. In the fall, sperm whales tend to migrate south of New England on the continental shelf. The main food source of the sperm whale is medium-sized deep water squid, but it also feeds on species of fish, skate, octopus, and smaller squid.

There is documentation of sperm whales being entangled in fishing gear. The estimated number of hauls of sperm whales in the pelagic drift net fishery increased from 714 individuals in 1989 to 1,144 in 1990 (NMFS, 2002b). In 1999, NMFS issued a Final Rule prohibiting the use of driftnets in the North Atlantic swordfish fishery. Fishing-related mortality or serious injury to the sperm whale decreased to zero from 1991 to 1998. Eighteen sperm whale strandings were documented along the Atlantic coast between Maine and Florida during 1994-2000 (NMFS, unpublished data). The potential for accumulation of stable pollutants such as PCBs, pesticides, PAHs, and heavy metals in long-lived high trophic-level animals is possible, but there is no definitive evidence at this time.

Blue Whale (*Balaenoptera musculus*): The blue whale, the largest mammal, was hunted for oil from 1900 until 1966, when the International Whaling Commission (IWC) banned all hunting of blue whales and gave them worldwide protection (ACS, 2003b). Recovery has been extremely slow, and only in the last few years have there been signs that their numbers may be increasing. The current distribution of the blue whale in the western North Atlantic generally extends from the Arctic to at least mid-latitude waters; they are most frequently sighted in the waters off eastern Canada (NMFS, 2002c). It is considered an occasional visitor in the U.S. Atlantic waters, with only a few documented occurrences of this species south to Florida and the Gulf of Mexico. The preferred water depth and habitat of the blue whale has not been documented, but due to their enormous size and ability to dive deeply, they are expected to be found in deep waters off the continental shelf and are not expected to be found in the ZSF. The blue whale population in the western North Atlantic was estimated by Mitchell (1974) to be in the low hundreds. The blue whale is thought to feed almost exclusively on small, shrimp-like creatures called euphausiids or krill. Blue whales are listed as endangered. There are no confirmed records of mortality or serious injury to blue whales in the U.S. Atlantic waters with the exception of one ship strike event that is assumed to have occurred in the North Atlantic Ocean.

Sei Whale (*Balaenoptera borealis*): The sei whale breeds and feeds in open oceans and is generally restricted to more temperate waters, although it can be found in the North Atlantic Ocean from Iceland south to Venezuela. These whales are generally found in deeper waters characteristic of the continental shelf edge region (Hain *et al.* 1985). During feeding season, the sei whale population is generally centered in northerly waters with occasional trips into more shallow and inshore waters. The sei whale, like the right whale, is largely planktivorous, feeding primarily on euphausiids and copepods (NMFS, 1998). It feeds mostly by filtering plankton while swimming (skim feeding) but is also known to gulp-feed on krill, shrimp, and small fish (New York State Department of Environmental Conservation [NYSDEC], 2003a). Reduced predation on copepods by other predators, and thus greater abundance of this food source, have increased the reports of sei whales in more inshore locations such as Stellwagen Bank (NMFS, 1998). Mitchell (1975) described two "runs" of sei whales, in June-July and in September-October. The sei whale population migrates from south of Cape Cod and along the coast of eastern Canada in June and July, and returns on a southward migration again in September and October; however, such a migration remains unverified. If this migration pattern is accurate, then sei whales could possibly be found in the outer areas of the ZSF in the summer to early fall, but overall its occurrence would be transitory.

The total number of sei whales in the U.S. Atlantic is unknown. Two estimates by two different methods have estimated the western North Atlantic stock to range from 253 individuals (aerial survey in 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia; Cetacean and Turtle Assessment Program (CETAP), 1982) to between 1,393 and 2,248 individuals (based on a tag-recapture study conducted in 1966-1972 in Nova Scotia (Mitchell and Chapman, 1977). There are no reports of fishery-related mortality or serious injury to sei whales in fisheries observed by NMFS during 1991-1997. There are also no reports of mortality, entanglement, or injury in Northeast Fisheries Science Center (NEFSC) databases with the exception of one reported ship strike.

Reptiles

Loggerhead Turtle (*Caretta caretta*): The loggerhead sea turtle is listed as threatened under the ESA. It is the most common and seasonally abundant turtle in inshore coastal waters of the western North Atlantic. Loggerhead turtle population estimates are best obtained from nesting data. The Turtle Expert Working Group (TEWG) (2000) reports that the South Florida subpopulation appears to be increasing and that no trends are apparent in the northern subpopulation.

Loggerhead turtles are abundant during spring and summer months in coastal waters off New York and the mid-Atlantic states; small numbers of individuals may reach as far north as New England. In New England coastal waters, loggerheads feed primarily on small benthic crabs such as spider crabs, rock crabs, and green crabs, typically in water depths less than 20 m (Burke *et al.*, 1990; Morreale and Standora, 1992, 1993). In the fall, loggerheads migrate south to coastal waters off the south Atlantic states, particularly Florida, and to the Gulf of Mexico. During the winter, the turtles tend to aggregate in warmer waters along the western boundary of the Gulf Stream off the Florida coast (Thompson, 1988). In the spring, they congregate off southern Florida before migrating north to their summer feeding ranges (Winn, 1982).

For loggerheads that have not migrated south as water temperatures cool, strandings due to cold stunning may occur, particularly between November and January in Long Island, Rhode Island, and Massachusetts waters. Cold strandings may occur when the water temperature drops below 12 ºC. The metabolic rate of these cold-blooded reptiles decreases to the point where they are unable to swim and digest food; they become comatose and may die if not warmed quickly. Information from strandings, entanglements, mariner reports, and the U.S. Coast Guard suggest that loggerheads can be expected to occur in the ZSF in the summer and fall months, though no systematic surveys have been conducted in this area. The major sources of mortality of loggerheads caused by human activities include incidental take in bottom trawls, particularly shrimp trawls (Henwood and Stuntz, 1987; Thompson, 1988; National Research Council [NRC], 1990; Anonymous, 1992), coastal gill net fisheries, ingestion or entanglement of marine debris, and channel dredging (Thompson, 1988; NMFS, 1992). Collisions with vessels and entrainment in electric power plant cooling water may also be causes of loggerhead mortality.

Kemp's Ridley Turtle (*Lepidochelys kempii*): The Kemp's ridley sea turtle is the most endangered sea turtle in the world. It is distributed throughout coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean and is assumed to constitute a single stock (TEWG, 1998). The entire Atlantic population is dominated by juveniles, but recovery efforts are increasing the population from the low of 500 individuals reported by Carr and Mortimer in 1980. The total world population of adult ridleys is approximately 2,200 individuals, down from an estimated 162,400 adult individuals in 1947 (Márquez, 1989).

Although the Kemp's ridley sea turtle is found primarily in the Gulf of Mexico, juveniles do occur during the summer along the Atlantic seaboard from Florida to Long Island Sound, Martha's Vineyard, and occasionally north of Cape Cod, in Cape Cod Bay, Massachusetts Bay, the Gulf of Maine, and as far north as the Canadian Maritime Provinces (Lazell, 1980). Groups of young ridleys are frequently observed during the summer feeding in shallow coastal waters with depths less than 20 m in Vineyard Sound, Buzzards Bay, and in the eastern bays of Long Island (Carr, 1967; Lazell, 1980; Morreale and Standora, 1993). Prey species include various crabs and other crustaceans. Although rare, ridleys may visit areas of the ZSF. Ridleys begin leaving northern waters in mid-September and most are gone by early November. Some may hibernate in nearshore sediments during the winter (Carminati *et al.*, 1994). However, most observed in northern waters after the beginning of November are cold-stunned.

While ridley strandings are common on Cape Cod beaches, they rarely strand in Rhode Island waters (Sea Turtle Stranding and Salvage Network [STSSN], 2002). A major cause of sea turtle mortality attributable to humans is entanglement in fishing gear, particularly shrimp nets (NRC, 1990). Entanglement in lobster gear and pound nets may also result in mortality.

Leatherback Turtle (*Dermochelys coriacea*): The Federally endangered leatherback turtle is the second most common sea turtle along the eastern seaboard of the United States and is the most common sea turtle north of the 42ºN latitude. Leatherbacks forage in temperate and subpolar waters and nest on tropical beaches. They have a layer of subcutaneous fat and circulatory adaptations to reduce the rate of heat loss through their flippers (Greer *et al.*, 1973), thus allowing them to survive and feed in colder temperate waters than other sea turtles.

Because leatherback turtles are a largely pelagic, open ocean species, estimates of their population status and trends have been difficult to obtain. In addition, only a small fraction of the North Atlantic population nests on beaches of the continental United States, mostly in Florida (NRC, 1990; Meylan *et al.,* 1994) and the U.S. Virgin Islands (Boulon *et al.,* 1994); others nest on islands in the Caribbean.

Adult leatherback turtles are common during the summer months in North Atlantic waters from Florida to Massachusetts (Goff and Lien, 1988). New England and Long Island Sound waters support the largest populations on the Atlantic coast during the summer and early fall (Lazell, 1980; Prescott, 1988; Shoop and Kenney, 1992). During the summer, leatherbacks move into fairly shallow coastal waters, apparently following their preferred jellyfish prey. In the fall, they move offshore and begin their migration south to the winter breeding grounds in the Caribbean (Payne *et al.,* 1984).

Some leatherbacks strand each year in Rhode Island waters (STSSN, 2002). Being a temperate water species, leatherbacks do not seem to be sensitive to cold temperatures, and strandings cannot be attributed to cold stunning. Leatherbacks are very susceptible to entanglement in shrimp nets and other fishing gear and plastic debris (Mager, 1985; Witzell and Teas, 1994). Because their preferred diet is that of gelatinous zooplankton, particularly jellyfish, leatherback turtles often ingest floating plastic debris, mistaking it for food (Wallace, 1985; O'Hara, 1989).

Green Turtle (*Chelonia mydas*): The green turtle is the largest of the thecate (hard-shelled) sea turtles. The species is distributed throughout the Caribbean Sea, the Gulf of Mexico, and in the western North Atlantic from Florida to Massachusetts. Primary nesting sites are on the east coast of Florida. The number of nesting females in Florida is estimated at between 200 and 1,100 individuals. Current population trends are unavailable. However, since 1980, the number of green turtles nesting each year and the total population of green turtles in Florida waters appear to have increased gradually (Thompson, 1988; Steinback *et al.*, 1999).

During the summer, small numbers of green turtles venture as far north as Rhode Island Sound and New England. Green turtles rarely strand in Rhode Island waters (STSSN, 2002). Green turtles are herbivorous as adults and feed in shallow coastal waters on sea grasses and marine algae. Some green turtles become cold-stunned each year by falling water temperatures in the fall and winter, especially in northern waters (Morreale *et al.,* 1992).

Natural and anthropogenic disturbances affect green turtles at their nesting locations and in offshore waters. Nesting habitat is lost to erosion, shoreline fortification, and beach renourishment. Green turtles are also susceptible to entanglement in shrimp trawls and in other fishing gear. They also frequently ingest and become entangled in marine debris or may collide with vessels.

Hawksbill Turtle (*Eretmochelys imbricata*): The hawksbill turtle was classified as endangered in 1970, and its status has not changed. Commercial exploitation is the major cause of the continued decline of the hawksbill sea turtle, based on the continuing demand for the shell as well as other products such as leather, oil, perfume, and cosmetics (NMFS, 2003a).

These turtles are characterized as small to medium-sized sea turtles that utilize different habitats at different stages of their life cycle. Post-hatchlings occupy pelagic environments; coral reefs are the resident foraging habitat of juveniles, subadults, and adults due to their diet of sponges (NMFS, 2003a). They are also found on ledges and caves of reefs and around rocky outcrops and high-energy shoals, which provide optimum sites for sponge growth (NMFS, 2003a). Hawksbills are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of land masses where coral reefs are absent (NMFS, 2003a).

Hawksbill turtles are widely distributed in the Caribbean Sea and western Atlantic Ocean. They have been recorded along the eastern seaboard as far north as Massachusetts, but sightings north of Florida are rare (NMFS, 2003a). Based on the distribution and habitat patterns of the hawksbill turtle, the presence of a hawksbill turtle in the ZSF would be unusual.

Birds

Bald Eagle (*Haliaeetus leucocephalus*): The bald eagle is protected by the Migratory Bird Treaty Act (1913), the Bald Eagle Act (1940; reauthorized in 1971), and law preceding the ESA (1967). Its Federal status was changed from endangered to threatened in 1995. As of 1995, eight pairs of bald eagles have bred in Massachusetts, producing a total of 52 wild young (MAFWS, 2002). The species is distributed in Alaska and Canada, and south throughout the United States to Florida and Baja California. Bald eagles may occur in Massachusetts, Rhode Island, and Connecticut, especially during migration periods in March-April and September-October, though transient individuals may occur in these areas throughout the year. Bald eagles have been known to overwinter along the coast of Cape Cod, the islands of Martha's Vineyard and Nantucket, and the Atlantic coastlines.

Bald eagles inhabit coastal areas, estuaries, and large inland waterways. Habitat requirements for this species include stands of forest at the water's edge for nesting, trees projecting above the forest canopy for perching, an adequate supply of moderate-sized to large fish, and reasonable freedom from human disturbance (MAFWS, 2002). Overwintering eagles require suitable roost trees in locations that are protected from the wind by vegetation or terrain; these roost trees may be 10 nmi or more from feeding areas.

The breeding and nesting season for bald eagles in Massachusetts and Rhode Island begins in March. Marine and freshwater fish are the bald eagle's preferred food. Bald eagles have also been known to prey on other birds, especially waterfowl and seabirds, small mammals, and carrion, including dead fish. In winter, eagles of all ages gather in large numbers in areas near open water where fish or other food sources are abundant. Bald eagles have been identified and documented as nesting and feeding in coastal areas of Massachusetts and Rhode Island and would likely feed on prey found in the northern, coastal areas of the ZSF.

Piping Plover (*Charadrius melodus*): Piping plovers along the U.S. Atlantic coast are listed as threatened under the ESA. Piping plovers breed during summer months on coastal beaches of the western Atlantic from Newfoundland and the Gulf of Maine south to North Carolina. In 1990, 139 breeding pairs of piping plovers were documented at 58 sites in Massachusetts, which has the second largest population of piping plovers along the U.S. Atlantic coast (MAFWS, 2002). In 1991, the North American population census of piping plovers reported 5,840 adults (Canadian Wildlife Service [CWS], 2002). Piping plover sightings have been verified since 1978 on the coast of Massachusetts, Martha's Vineyard, Block Island, and along the Atlantic coastlines.

Piping plovers require sandy coastal beaches that are relatively flat and free of vegetation, typically found on outer coastal shores. They nest in a narrow strip of land between the high tide line and the foot of the coastal dunes. The birds feed exclusively on organisms that live along the shoreline, including marine worms, mollusks, insects, and crustaceans. They forage along the waterline, on mudflats at low tide, and in wrack along the beach. Because of their coastal habitat range and preferred food species, piping plovers are likely to be found only in the coastal waters of the northern edge of the ZSF.

Several factors are involved in the decline of piping plover populations, including human disturbance, loss of habitat, and predation. Gulls, crows, raccoons, foxes, and skunks are also a threat to plover eggs, and falcons may prey on juvenile and adult plovers (CWS, 2002).

Roseate Tern (*Sterna dougallii dougallii*): The roseate tern is a Federally endangered species. It is listed by the State of Rhode Island as a historical species, meaning it has historically been known to occur in Rhode Island, but its occurrence in the state is currently unknown. The last roseate tern sighting on record for Rhode Island occurred in 1979 (RIDEM, 2002a). The roseate tern breeds from Nova Scotia to Long Island during summer months. During the late 1980s and early 1990s, about 90 percent of the northeast U.S. breeding population of roseate terns nested south and west of Cape Cod (Spendelow, 2002). Currently, about 6,000 to 6,500 individual roseate terns breed in an area from the south shore of Long Island north to Nova Scotia (Spendelow, 2002).

Roseate terns arrive in northern nesting habitats in early May along with other tern species. They leave their nesting grounds at the end of August and then congregate for approximately a month at a traditional site to roost, feed, and rear their young. In late September, roseate terns migrate south en masse and may overwinter in the eastern Caribbean and along the Atlantic coast of South America. Preferred habitat for the roseate tern includes islands, coastal beaches, and inshore waters, but they can also be found feeding in the open ocean up to 0.5 nmi offshore and are likely to be found in the coastal areas of the ZSF. This species feeds on sand lance, small herring, and mackerel, but rarely feeds on other fish or invertebrates.

Roseate tern populations face pressure from predators and anthropogenic activities, particularly at their breeding colonies. The explosion in the gull population during the 20th century and the predation of roseate tern nests and young by gulls, crows, and ravens have affected roseate tern populations. This can lead to the terns abandoning their colonies in search of new locations that may be impacted by human development. Declines in the fish stocks that are sources of prey for terns may also affect roseate tern populations.

Common Loon (*Gavia immer*): A winter resident of southern Rhode Island, the common loon can frequently be found on the ocean in shallow coastal bays and other nearshore areas. Solitary by nature and extremely territorial, the common loon is rarely seen on land in winter months. The rear anatomical placement of the legs makes terrestrial movement nearly impossible. The diet of the common loon consists primarily of small fish, such as minnows and perch, with occasional supplements of crustaceans, aquatic insects, and aquatic plants (Kaufman, 1996). Massachusetts lists the common loon as a species of special concern, and its numbers have increased dramatically over the past several years. The ingestion of lead fishing sinkers remains the highest cause of mortality for the species, although human disturbance, nest predation, and toxic pollutants are significant threats (MAFWS, 2003a). The common loon is likely to be found in coastal, nearshore areas of the ZSF during the winter season.

Common Tern (*Sterna hirundo*): The common tern is a summer breeding resident of southern Rhode Island, preferring to nest in large colonies on pebbly beaches or rocky shores. They are loyal to a nesting area, typically returning to the same site summer after summer. Small fish make up the majority of the tern's diet. Foraging involves hovering over shallow areas, then diving into the water when the prey is spotted. Other food sources include marine worms, crustaceans, and insects. The eggs are incubated by both the male and female for approximately 3 weeks, after which the hatchlings are brought food by both parents (Kaufman, 1996). Classified as a species of special concern in Massachusetts, the success of common tern colonies is highly dependent on the level of predation as well as the adaptational ability of the adults to protect their brood. Other colonial species, particularly gulls, can displace the common tern from prime nesting areas (MAFWS, 1985). The common tern is likely to be found feeding in coastal, nearshore areas of the ZSF.

Arctic Tern (*Sterna paradisaea*): Arctic terns are long-distance migrators, breeding on the tundras and northern coasts of North America and Europe and migrating south to open ocean areas. During the winter months, this species is rarely seen from land in North America, preferring to remain far offshore and foraging primarily for pelagic shrimp and other planktonic organisms. The hunting style of the arctic tern is analogous to that of most members of the Sterna genus: they hover above the water, spot the prey, and dive beneath the surface to retrieve it. The arctic tern's nest is a shallow depression in the ground, typically lined with a variety of debris for camouflage. Both adults incubate the eggs and both also bring food to the hatchlings after their 3-week gestation period (Kaufman, 1996). With only a few known breeding sites in Massachusetts (most of which are on offshore islands), the arctic tern is listed as a species of special concern. The numbers of arctic terns have been declining steadily since the 1940s, primarily due to human disturbance and coastal development, although predation by a variety of animals is a significant threat (MAFWS, 1988a). The arctic tern is likely to be found in the open waters of the ZSF during the winter season.

Least Tern (*Sterna antillarum*): The least tern is the smallest member of its genus found in North America and is perhaps the most vulnerable to human disturbance. The diet of the least tern consists mainly of small fish, crustaceans, and insects, the latter of which are often caught in mid-flight. Least terns nest in large colonies on sandy beaches with extensive nearby shallow water areas, usually camouflaging the nest depression with grass, pebbles, or broken shells. These preferred nesting beaches are also popular with humans, and the nesting sites can be disturbed by beachgoers. Other threats to the least tern include mammalian and avian predation and loss of nesting habitat to human development. This species, however, has several adaptations that serve to protect the nest and young, including camouflaged eggs, synchronous nesting (which results in many chicks of the same age being reared together, thereby lowering the odds of any one chick being predated), and aggressive physical attacks on any intruder to the general nesting area (MAFWS, 1988b). The least tern is likely to be found feeding in coastal, nearshore areas of the ZSF.

Leach's Storm-Petrel (*Oceanodroma leucorhoa*): The Leach's storm-petrel is primarily pelagic, preferring to spend the winter months on the open ocean; as a result, a winter mainland sighting of this species is a rare occurrence. They breed on small, offshore islands, especially in eastern Canada, where the male constructs deep burrows in the soil for the incubation and protection of the brood. Even during the nesting season, adult Leach's storm-petrels usually come ashore only after nightfall, following a day foraging at sea for small crustaceans, squid, and small fish. Both adults care for the eggs and young, incubating for approximately one and a half months and, after the eggs have hatched, regurgitating the day's catch for the hatchlings. Due to the ground-nesting nature of Leach's storm-petrel, this species can be vulnerable to introduced mammals, especially rats, cats, raccoons, and possums (Kaufman, 1996). Its endangered status in Massachusetts is mainly due to limited nesting areas, introduced mammals, and competition with other seabirds, especially gulls (MAFWS, 2003b). The Leach's storm-petrel is likely to be found in the open waters of the ZSF during the winter season.

Insects

Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*): The northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) is a historical inhabitant of several Rhode Island beaches; however, only one viable population (approximately 40 adults on Martha's Vineyard) of the insect is known to exist north of Maryland (NYSDEC, 2003b). Despite its apparent near extinction from the region, in 1990 the species was listed as Federally threatened throughout its historic range due to the existence of potential habitat at select areas along the Atlantic coast (USFWS, 2003b). The predatory tiger beetle feeds on small amphipods and arthropods, although it may obtain much of its diet from scavenging dead fish and crabs. Their population numbers reach their peak in early July and begin declining in August. Much of their mating and foraging behavior is believed to be nocturnal. Tiger beetle larvae are the part of the population most vulnerable to disturbances, due in part to the 2-year length of this stage. Larvae burrow in the intertidal portion of the beach, an area that can experience high pedestrian and offroad vehicle traffic, as well as being the preferred locations for some forms of anti-erosion structures (USFWS, 1994). The Massachusetts Department of Fish and Wildlife (Simmons, 2003) is currently conducting a project with the northeastern beach tiger beetle along the Horseneck Beach, Massachusetts, area. These beetles have been found in this area and are being closely monitored for any disturbances or changes in habitat. These beetles are found in the coastal, intertidal areas of the beach and therefore are not likely to be found in any areas of the ZSF.

American Burying Beetle (*Nicrophorus americanus*): The American burying beetle, also known as the "giant carrion beetle", is a scavenger and is listed on the endangered species list. It is found only in a few Midwest states and on Block Island (a single population) (NYSDEC, 2003c). These beetles are active from late April through September. Their life history involves finding a carcass with an optimum weight of between 100 and 200 grams (g) (such as birds or mammals), burying the carcass, building a brood chamber, and laying eggs. The larvae then pupate, and the parents die off after reproduction or during the subsequent winter (NYSDEC, 2003c). The young then become adults and reproduce the following June or July.

The habitat on Block Island includes maritime shrub thickets and grazed fields (coastal moraine grasslands). Large 100- to 200-g carcasses are preferable habitat, as well as small carcasses (<100 g) that are twice as abundant in these areas. The FWS has a primary goal to protect the two known populations; the breeding populations will be maintained and reintroductions will be added as necessary. The American burying beetle is found only on land and therefore is not likely to be found in any area of the ZSF.

3.15.2 Alternative Sites

Both Sites E and W are located within the general ZSF area and are within 120- to 130-ft deep water. The findings for the threatened and endangered species at these sites are the same as for the general ZSF and are summarized as follows:

- Fin whales have the greatest potential to be found in the ZSF. These whales prefer to feed in coastal waters along the 130- to 165-ft depth contour and therefore may potentially be found in the southern areas of the ZSF. The other whales are generally found off the continental shelf or deeper waters and therefore are not expected to occur in the ZSF except as an occasional visitor during possible migration or along feeding routes in the summer months.
- Five species of turtles have migration and feeding patterns that could potentially include the ZSF. Three of these turtle species (loggerhead, leatherback, and green turtles) are more common in the shallow, coastal areas in the summertime in search of food, with the frequency decreasing in the winter months when most turtles are cold-stunned by water temperatures.
- Because of the nature of the marine mammal and sea turtle use of the ZSF, it is unlikely that they would be found in the area of either Site E or Site W. For the sea turtles, the water depths are beyond their usual feeding depths; for the marine mammals, they are generally found farther offshore than the ZSF.
- The bald eagle, roseate tern, arctic tern, and Leach's storm-petrel are the bird species most likely to feed in the open waters of the ZSF, but on an incidental basis only. The other threatened and endangered bird species (piping plovers, common loon, common tern, and least tern) are more likely in the nearshore, coastal areas of the ZSF.
- The two beetle species are found strictly in the intertidal areas (northeastern beach tiger beetle) or in the shrubs or grasses on Block Island (American burying beetle) and are not expected in the open areas of the ZSF.

3.16 CONTAMINANTS IN ORGANISMS [40 CFR SECTION 228.10(b)(6)]

Contaminants in sediment and water are available to aquatic organisms such as fish and benthos (e.g., lobster, bivalve) through a variety of pathways, including direct uptake (i.e., bioconcentration or bioaccumulation) and through ingestion of contaminated prey. Once in the tissues of aquatic organisms, these chemicals can pose a health threat both to the organisms directly and to other organisms (e.g., upper trophic-level species and humans). While relatively low levels of contaminants are present in the sediments and surface waters of the ZSF (see Sections 3.5 and 3.7, respectively), sediment and water column contaminant concentrations increase significantly northward into Narragansett Bay and up into the Providence River (Pruell & Quinn, 1985; Pilson and Hunt, 1989; King *et al.,* 1995; Bricker, 1990). Many biota present in the ZSF are migratory and do not reside solely within the waters of the ZSF. Therefore, organisms that migrate into and out of Narragansett Bay (or other inshore areas), such as fish and lobster, may be exposed to contaminant levels that are different than the concentration levels that the organisms that remain solely within the ZSF, are exposed to.

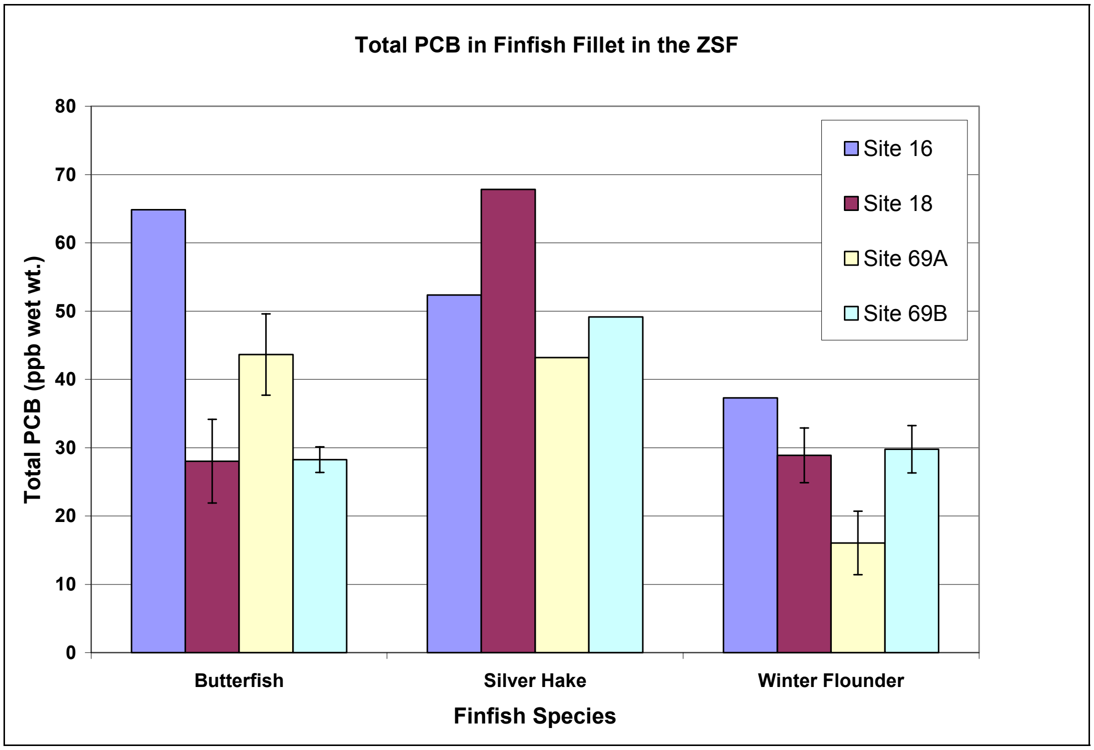
3.16.1 Rhode Island Region ZSF

Few measurements of contaminant levels in biota have been taken within the ZSF. However, measurements of contaminant concentrations in biota have been made in nearshore waters adjacent to the ZSF. For example, Wang *et al.* (1996) measured selected organic contaminants and trace metals in winter flounder (*Pseudopleuronectes americanus*) from two locations in Narragansett Bay and from a reference area in a coastal pond along the Rhode Island coast in the mid-1980s. Contaminant concentrations among samples collected at the three locations showed a concentration gradient of decreasing contaminant levels (total polychlorinated biphenyls [PCBs], total PAH, and selected trace metals) in winter flounder (*Pseudopleuronectes americanus*) with distance from the Providence River southward out of Narragansett Bay. This gradient is consistent with the gradient of pollutants found in Narragansett Bay sediments, as discussed in Section 3.5. The study also revealed some correlation between contaminant levels and collection date, which might correspond to migration pathways of winter flounder.

In 2001, selected organisms were collected at four locations within Rhode Island Sound (Site 16, Site 18, Site 69A, and Site 69B) (see Figure 3-2) for chemical contaminant analyses to characterize body burdens of biota within the ZSF. Chemical analyses were performed on finfish, lobster, and bivalve tissue collected from each site. Tissues were analyzed for a wide range of parameters, including PCB congeners, PAHs, phthalate, chlorinated pesticides, butyltins, dioxin/furans, lipids, and trace metals (Ag, As, beryllium [Be], Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn) (Corps, 2002g; Corps, 2003i; Corps, 2003l; Corps, 2003g). Summary tables of the analysis results, along with a comparison with regional contaminant levels by tissue type, are presented in Appendix A-6.

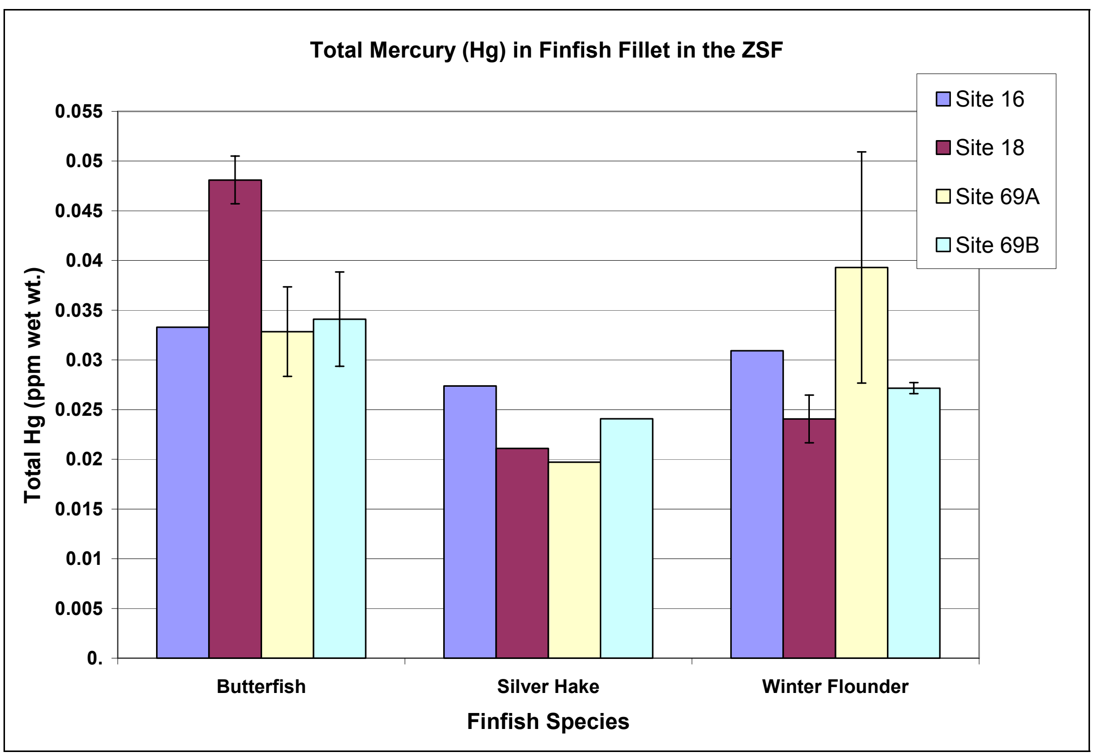
Finfish Tissue Concentrations

Finfish species (butterfish [*Peprilus triacanthus*], scup [*Stenotomus chrysops*], silver hake [*Merluccius bilinearis*], and winter flounder [*Pseudopleuronectes americanus*]) were collected at four locations within the ZSF in fall 2001 and again in spring 2002 (Corps, 2002g; Corps, 2003i) for chemical analyses. Little difference was observed in concentrations of contaminants among species or between collection locations for total PCB (Figure 3-60) or for total Hg (Figure 3-61). A similar lack of any trend was noted for other organic and metals concentrations measured. In all cases, the levels were well below environmental risk or human health concern levels.



Note: Error bars represent one standard deviation from mean.

Figure 3-60. Total PCB in Finfish Fillet in the ZSF.



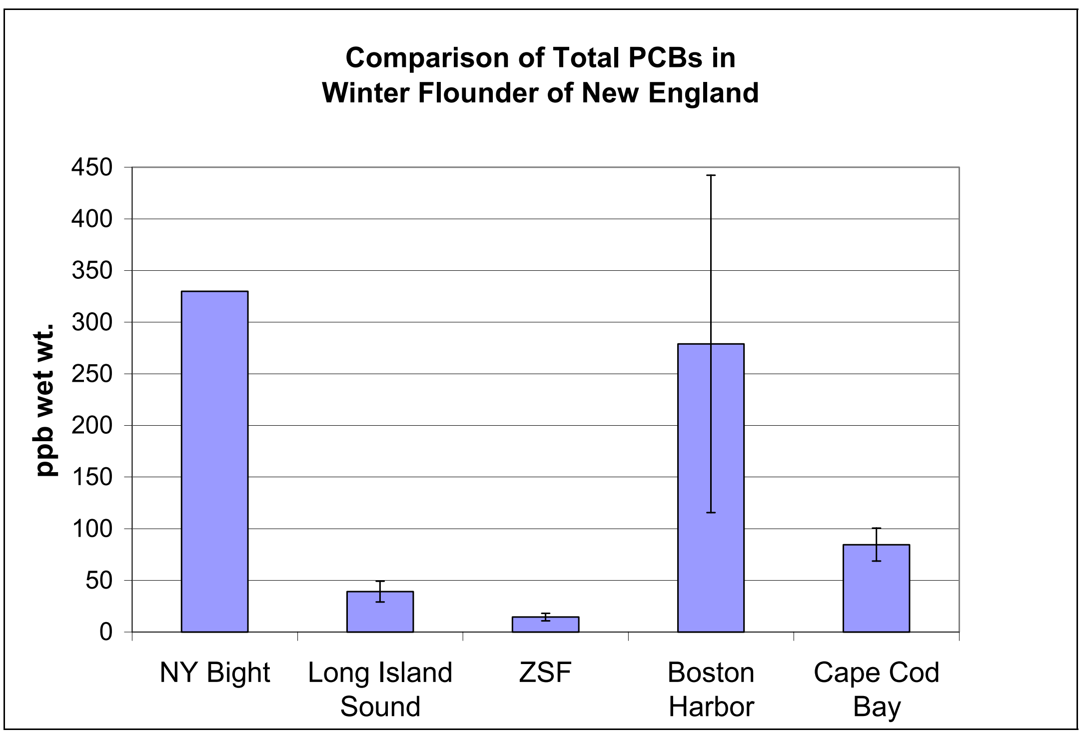
Note: Error bars represent one standard deviation from mean.

Figure 3-61. Total Mercury (Hg) in Finfish Fillet in the ZSF.

Regional Comparison of Fish Concentrations

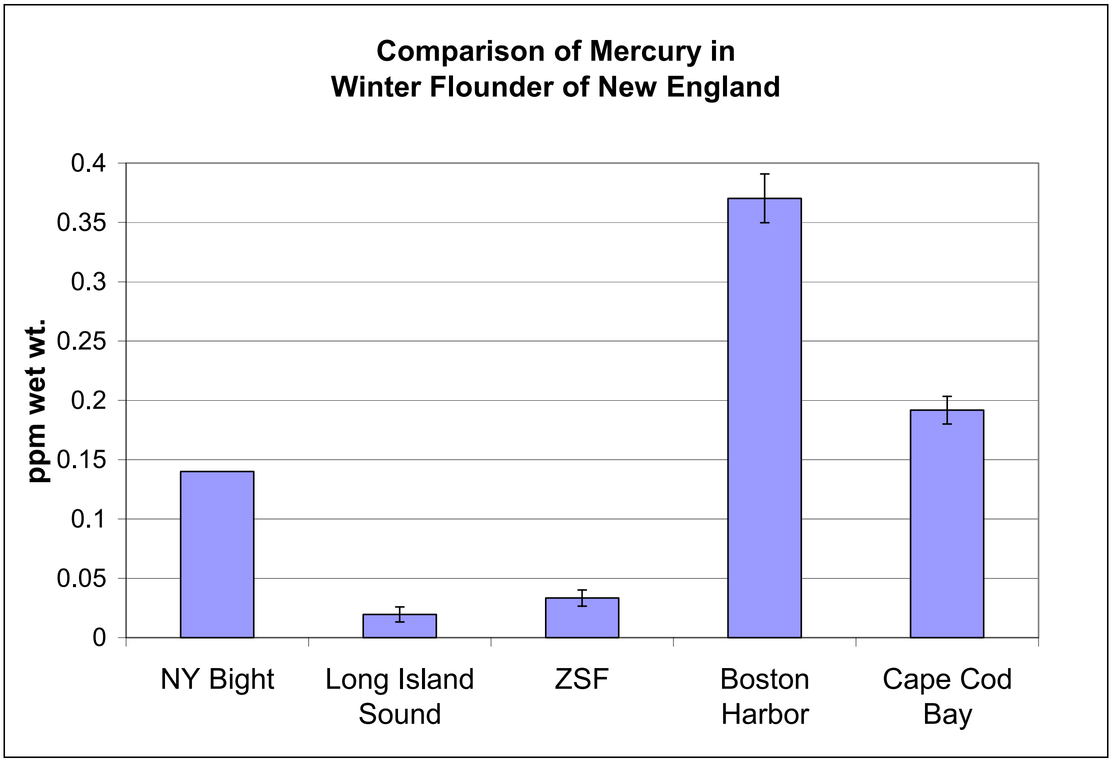
Contaminant concentrations measured in fish from the ZSF are low when compared to concentrations measured in fish from other nearby coastal waters. For example, mean total PCB and Hg concentrations in winter flounder (*Pseudopleuronectes americanus)* muscle collected since 2000 from Long Island Sound (Corps, 2002h) and from Boston Harbor and Cape Cod Bay (Pala *et al.*, 2003) were higher compared to the mean concentration of winter flounder fillets from the 2001 and 2002 samples collected in the ZSF (Corps, 2002g; Corps, 2003i) (Figure 3-62 and Figure 3-63). Concentrations of chlorinated organics (total PCB, total dichlorodiphenyltrichloroethane [DDT], and other chlorinated pesticides) in winter flounder fillets collected within the ZSF were the lowest among these recent regional measurements. Hg concentrations were similar to those found in winter flounder from Long Island Sound, but well below concentrations found in highly urbanized areas such as Boston Harbor and New York Bight.

In addition, the recent total PCB concentrations measured in winter flounder in the ZSF are much lower than those reported in the mid-1980s by Wang *et al.* (1996), which ranged from 104 to 381 ppb wet weight. These older samples were also collected from within the mouth of the Providence River and lower Narragansett Bay, areas of documented higher sediment PCB concentrations compared to sediments found in the ZSF.



Note: Error bars represent one standard deviation from mean.

Figure 3-62. Total PCB in Winter Flounder.

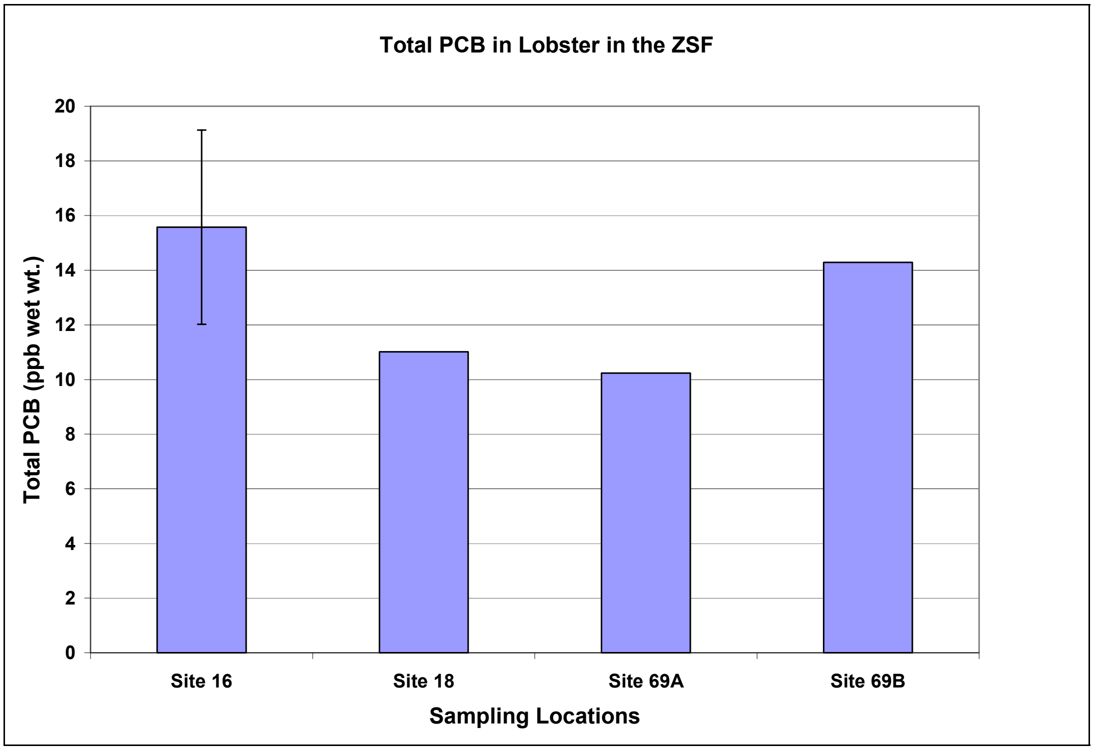


Note: Error bars represent one standard deviation from mean.

Figure 3-63. Mercury in Winter Flounder.

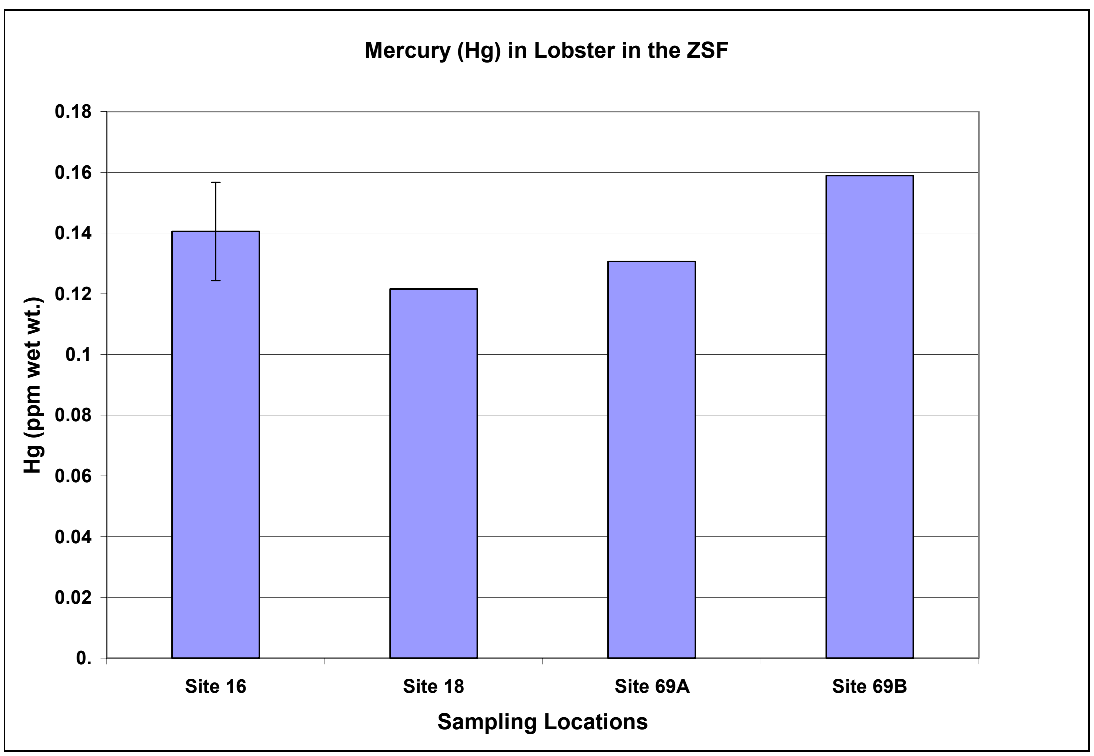
Lobster Tissue Concentrations

Because recent or historical American lobster (*Homarus americanus*) contaminant data were not available for areas within the ZSF, lobsters were collected from four locations (Site 16, Site 18, Site 69A, and Site 69B) in the summer of 2002 to evaluate bioaccumulation of contaminants in this species (Corps, 2003l). Metals and organic chemical concentrations were evaluated in both muscle tissue (i.e., "meat") and the hepatopancreas. Mean concentrations presented by collection site for both meat and hepatopancreas are presented in Appendix A-6. Concentrations of the organic contaminants were similar at all sites except Site 16, the historic Brenton Reef disposal site, where concentrations were slightly higher for PCBs (Figure 3-64), PAHs, and butyltins. These elevated organic concentrations may be a result of historic and regulated disposal of sediments at that location or a result of closer proximity to Narragansett Bay. Hg concentrations in lobster meat were somewhat more variable across the sites compared to organic contaminants, and no spatial trends were evident (Figure 3-65). Similar variability was observed for the other trace metals measured.



Note: Error bars represent one standard deviation from mean.

Figure 3-64. Total PCB in Lobster Meat from the ZSF.

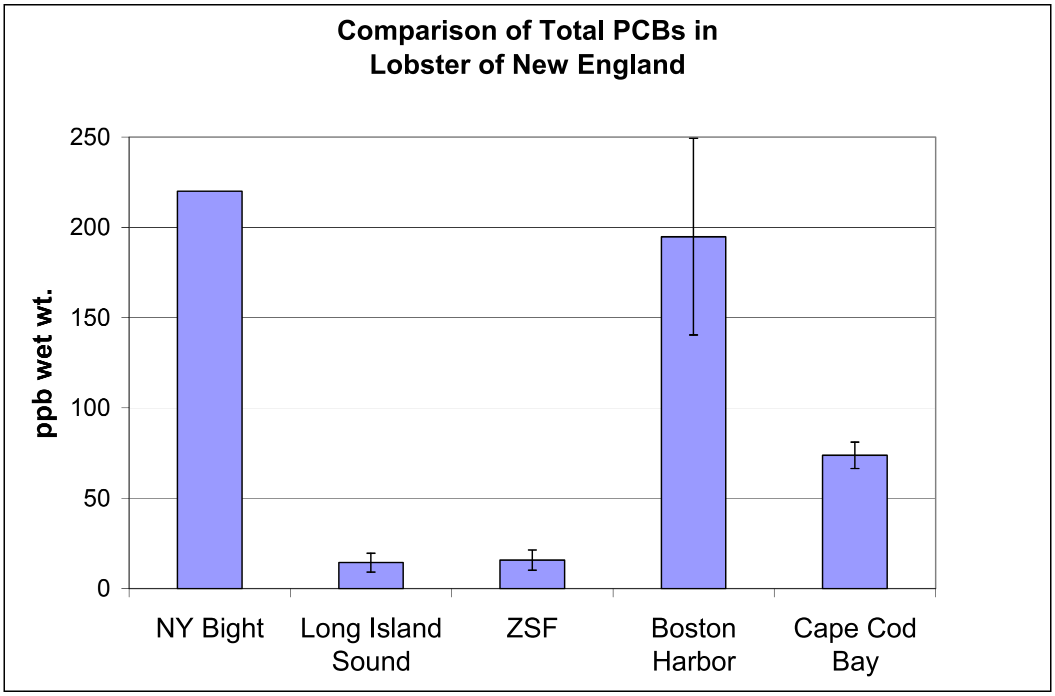


Note: Error bars represent one standard deviation from mean.

Figure 3-65. Mercury in Lobster Meat from the ZSF.

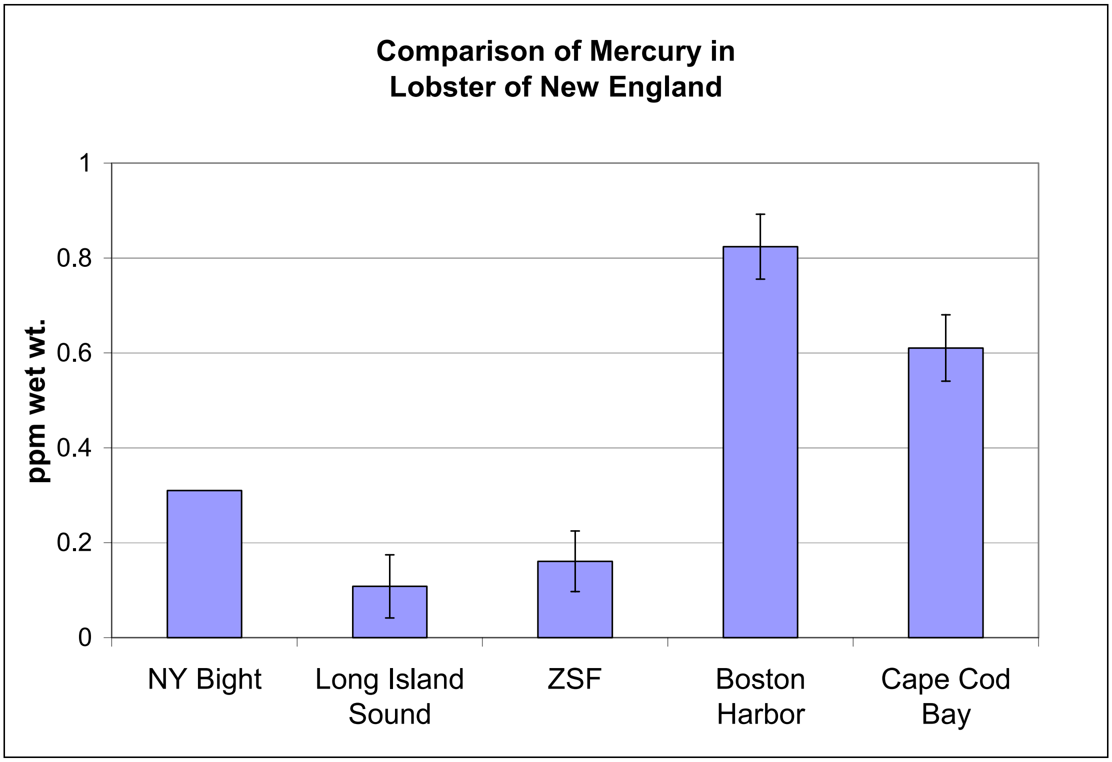
Regional Comparison of Lobster Concentrations

As observed for winter flounder, contaminant concentrations in lobster meat from the ZSF were relatively low compared to concentrations in lobster from other nearby coastal waters in the northeast United States (Figure 3-66 and Figure 3-67). Total PCB and Hg concentrations in lobster meat collected from Boston Harbor and Cape Cod Bay (Pala *et al.*, 2003) and from New York Bight (EPA, 1997) were much higher compared to the mean concentrations from samples collected in the ZSF. Concentrations of total PCB and Hg in lobster meat from the ZSF were similar to those measured in Long Island Sound (Corps, 2002h).



Note: Value for New York Bight is the median of the reported range of values.
Error bar represents one standard deviation from the mean.

Figure 3-66. Total PCB in Lobster Meat of the Northeast United States.

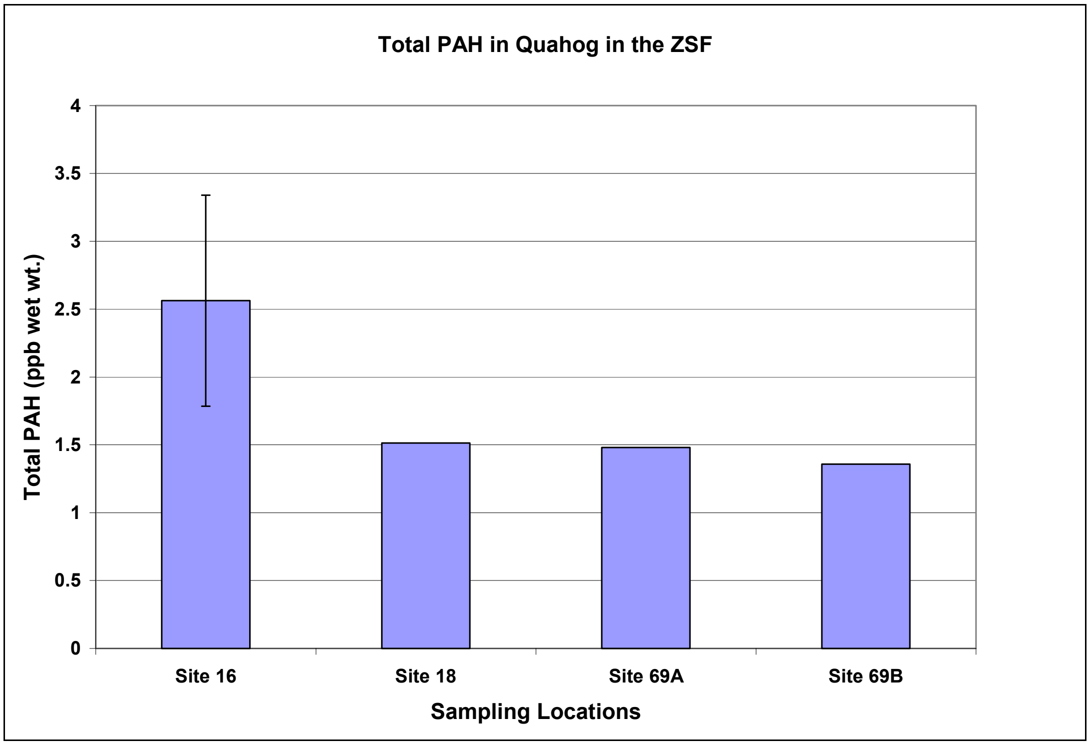


Note: Value for New York Bight is the median of the reported range of values.
Error bar represents one standard deviation from the mean.

Figure 3-67. Total Mercury (Hg) in Lobster Meat of the Northeast United States.

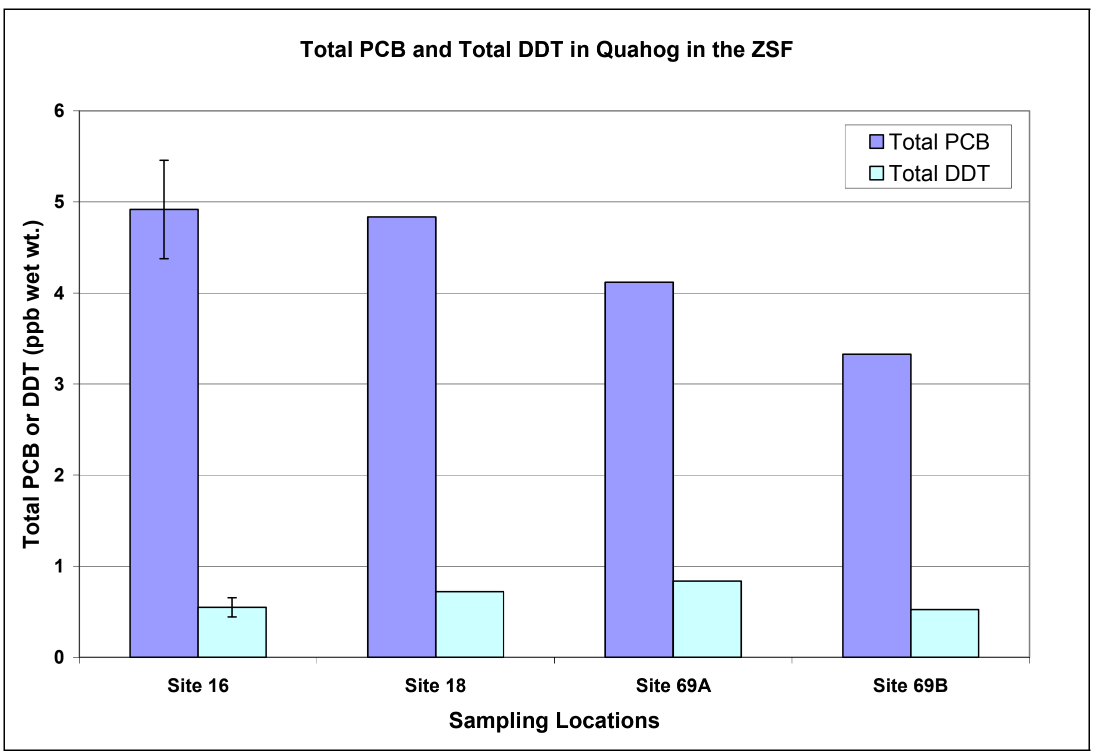
Quahog Tissue Concentrations

The bivalve *Artica islandica*, commonly referred to as the ocean quahog, was also collected at the four locations sampled for fish and lobster (Corps, 2003g). One composite, consisting of approximately 20 clams per site, was analyzed from each of the three locations at Sites 18, 69A, and 69B, and three composites were analyzed from Site 16. A summary of the chemical concentrations measured is presented in Appendix A-6. Total PAH at Site 16 was somewhat higher than total PAH measured at the other three locations (Figure 3-68), while total PCB and total DDT (Figure 3-69) results showed similar concentrations across the sites. Hg was highest at Site 69A (Figure 3-70), as were the other metals analyzed. As with lobster, it is difficult to determine whether the elevated PAHs in quahog from Site 16 are a result of past disposal activities at the site or whether they are related to the relative proximity to the urbanized coastal regions of Narragansett Bay.



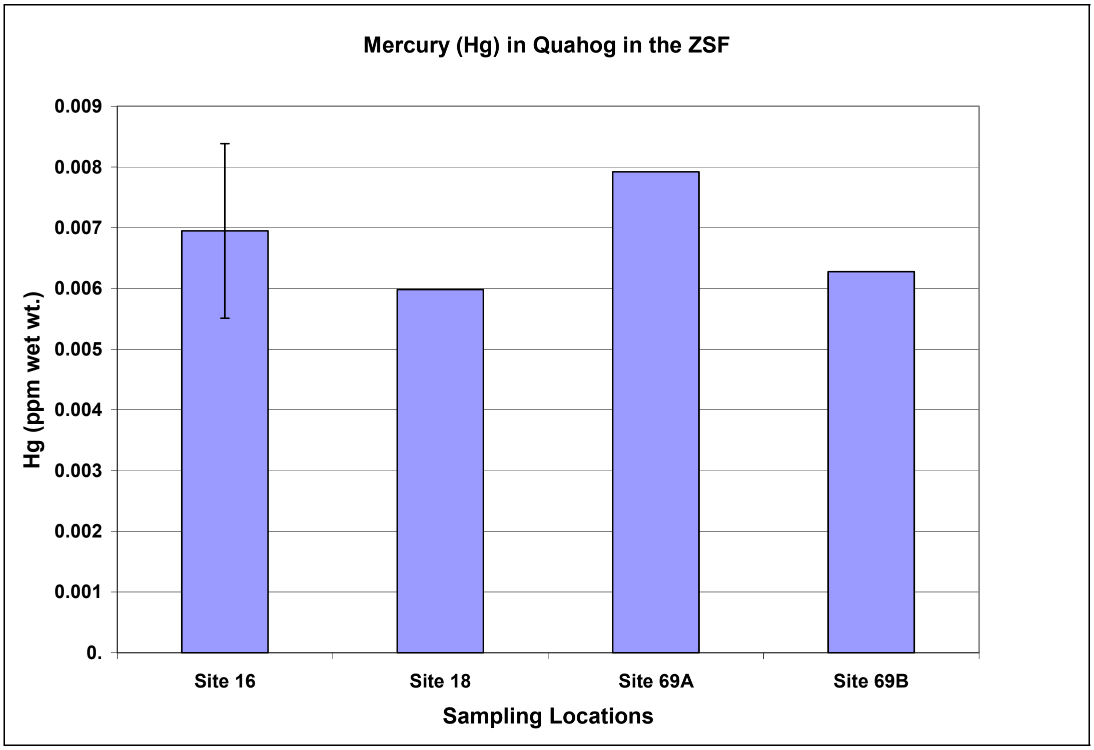
Note: Error bars represent one standard deviation from mean.

Figure 3-68. Total PAH in Ocean Quahogs from the ZSF.



Note: Error bars represent one standard deviation from mean.

Figure 3-69. Total PCB and DDT in Ocean Quahogs from the ZSF.



Note: Error bars represent one standard deviation from mean.

Figure 3-70. Mercury in Ocean Quahogs from the ZSF.

Controlled bioaccumulation tests were conducted using Site 18 sediments to determine the bioavailability of chemicals typical in the ZSF (Corps, 2000b). Laboratory exposures (28-day bioaccumulation tests) showed similar concentrations of trace metals and of dioxins and furans in clams (*Macoma nasuta*) compared to field-collected bivalves reported in earlier Corps studies (Corps, 2003g). The low levels of contaminants measured in the tissues exposed to these sediments, both in the laboratory tests and in the field, indicate a small bioavailable fraction of contaminants in these relatively coarse, clean sediments. It is expected that similar sediment types in the ZSF would have similar test results, given the observations that the contaminant levels at this location are similar to those in other areas in the ZSF.

Comparison to Food and Drug Administration (FDA) Limits

The FDA has set action/tolerance limits that define levels of selected contaminants in food that are safe for human consumption. Measured chemical concentrations in edible tissue from finfish, lobster, and quahogs from within the ZSF were all very low (Table 3-20) and were at least one to two orders of magnitude (i.e., 10 to 100 times) below FDA limits for all parameters measured.

Table 3-20. Comparison of ZSF Tissue Mean Concentrations to FDA Action Levels for Selected Parameters in Food (Edible Portion) (ppb wet weight basis).

	Total PCB (ppb)	Total DDT (ppb)	Total Chlordane[a] (ppb)	Aldrin (ppb)	Dieldrin (ppb)	Heptachlor (ppb)	Heptachlor Epoxide (ppb)	Mercury (ppm)
FDA Limits	2000	5000	300	300	300	300	300	1
Mean Concentrations in ZSF (s.d.)								
Fish Fillet[1]	42.5 (15.4)[b]	3.3 (1.3)	1.3 (0.61)	ND	0.42(0.34)	ND	ND	0.09 (0.1)
Lobster Meat[2]	12.8 (2.6)	0.73 (0.16)	0.15 (0.02)	ND	0.29 (0.04)	ND	0.03 (0.004)	0.14 (0.02)
Ocean Quahog[3]	4.3 (0.74)	0.66 (0.15)	0.33 (0.12)	ND	ND	ND	0.13 (0.04)	0.007 (0.001)

ND = not detected at or above method DL.
s.d. = standard deviation
[1]Mean of winter flounder (n= 7); butterfish (n=7); scup (n=3); and silver hake (n=4).
[2]Mean calculated from n=8 lobster meat composites values.
[3]Mean calculated from n=6 quahog composite values.
[a] Total chlordane is the sum of cis Chlordane and trans-Nonachlor, as described in FDA (1989).
[b] Value in parenthesis is standard deviation of the mean value.

3.16.2 Site E

No tissue concentrations from biota within or near Site E are available for evaluation. However, tissue concentrations found at four stations within the ZSF were similar to and are most likely representative of the entire ZSF, including Site E. Based on sediment characteristics and contaminant levels measured in 2003 (Corps, 2003f), which were similar at Site E and the surrounding area to other areas in the ZSF, there is no reason to suspect unusually elevated levels of contaminants in biota coming in contact with the sediments or waters of Site E.

3.16.3 Site W

Tissue concentrations of fish, lobster, and quahog samples collected in and around Site 69B in 2001 provide information on concentrations in biota at Site W. Concentrations in all organisms collected at Site 69B were similar to concentrations found at other locations within the ZSF and are lower than biota concentrations measured in nearby urban and near-urban environments.

3.17 SOCIOECONOMIC ENVIRONMENT [40 CFR SECTIONS 228.6(a)(8) AND (11)]

This section describes the socioeconomic environment of the ZSF and, in some instances, of areas that extend beyond the ZSF. Sections on shipping (Section 3.17.2), military usage (Section 3.17.3), mineral and energy development (Section 3.17.4), recreational activities (Section 3.17.5), natural or cultural features of historic importance (Section 3.17.6), other legitimate uses (Section 3.17.7), and areas of special concern (Section 3.17.8) all focus on the ZSF only. Commercial and recreational fisheries (Section 3.17.1) are discussed in terms of both the ZSF and a larger Economic Study Area that extends beyond the ZSF. The economic baseline (Section 3.17.9) is discussed in terms of the Economic Study Area.

The Economic Study Area (Figure 3-71; Table 3-21) takes in Rhode Island's coast, including Narragansett Bay and Block Island, and a portion of the southern coast of Massachusetts beginning at the Rhode Island state line and extending along the coast eastward to Falmouth, including Martha's Vineyard (Corps, 2004d). It comprises a portion of the Southern Cape Cod and the Islands Dredging Center, and all of the other three dredging centers (described in Section 2.2). The Economic Study Area was established to extend beyond the ZSF in order to capture all relevant data regarding socioeconomic activities within southeastern Massachusetts. New Bedford and Fairhaven harbors and Taunton River, which lie within the Economic Study Area, were excluded due to a finding by EPA that dredged materials taken from those locations are not suitable for open-water disposal (Corps, 2003o).

Descriptions of the distribution and abundance of commercially and recreationally important fish and shellfish are presented in Sections 3.10 (Fish), 3.11 (Shellfish), and 3.12 (Lobster). The following sections present information on commercial and recreational fisheries, including fishing practices, abundance (or landings) of fish and shellfish, and the value (in dollars) of these fish species.

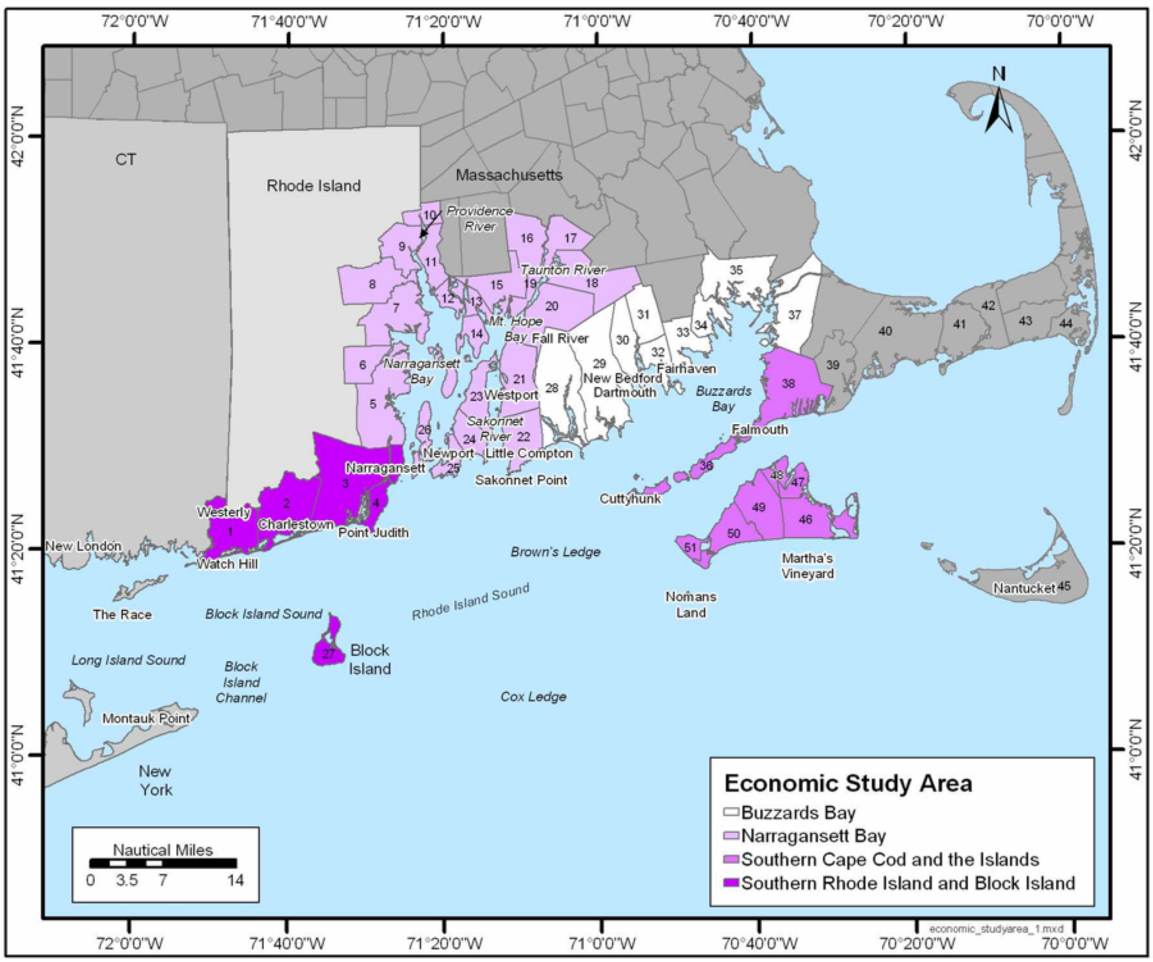


Figure 3-71. RIR Economic Study Area.

Table 3-21. Key of Towns in the RIR Economic Study Area.

Map ID	City/Town	State	Map ID	City/Town	State
1	Westerly	Rhode Island	27	New Shoreham (Block Island)	Rhode Island
2	Charlestown	Rhode Island			
3	South Kingstown	Rhode Island	28	Westport	Massachusetts
4	Narragansett	Rhode Island	29	Dartmouth	Massachusetts
5	North Kingstown	Rhode Island	30	New Bedford	Massachusetts
6	East Greenwich	Rhode Island	31	Acushnet	Massachusetts
7	Warwick	Rhode Island	32	Fairhaven	Massachusetts
8	Cranston	Rhode Island	33	Mattapoisett	Massachusetts
9	Providence	Rhode Island	34	Marion	Massachusetts
10	Pawtucket	Rhode Island	35	Wareham	Massachusetts
11	East Providence	Rhode Island	36	Gosnold	Massachusetts
12	Barrington	Rhode Island	37	Bourne	Massachusetts
13	Warren	Rhode Island	38	Falmouth	Massachusetts
14	Bristol	Rhode Island	39	Mashpee	Massachusetts
15	Swansea	Massachusetts	40	Barnstable	Massachusetts
16	Dighton	Massachusetts	41	Yarmouth	Massachusetts
17	Berkley	Massachusetts	42	Dennis	Massachusetts
18	Freetown	Massachusetts	43	Harwich	Massachusetts
19	Somerset	Massachusetts	44	Chatham	Massachusetts
20	Fall River	Massachusetts	45	Nantucket	Massachusetts
21	Tiverton	Rhode Island	46	Edgartown	Massachusetts
22	Little Compton	Rhode Island	47	Oak Bluffs	Massachusetts
23	Portsmouth	Rhode Island	48	Tisbury	Massachusetts
24	Middletown	Rhode Island	49	West Tisbury	Massachusetts
25	Newport	Rhode Island	50	Chilmark	Massachusetts
26	Jamestown	Rhode Island	51	Gay Head	Massachusetts

3.17.1 Commercial and Recreational Fisheries

Commercial and recreational fisheries in the waters within the ZSF and in the Economic Study Area are valuable resources to Rhode Island and Massachusetts. The value of commercial fish landings for Rhode Island in 2001 (the most recent year for which data are available) exceeded $65 million.

Commercial Fishery

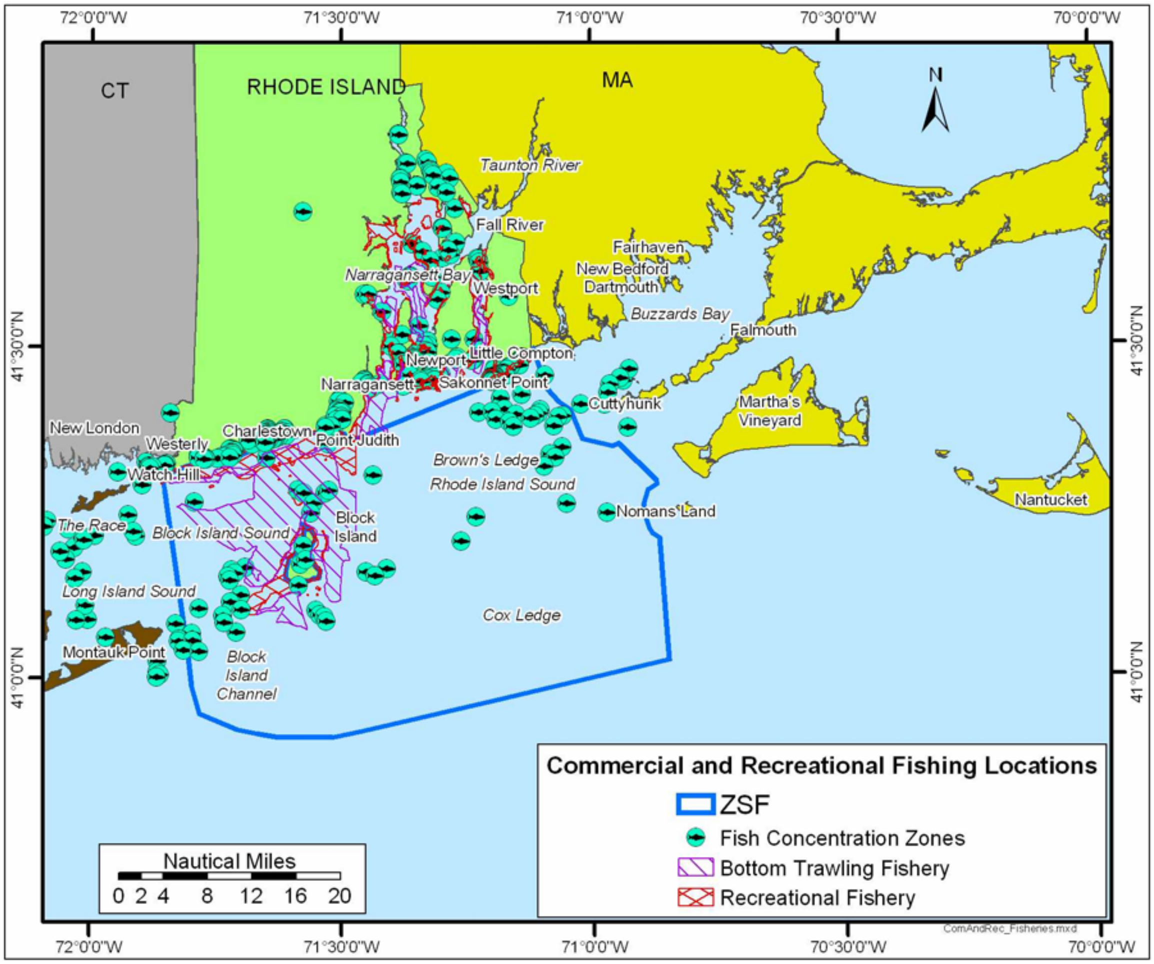
The commercial fishery in the Economic Study Area consists of both inshore and offshore fisheries. Within the Economic Study Area, 512 commercial fishing boats (402 in Rhode Island and 110 in Massachusetts) are registered, including charter fishing boats (Table 3-22). Inshore fisheries primarily use small vessels, perform mostly day trips, and harvest species present in shallower waters such as hard clams, lobsters, and sea herring (Intergovernmental Policy Analysis Program, 1989).

Table 3-22. Commercial Fishing Boat Registration in Economic Study Area (2001).

Massachusetts			Rhode Island		
Port	**Boats**	**Share**	**Port**	**Boats**	**Share**
Buzzards Bay	2	0.4%	Barrington	3	0.6%
Chilmark	7	1.4%	Block Island	10	2.0%
Dartmouth	2	0.4%	Charlestown	1	0.2%
Dighton	1	0.2%	Coventry	1	0.2%
Edgartown	7	1.4%	Cranston	1	0.2%
Fall River	1	0.2%	Davisville	3	0.6%
Falmouth	17	3.3%	East Greenwich	1	0.2%
Marion	2	0.4%	Galilee	24	4.7%
Martha's Vineyard	1	0.2%	Jamestown	7	1.4%
Mattapoisett	7	1.4%	Jerusalem	1	0.2%
Oak Bluffs	4	0.8%	Little Compton	9	1.8%
Onset	2	0.4%	Narragansett	24	4.7%
Pocasset	1	0.2%	Newport	54	10.5%
South Dartmouth	3	0.6%	North Kingstown	2	0.4%
Swansea	1	0.2%	Point Judith	178	34.8%
Vineyard Haven	3	0.6%	Portsmouth	3	0.6%
Wareham	4	0.8%	Providence	1	0.2%
Westport	35	6.8%	Riverside	1	0.2%
Westport Point	2	0.4%	Sakonnet	1	0.2%
Woods Hole	8	1.6%	Sakonnet Point	6	1.2%
MA Total	**110**	**21.5%**	Salt Pond	2	0.4%
			Saunderstown	1	0.2%
			Slocum	1	0.2%
			Tiverton	15	2.9%
			Wakefield	26	5.1%
			Warren	3	0.6%
			Warwick	7	1.4%
			Watch Hill	1	0.2%
			Weekapaug	1	0.2%
			Westerly	2	0.4%
			Wickford Harbor	12	2.3%
			RI Total	**402**	**78.5%**

Source: Corps, 2004d
Totals may not match sums due to rounding.

The Rhode Island Resource Protection Project (RIRPP) (a New England-wide effort, initiated by EPA-New England, the state environmental regulatory agencies, and the New England Interstate Water Pollution Control Commission to identify the region's most ecologically healthy areas [RIRPP, 2003]) and the URI indicated that areas of high concentrations of inshore fisheries within the ZSF occur along the coastal areas of Watch Hill through Point Judith and the coastal areas of Little Compton (RIRPP, 2003) (Figure 3-72). In addition, areas of high fishery resources have been observed south of Sakonnet Point, north of Block Island, and between Block Island and Montauk Point, New York.



Source: RIRPP, 2003

Figure 3-72. Commercial and Recreational Fishing Locations Within the ZSF Identified by the RIRPP.

Offshore fisheries consist of larger ocean-worthy vessels than the inshore fleet; primarily fish for large finfish (swordfish, tuna, shark) found in open, deep waters; and may leave port for several days at sea. Offshore fisheries within the Economic Study Area extend southward from an area bounded to the northeast by a line from Nantucket, Massachusetts, to Montauk Point, New York.

Fishing Methods: Commercial fishermen in the RIR harvest the various fishery resources using an assortment of methods. These methods often target distinct species and include otter trawls (paired, bottom, and midwater), gill nets, sink nets, longlines, lobster pots, fish pots, conch pots, and quahog and scallop dredges. It is common for fishermen to use different gear types and vessels to optimize catch in the region (RIRPP, 2003). Figure 3-72 and Figure 3-73 show areas within the ZSF where bottom trawling (often referred to as dragging), gill nets, and lobstering are the primary fishing methods used.

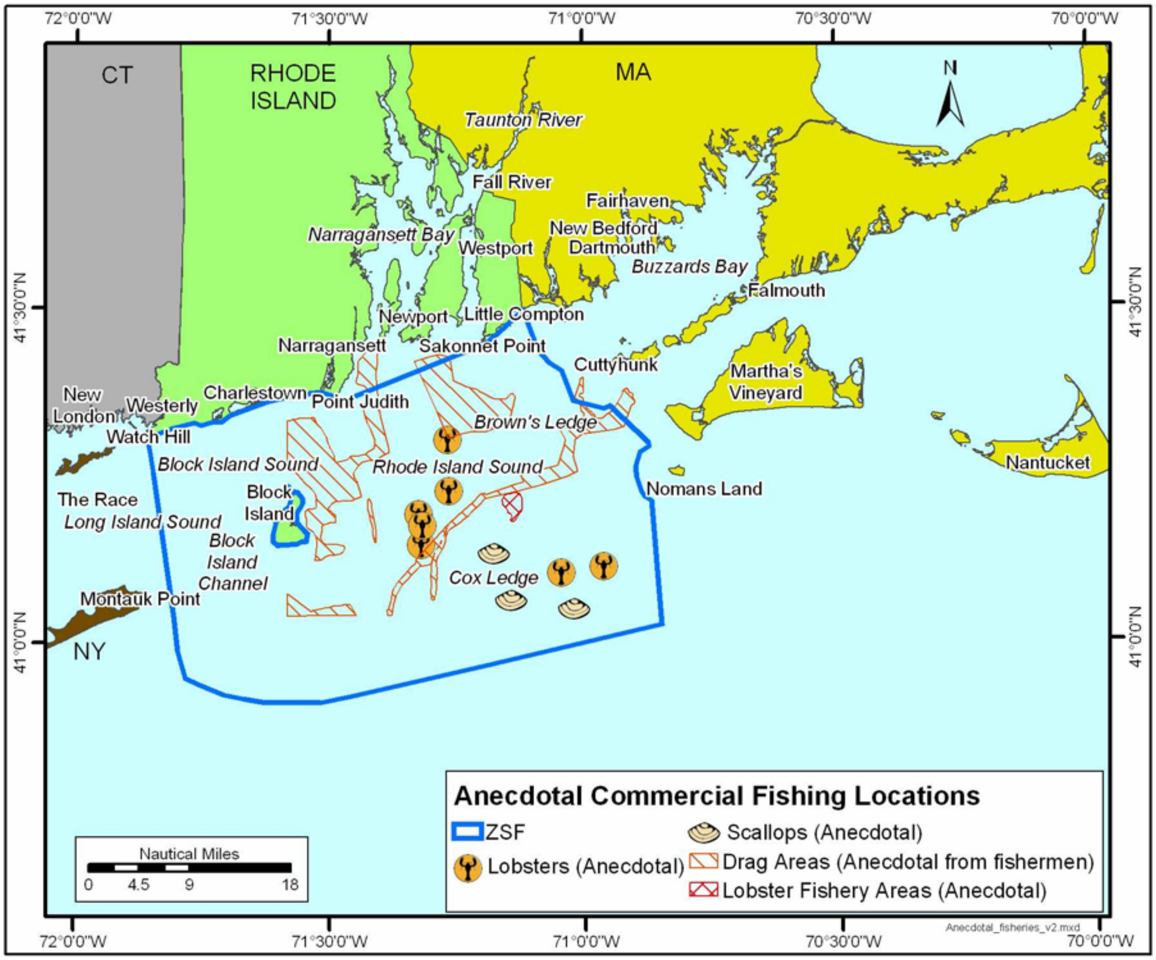


Figure 3-73. Commercial Fishing Locations Within the ZSF Identified by Members of the Rhode Island Fisherman's Association.

Table 3-23 lists the number of fishing licenses issued in Rhode Island and Massachusetts by various categories, including fish type, vessel size, and gear type. Many of the commercial fishermen fish several different species of fish during the same year so that they can take advantage of seasonal migrations. Additionally, many commercial fishermen in the region have multiple vessels rigged with different gear to take advantage of the habitats of different species. Therefore, the number of multipurpose licenses issued tends to be larger than the number of licenses for any given species or gear type. Dealers, who accept fish caught from fishermen, must also be licensed. Again, more multipurpose licenses are issued, allowing the dealer to accept a variety of species (lobster, various shellfish species, and various finfish species).

Table 3-23. Commercial Fishing Licenses.

Rhode Island Fishermen	Number of Licenses (2001)[1]	Massachusetts Fishermen	Number of Licenses (1998 – 1999)[1]
Shellfish	1,337	Shellfish	1,221
Multi-Purpose	998	Coastal Lobster	1,581
Multi w/Gillnet	371	Offshore Lobster	543
Lobster	95	Boat 0-59'	1,696
N/C[2] Lobster Diver	539	Boat 60-99'	107
N/C Lobster Pot	434	Student Lobster	82
Otter/Beam Trawl	12	Individual	625
Rod and Reel	390	Rod and Reel	3,143
Miscellaneous Pot	1	Shellfish (Rod/Reel)	946
FW Minnow	14	Coastal Transfers	54
Total	**4,191**	**Total**	**9,998**
Dealer	**Licenses**	**Dealer**	**Licenses**
Lobster	7	Wholesale Dealer	533
Shellfish	10	Wholesale Truck	142
Finfish	14	Wholesale Broker	34
Multi-Purpose	79	Retail Dealer	707
Total	**110**	Retail Truck	39
		Retail Boat	53
		Bait Dealer	149
		Total	1,657

Source: Angell and Olszewski, 2002; RIDEM, 2002b; Massachusetts Division of Marine Fisheries, 2002
[1] The number of licenses for fishermen and dealers is for all of Rhode Island or Massachusetts, not just the Economic Study Area.
[2]N/C – non-commercial

VTR and Weigh Out Data Sources: To determine the use and, consequently, the economic importance of commercial fisheries, weigh out data and vessel trip data were evaluated. VTRs document the number of trips commercial vessels make to a particular area. VTRs are submitted to NMFS by commercial fishermen; they contain information on approximate location fished, gear type used, and pounds of the various species that are caught and sold (landed). The VTRs do not contain monetary information. The VTR data provided by NMFS were specific for the ZSF and therefore provided data on the relative abundance and seasonal distribution of key commercial species within the ZSF.

Weigh out data (or landings) record the quantity (in this case, by weight in pounds) of fish or shellfish brought to shore and sold. The fish landings are then given a dollar value. Fishery landings and price information are collected by NMFS port agents at the point of initial sale of the catch through dealer reports and "weigh out" receipts. Weigh out data cannot identify specific areas where the fishery resources are harvested (i.e., the resources may be fished in Massachusetts waters but landed in Rhode Island); however, because of the nature of the fishing effort mounted from the targeted home ports of the vessels, it is assumed that a large fraction of the commercial catch is from within the ZSF.

VTRs: Fishing vessels from several New England and mid-Atlantic states voyage to the ZSF for commercial fishing activities (Table 3-24). The 2001 NMFS VTR data provide information on the level of effort commercial fishermen spend fishing within the ZSF. In 2001, 511 vessels made 32,763 fishing trips into the ZSF. Most of the fishermen were from the Point Judith area. A total of 179 vessels made a total of 18,544 trips to the region from Point Judith alone. Fishermen from New Bedford and Westport were responsible for the bulk of the effort from Massachusetts, with 1,001 and 834 vessel trips, respectively, in 2001. Although New Bedford and Fairhaven ports were excluded from the Economic Study Area, the VTR values for these ports are shown here to indicate the number of fishing vessels that fish within the ZSF. Smaller ports, identified in Table 3-24 as "Other Ports" in Maine, Connecticut, New York, New Jersey, Maryland, and New Hampshire, accounted for 95 vessels making 6,224 vessel trips within the ZSF in 2001.

Table 3-24. Total Number of Vessels and Vessel Trips Made to the ZSF in 2001.

Port	Total Vessels	Vessel Trips	Port	Total Vessels	Vessel Trips
Rhode Island			***Massachusetts***		
Avondale	1	101	Barnstable	1	4
Bristol	1	51	Chatham	1	2
Jamestown	1	70	Chilmark	14	292
Little Compton	16	1,494	Cotuit	1	2
Newport	29	1,983	Cuttyhunk	2	11
New Shoreham	19	386	Dartmouth	1	6
North Kingstown	8	82	Edgartown	1	14
Old Harbor	2	13	Fairhaven	16	372
Point Judith	179	18,544	Fall River	4	73
Portsmouth	5	89	Falmouth	1	2
Providence	1	4	Gloucester	2	6
South Kingstown	2	27	Martha's Vineyard	1	1
Tiverton	18	828	Mattapoisett	1	36
Westerly	1	31	Nantucket	1	1
Total Rhode Island	**299**	**23,703**	New Bedford	55	1,001
			Newburyport	2	19
			Sandwich	4	146
***Other Ports*[1]**	***95***	***6,224***	Tisbury	3	15
			Westport	16	834
			Total Massachusetts	**117**	**2,836**

Source: NMFS VTR data from 2001; NMFS, 2003b

[1] Other ports include smaller ports located in Connecticut, New York, New Jersey, Maryland, Maine, and New Hampshire that support a small number of fishermen who fish within the ZSF.

In 2001, Point Judith accounted for 42,804,649 lbs landed, equating to a value of $32,173,762 and ranking as the 16th most valuable port in the United States (NMFS, 2003b). New Bedford ranked first in the nation in 2001, with 106,900,000 lbs landed, accounting for a value of $150,500,000 (NOAA, 2003b).

Weigh Out Data: In the Economic Study Area, commercial fisheries exist for various species of finfish, shellfish, lobster, and other invertebrates such as squid and crabs. Table 3-25 summarizes the total pounds of commercial species (finfish, lobster, and shellfish combined) landed in the State of Rhode Island and in southeast Massachusetts from 1990 through 2002. The monetary value associated with these landings is also presented. Values for each individual port were not available. Consequently, the NMFS data shown is for each county that lies within the Economic Study Area. In Rhode Island, NMFS data were compiled for Bristol, Kent, Newport, Providence and Washington counties. In Massachusetts, NMFS data were compiled for the counties of Barnstable, Bristol, Dukes, and Plymouth.

Table 3-25. Total Pounds and Associated Value of Landings (By County) Within the Economic Study Area.

Year	Rhode Island[1]		Southeast Massachusetts[2]		Rhode Island and Southeast Massachusetts	
	Total Pounds Landed (Millions)	Value ($ Millions)	Total Pounds Landed (Millions)	Value ($ Millions)	Total Pounds Landed (Millions)	Total Value ($ Millions)
1990	126.0	72.6	151.5	220.9	278.3	293.5
1991	134.5	85.0	143.4	218.9	277.9	303.9
1992	135.6	85.5	126.0	213.3	261.6	298.9
1993	126.9	79.1	113.1	170.7	240.0	249.9
1994	108.2	76.9	82.2	111.0	190.4	187.9
1995	122.6	68.5	90.0	123.3	213.5	191.8
1996	131.8	70.3	106.9	136.4	238.7	206.7
1997	132.8	77.9	99.2	132.3	232.0	210.3
1998	126.5	71.7	99.7	139.0	226.2	210.7
1999	119.6	79.0	109.5	192.0	229.0	271.0
2000	112.6	72.5	113.1	215.7	225.7	288.2
2001	111.0	65.2	127.0	217.3	238.0	282.4
2002	97.6	59.7	132.1	229.5	229.8	289.3
Total	1,585.7	1,656	1,494.8	2,320.3	3,081.1	3,284.5
13-year average	121.98	127.4	115.0	178.5	237.0	252.7

Source: NMFS weigh out data from 1990 through 2002; NMFS, 2003b
Note: Landings include all finfish species, shellfish, lobster and other invertebrates (squid and crabs), as well as those reported as "unknown" in the NMFS weigh out database
[1] Rhode Island counties include: Bristol, Kent, Newport, Providence, and Washington counties
[2] Massachusetts counties include: Barnstable, Bristol, Dukes, and Plymouth counties

Commercial harvest revenue from fisheries in the region was almost $3.3 billion for the 13 years from 1990 to 2002, with over 3 billion lbs landed during that time. The highest total amount landed (Rhode Island and Massachusetts counties combined) was in 1990 (278 million lbs). For

Rhode Island, the total in 2002 represented the lowest total pounds harvested and the lowest value for the 13 years presented (1990-2002). In Massachusetts, the lowest pounds landed and lowest associated harvest value occurred in 1994. Revenues derived from the harvesting of commercial fish species totaled approximately $1.7 billion in Rhode Island and $2.3 billion in southeastern Massachusetts over the 13-year period.

Taken together, landings of finfish, lobster, and shellfish were relatively consistent during the 13-year period, with an average of 237 million lbs landed each year earning an average annual value of $253 million. The specific causes for any variations in the landings are not known, but low harvests could be attributed to overfishing or seasonal availability of food in some years, decimation of a portion of the juvenile lobster population from the North Cape oil spill, or potential increased mortality to lobsters from shell disease.

The major commercial fisheries (finfish [including squid], lobster, shellfish, and other crustaceans) within the Economic Study Area are discussed in more detail below and are presented in Table 3-26. The data provided by NMFS for each fishery are described in terms of the Rhode Island and Massachusetts counties that lie within the Economic Study Area for the 5-year period from 1998 to 2002.

Finfish Fishery: The ZSF supports several commercially important finfish species, including various skates, hakes, herrings, scup, sea bass, and groundfish such as summer flounder, winter flounder, yellowtail flounder, and cod. Squid, often included in the finfish catch because they are collected with finfish during otter trawling, also are a key commercial species in the region. The finfish commercial fishery is not seasonal, but the catch varies with the season. Fishing is normally highest in spring and fall months, when fish are migrating; however, the fishery is active year round and fishermen will target different species at different times of the year. The market value of any given species for any given year is often dependent on the abundance of that species in a given year.

Finfish (including squid) make up the majority of the total commercial harvest in Rhode Island and Massachusetts. Table 3-27 summarizes trends in the finfish landings for the 5-year period from 1998 to 2002.

NMFS weigh out data suggest that from 1998 to 2002, landings for finfish totaled approximately 987 million lbs. Over 188 million lbs were landed in 2002, the lowest amount yielded since 1998. The highest landing for finfish for the 5-year period was in 1998, with 211 million lbs for that year. Also in 1998, finfish landings accounted for 93 percent of the total commercial landings and 70 percent of the commercial fishery value, at nearly $147 million.

Table 3-26. Summary of Major Commercial Fisheries within the Economic Study Area.

Year	State	County	Finfish		Lobster		Shellfish[1]		Other Crustaceans[2]	
			Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1998	MA	Barnstable	17,208,886	$14,949,940	474,691	$2,073,490	120,697	$754,443	969,333	$490,526
		Bristol	66,266,873	$57,759,850	890,058	$3,774,640	5,635,342	$35,099,639	102,606	$43,352
		Dukes	411,537	$770,998	101,969	$429,103	149,763	$313,511	43,364	$22,317
		Plymouth	7,353,792	$22,467,958	2,789	$9,700	None reported	NA	None reported	NA
		Total	91,241,088	95,948,746	1,469,507	6,286,933	5,905,802	36,167,593	1,115,303	556,195
	RI	Bristol	1,861,630	$1,218,586	None reported	NA	None reported	NA	None reported	NA
		Kent	608,306	$2,102,013	914,248	$3,215,506	None reported	NA	None reported	NA
		Newport	11,320,401	$6,736,698	1,296,497	$4,796,984	104,965	$599,449	328,457	$136,902
		Providence	5,709,327	$381,769	None reported	NA	None reported	NA	None reported	NA
		Washington	100,549,640	$40,367,321	3,399,181	$11,971,266	4,027	$2,329	396,975	$183,458
		Total	120,049,304	50,806,387	5,609,926	19,983,756	108,992	601,778	725,432	320,360
1999	MA	Barnstable	20,978,064	$21,736,504	2,466,726	$10,785,468	107,972	$750,452	1,646,543	$859,667
		Bristol	60,079,247	$58,073,526	2,426,837	$10,916,970	12,444,174	$69,517,965	220,313	$101,024
		Dukes	635,319	$1,055,751	271,461	$1,155,590	None reported	NA	1,956	$992
		Plymouth	4,965,585	$3,274,891	3,265,899	$13,747,933	1,079	$10,649	None reported	NA
		Total	86,658,215	84,140,672	8,430,923	36,605,961	12,553,225	70,279,066	1,868,812	961,683
	RI	Bristol	1,931,682	$1,303,199	None reported	NA	None reported	NA	None reported	NA
		Kent	425,940	$2,118,735	None reported	NA	None reported	NA	None reported	NA
		Newport	12,108,905	$10,496,451	1,085,492	$4,442,369	90,186	$491,250	278,257	$120,282
		Providence	7,589,304	$1,340,164	None reported	NA	None reported	NA	None reported	NA
		Washington	89,588,910	$37,656,807	5,298,693	$20,296,652	43,118	$242,525	1,111,799	$467,863
		Total	111,644,741	52,915,356	6,384,185	24,739,021	133,304	733,775	1,390,056	588,145
2000	MA	Barnstable	19,172,351	$25,419,684	2,190,574	$10,006,391	630,791	$1,553,347	1,005,915	$547,853
		Bristol	63,236,309	$62,943,678	2,528,166	$12,020,565	16,078,276	$83,226,880	219,980	$120,769
		Dukes	680,056	$734,859	247,673	$1,177,286	170,855	$399,520	None reported	NA
		Plymouth	3,806,558	$3,985,447	3,158,676	$13,593,085	None reported	NA	None reported	NA
		Total	86,895,274	93,083,668	8,125,089	36,797,327	16,879,922	85,179,747	1,225,895	668,622

Source: NMFS, 2003b
NA = not applicable
[1] Shellfish include sea scallops and the various conch and whelk species.
[2] Other crustaceans include the various crab species that are often harvested as a by-product of the catch.

Table 3-26 (continued). Summary of Major Commercial Fisheries within the Economic Study Area.

Year	State	County	Finfish		Lobster		Shellfish[1]		Other Crustaceans[2]	
			Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
2000	RI	Bristol	1,988,601	$2,252,209	none reported	NA	none reported	NA	none reported	NA
		Kent	323,804	$1,869,382	none reported	NA	none reported	NA	none reported	NA
		Newport	16,438,654	$10,490,453	1,074,726	$4,301,983	147,343	$779,329	1,802,665	$1,394,015
		Providence	1,057,567	$670,463	none reported	NA	none reported	NA	none reported	NA
		Washington	84,863,213	$34,163,925	3,775,387	$15,427,941	112,117	$656,195	1,031,244	$468,968
		Total	104,671,839	49,446,432	4,850,113	19,729,924	259,460	1,435,524	2,833,909	1,862,983
2001	MA	Barnstable	19,881,007	$25,648,236	2,329,585	$10,147,401	1,250,748	$5,074,205	1,099,712	$637,231
		Bristol	67,178,623	$63,603,170	2,229,875	$9,755,661	21,339,297	$81,913,529	4,778,023	$3,918,913
		Dukes	413,275	$538,560	172,445	$757,836	none reported	NA	1,994	$1,319
		Plymouth	3,827,350	$4,315,541	2,434,080	$10,949,377	3,131	$13,600	none reported	NA
		Total	91,300,255	94,105,507	7,165,985	31,610,275	22,593,176	87,001,334	5,879,729	4,557,463
	RI	Bristol	3,743,709	$2,406,502	none reported	NA	none reported	NA	none reported	NA
		Kent	227,950	$1,403,184	none reported	NA	none reported	NA	none reported	NA
		Newport	17,286,379	$11,206,683	1,181,721	$4,816,975	3,160	$8,642	477,838	$250,264
		Providence	115,408	$607,683	none reported	NA	none reported	NA	none reported	NA
		Washington	84,243,688	$32,484,698	2,525,018	$10,746,373	178,927	$675,958	1,034,999	$565,909
		Total	105,617,134	48,108,750	3,706,739	15,563,348	182,087	684,600	1,512,837	816,173
2002	MA	Barnstable	22,364,432	$23,869,032	2,275,010	$10,172,150	652,675	$2,776,929	1,415,348	$822,290
		Bristol	67,418,347	$65,239,219	2,375,861	$10,404,179	24,458,708	$96,781,934	3,669,066	$3,105,912
		Dukes	1,042,123	$1,455,777	128,216	$573,374	none reported	NA	154	$92
		Plymouth	3,964,259	$3,849,275	2,372,845	$10,451,383	6,347	$42,090	5,377	$2,670
		Total	94,789,161	94,413,303	7,151,932	31,601,086	25,117,730	99,600,953	5,089,945	3,930,964
	RI	Bristol	2,048,155	$2,202,986	none reported	NA	none reported	NA	none reported	NA
		Kent	471,057	$3,814,766	none reported	NA	none reported	NA	none reported	NA
		Newport	25,684,305	$11,629,635	787,298	$3,193,537	none reported	NA	181,152	$101,114
		Providence	123,909	$488,813	none reported	NA	none reported	NA	none reported	NA
		Washington	65,387,478	$29,198,491	2,052,300	$8,556,894	23,689	$90,274	863,752	$432,462
		Total	93,714,904	47,334,691	2,839,598	11,750,431	23,689	90,274	1,044,904	533,576
Total all			986,581,915	710,303,512	55,733,997	234,668,062	83,757,387	381,774,644	22,686,822	14,796,164

NA = not applicable
[1] Includes sea scallops and various conch and whelk species. [2] Includes the various crab species often harvested as a by-product of the catch.

Table 3-27. Summary of Commercial Finfish Landings (1998 to 2002).

Year	Finfish Landings (Million lbs)	Value of Finfish Landings ($ Million)	All Commercial Landings (Million lbs)[1]	Value of All Landings ($ Million)[1]	%Total Landings from Finfish	% Total Value from Finfish
1998	211.3	146.8	226.2	210.7	93%	70%
1999	198.3	137.1	229.1	271.0	87%	51%
2000	191.6	142.5	225.7	288.2	85%	49%
2001	196.9	142.2	238.0	282.4	83%	50%
2002	188.5	147.7	229.8	289.3	82%	51%
Total	986.6	710.3	1,148.9	1341.6	86%	53%
5-year Average	197.3	142.1	229.8	268.3	86%	53%

Source: NMFS weigh out data for Rhode Island, 1998-2002; NMFS, 2003b
[1] All commercial landings represent the total landings of finfish, lobster, shellfish, and other crustaceans for the given year.

The total value of the finfish fishery for the 1998-2002 period was more than $710 million, or approximately $475 million more than the value of lobster landings, approximately $328 million more than the shellfish landings, and approximately $695 million more than other crustaceans.

Lobster Fishery: Lobstering has historically been the major single-species commercial fishery in the ZSF. The fishery consists of both an inshore and offshore component. Within the ZSF, most of the activity takes place in the inshore fishery, an area that includes Narragansett Bay and Rhode Island Sound out to 20 nmi (Angell and Olszewski, 2002). The inshore lobster fleet is composed mostly of day boats, with vessels leaving and returning in the same day (Intergovernmental Policy Analysis Program, 1989). The majority of lobsters in the inshore fishery are caught in baited traps (pots) in shallow waters ranging in depth from 15 to 100 ft (MacKenzie and Moring, 1985).

Recent trends have indicated an increase in offshore lobstering, particularly the areas near the edge of the continental shelf. Like the inshore fishery, offshore lobsters are harvested by using pots attached to long lines; however, they are also collected during otter trawling (MacKenzie and Moring, 1985). Within the offshore fleet, fishermen have been observed fishing both exclusively for lobster and for multiple species (Angell and Olszewski, 2002). This diversification of fishing techniques allows fishermen to remain economically viable during times of lower lobster abundance. The majority of the lobster catch occurs between late summer and early fall, when lobsters are migrating between deeper and shallower waters (MacKenzie and Moring, 1985). However, the lower catches and the emergence of the offshore fishery have resulted in more lobstermen fishing year round.

NMFS weigh out data for lobster landings recorded at Rhode Island and Massachusetts ports within the Economic Study Area suggest that an average of 11 million lbs of lobster was landed annually in the 5-year period from 1998 to 2002 (Table 3-28).

Table 3-28. Summary of Commercial Lobster Landings (1998 to 2002).

Year	Lobster Landings (Million lbs)	Value of Lobster Landings ($ Million)	All Commercial Landings (Million lbs)[1]	Value of All Landings ($ Million)[1]	% Total Landings from Lobster	% Total Value from Lobster
1998	7.1	26.3	226.2	210.7	3%	12%
1999	14.8	61.3	229.1	271.0	6%	23%
2000	13.0	56.5	225.7	288.2	6%	20%
2001	10.9	47.2	238.0	282.4	5%	17%
2002	10.0	43.4	229.8	289.3	4%	15%
Total	55.7	234.7	1,148.9	1,341.6	5%	17%
5-year Average	11.1	46.9	229.8	268.3	5%	17%

Source: NMFS weigh out data for Rhode Island, 1998-2002; NMFS, 2003b
[1] All commercial landings represent the total landings of finfish, lobster, shellfish, and other crustaceans for the given year.

During the 5-year period, the commercial lobster harvest accounted for approximately 5 percent of the total commercial harvest but contributed 17 percent of the total revenue generated. The percentage of lobster harvested in the Economic Study Area varied from 3 percent (1998) to 6 percent (1999) of the total commercial fish (finfish, lobster, shellfish, other crustaceans combined) landed. Lobster landings averaged an annual value of almost $47 million during the years 1998 to 2002.

Shellfish (Bivalves): Bivalves species such as quahogs, clams, sea scallops, and conchs are also commercially harvested in the ZSF (Petruny-Parker *et al*., 2003). Quahogs have historically been the major harvested shellfish species, with approximately 75 percent of the landings from areas within Narragansett Bay. The quahog fishery reached its peak in 1985; since then, quahog landings in the region have decreased steadily (Pratt *et al.,* 1992). In the ZSF, quahogging has been observed in the coastal areas of Little Compton and Block Island, although activity most likely takes place throughout the coastal estuaries of the region. In 1997, approximately 500 full-time fishermen landed 651 metric tons (1,435,194 lbs) of quahogs in Rhode Island (Rice *et al*., 2000).

Sea scallop populations have declined significantly in recent years, and restoration efforts along the coastal estuaries have struggled to re-establish this once-thriving industry (Rice *et al*., 2000). Scallop fisheries were historically abundant in barrier beaches and lagoons of the Rhode Island coast, especially near Newport and Narragansett. Anecdotal information provided by Rhode Island commercial fishermen suggests that good scallop areas exist approximately 15 nmi southwest of Martha's Vineyard, Massachusetts (Figure 3-73) in the Cox Ledge area.

Other species of clams and oysters are harvested with some regularity in the ZSF. The most popular fishing methods include the use of tongs, rakes, and hydraulic dredges (Intergovernmental Policy Analysis Program, 1989). Clams have been observed in Little

Compton, Charlestown, and Westerly; oysters are also harvested from these areas (Pratt *et al*., 1992). Most of these areas, however, are outside the ZSF.

Table 3-29 shows the landings of shellfish from NMFS weigh out data from 1998 to 2002.

Table 3-29. Summary of Commercial Shellfish Landings (1998 to 2002)[1].

Year	Shellfish Landings (Million lbs)	Value of Shellfish Landings ($ Million)	All Commercial Landings (Million lbs)[2]	Value of All Landings ($ Million)[2]	% Total Landings from Shellfish	% Total Value from Shellfish
1998	6.0	36.8	226.2	210.7	3%	17%
1999	12.7	71.0	229.1	271.0	6%	26%
2000	17.1	86.7	225.7	288.2	8%	30%
2001	22.8	87.7	238.0	282.4	10%	31%
2002	25.1	99.7	229.8	289.3	11%	34%
Total	83.8	381.8	1,148.9	1,341.6	7%	28%
5-year Average	16.8	76.4	229.8	268.3	7%	28%

Source: NMFS weigh out data for Rhode Island, 1998-2002; NMFS, 2003b
[1] Shellfish includes sea scallops and the various conch and whelk species.
[2] All commercial landings represent the total landings of finfish, lobster, shellfish, and other crustaceans for the given year.

Landings of shellfish from 1998 to 2002 resulted in an annual average of $76 million. The lowest yield of shellfish in the 5-year period was in 1998, when 6 million lbs worth almost $37 million were harvested. Since 1998, shellfish landings have increased, with the highest yield of 25 million lbs (in 2002) worth almost $100 million. The NMFS weigh out data from 1998 through 2002 suggest that shellfish landings contributed as much as 11 percent of total commercial landings in 2002.

The contribution of other crustaceans to the total commercial fishery was relatively insignificant, with yields of just over 23 million lbs valued at $15 million for all 5 years evaluated (1998 through 2002).

Upland Processing Industry: Commercial fishing in the ZSF relies heavily on upland facilities to create a link between fish harvesting and wholesale and retail markets (Intergovernmental Policy Analysis Program, 1989). The economic multiplier for the fish processing industry in Rhode Island is relatively high at 3.87, indicating a close relationship between commercial fishing and local economies (Sedgwick *et al*., 1980). Commercial fishermen purchase fuel, ice, bait, insurance, and other products and services from local businesses, and strong social networks involve relationships between fishermen, crews, fish buyers, processors, and vessel service suppliers, among others (New England Fisheries Management Council [NEFMC], 2001; NMFS, 2001).

There are three basic functions of the processing industry in the ZSF: fish purchasing from vessels; primary processing (including cutting and filleting); and secondary processing (including the production of cooked and frozen fish products). The primary function of the fish-buying markets is to unload fish from the vessels, then sort, ice, and box the fish for delivery to the processing facilities. Primary processing then takes place, preparing fish and shellfish into a variety of marketable items for fresh fish markets. Fillet houses are the largest component of the packing industry (Intergovernmental Policy Analysis Program, 1989). The secondary processing industry focuses mostly on squid packaging and processing, in addition to stuffing quahogs and smoking fish.

Recreational Fishing

Locations and Methods: Recreational fishing occurs primarily between the spring and fall months within the ZSF. In 2001, it was estimated that roughly 390,000 saltwater anglers made 1.5 million fishing trips to the State of Rhode Island (RIDEM, 2002b). This is an increase from 1993, when Rhode Island recorded 1.160 million recreational fishing trips. Total expenditures from trips taken in 1993 produced revenues of over $62,652,000 for Rhode Island (Corps, 2001a). In 1998, 634,000 anglers (228,000 non-residents) participated in Massachusetts' marine recreational fishery, and approximately 3.5 million saltwater fishing trips were taken (Massachusetts Division of Marine Fisheries, 2002). In 2001, expenditures from boating trips were estimated to be $297 million for recreational boating in all of Massachusetts (Massachusetts Marine Trade Association, 2003) (values for southeastern Massachusetts only were not available in the literature).

In the ZSF, recreational fishing activity takes places both from shore and from boats off the coast. Shore-based fishing, generally defined as surf casting, takes places at beaches along the southern coast of Rhode Island. Jetties, piers, shoals, and banks are all angling sites for recreational fishermen. Within the ZSF, land-based angling sites include areas in Block Island, Newport, and South County. On Block Island, fishing takes place at Beach Avenue/Dunn's Bridge, Block Island National Wildlife Refuge, and Block Island State Park (Rhode Island Economic Development Corporation [RIEDC], 2003a). In South County, recreational fishing takes place at Bluff Hill Cove, Charlestown Breachway, Deep Hole (Matunuck), Ninigret Conservation Area, East Matunuck State Beach, Misquamicut State Beach, Napatree Point, Quonochontaug Breachway, Salty Brine State Beach, State Pier Number Four, and the Weekapaug Breachway. In addition, several launch sites for saltwater angling are located in Sakonnet Point, Charlestown, Galilee, Monahan's Dock, South Kingstown, and Westerly.

Beyond the ZSF are numerous jetties and piers along the southeastern Massachusetts coast in New Bedford, Dartmouth, Fall River, Falmouth, and Martha's Vineyard for offshore angling. In Massachusetts, approximately 52 percent of angling was from shore, 42 percent was from private/rental boats, and 6 percent was from charter boats (NMFS, 2003c).

Charter and party boats are used for recreational fishing in the ZSF. Over 170 vessels took more than 8,000 recreational fishing trips in the ZSF in 2001 (RIEDC, 2003a). Charter vessels often carry up to six passengers to a recreational fishing location in the area (RIEDC, 2003a). A bidding process often determines prices; fees include all bait and fishing gear for the trip.

Charter boats are available at numerous ports along the southeastern Massachusetts coast from Fairhaven, New Bedford, South Dartmouth, Falmouth, and Martha's Vineyard (MDMF, 2003).

Party boats carry more passengers than charter vessels and normally go out for shorter periods of time. Party boats can be found in the active recreational ports of Montauk, New York; Point Judith, Rhode Island; and New London, Connecticut, with the majority taking place out of Montauk (RIEDC, 2003a). Party boats from southeastern Massachusetts can be taken from ports in New Bedford, Falmouth, and Martha's Vineyard (MDMF, 2003).

State-permitted artificial reefs do not exist in the waters of the ZSF; however, several other man-made obstructions serve as artificial reefs in this area, including shipwrecks, jetties, groins, submerged pipelines, and cables (Steimle and Zetlin, 2000). These man-made habitats are often areas of active recreational fishing and diving. In 1997, the MDMF, in partnership with the University of Massachusetts at Dartmouth, planned and developed a sophisticated artificial reef project. The 3-acre site is in Buzzards Bay, east of Salters Point and Dartmouth, and is composed of prefabricated concrete units. Further artificial reef development is being considered by the MDMF (MDMF, 2002).

Recreational Fish Landings: Fishing trips taken on charter and party boats account for a large part of the catch and revenues for recreational fishing, and data on fish landing values for these trips are also the most readily available. NMFS VTR data taken from such vessels indicated that in 2001, 308,851 lbs of fish were caught on recreational fishing trips within the ZSF (Table 3-30).

Table 3-30. Annual Recreational Fish Catch from Party Boats Fishing Within the ZSF.

Year	Total Pounds Harvested
1994	328,026
1995	159,623
1996	78,469
1997	67,510
1998	115,600
1999	211,411
2000	258,675
2001	308,851

Source: NMFS VTR data from 1994-2001; NMFS, 2003b

The most popular recreational finfish caught within the ZSF included scup, black sea bass, striped bass, bluefish, summer flounder, winter flounder, hake, cod, tautog, tuna, and shark (RIDEM, 2002b; RIDEM, 2000). Catch information from the NMFS VTRs (charter and party boats generally oriented towards finfish) indicated that scup was the major species caught in 2001, accounting for 195,527 lbs harvested (Table 3-31).

Table 3-31. Top 15 Species Caught by Recreational Anglers Aboard Party and Charter Boats in the ZSF in 2001.

Species	Total Pounds Harvested
Scup	195,527
Black sea bass	35,410
Striped bass	21,520
Bluefish	18,975
Summer flounder/Fluke	10,689
Red hake	7,119
Cod	6,886
Tautog	2,695
Yellowfin tuna	2,238
Ocean pout	1,558
Bluefin tuna	1,334
Winter flounder	712
Cunner	650
Bonito	431
Mako shark	383
Other Species (39)	2,724
Total	308,851

Source: NMFS VTR data for 2001; NMFS, 2003b

Summer flounder, scup, and black sea bass are often grouped together as an important recreation multi-species fishery in the ZSF (Shepherd and Terceiro, 1994). All three species peak in summer and early fall, when fish are distributed in estuaries and nearby coastal waters. Scup and black sea bass catches normally peak in late spring and early fall, while summer flounder are harvested more frequently during the months of July through August (Grimes *et al*., 1989). Winter flounder are also caught from shore, bridges, jetties, docks, private boats, and charter and party boats in the ZSF (Gray, 1991). Bluefish and striped bass are popular "sport fish" in the ZSF. The two species have historically registered significant landings in the area (RIEDC, 2003a). Bluefish are found in the waters of the ZSF between the months of May through November. Striped bass would be expected to migrate through the region at similar times of the year. Other large sport fish include shark and tuna.

Lobster and quahog are the most popular recreational shellfish caught in the ZSF. Lobster is characterized as a "warm weather" fishery because the majority of the landings occur in the summer and early fall months (May through October) (Angell and Olszewski, 2002). Licenses for recreational lobstering are divided between non-commercial diving and non-commercial pots. In Rhode Island, divers are allowed to harvest eight lobsters per day, while pot licensees are able to fish up to five traps, with no limit on lobsters taken. In 1992, it was estimated that over 50,000 people engaged in the activity of recreational shellfishing in Rhode Island, the majority being quahogs, followed by soft-shell clams and oysters (Pratt *et al*., 1992). All Rhode Island residents are allowed to harvest shellfish from state waters without a license, with a daily limit of one-half bushel on most species. Popular locations for recreational shellfishing can be found in the salt ponds of Washington County.

In Massachusetts, lobster permits authorize up to 10 lobster pots to be set, with no limit on lobsters taken. Diver permits are also issued with no limit on lobsters taken (MDMF, 2002). Taking of shellfish (e.g., surf clams and ocean quahogs) in Massachusetts is regulated by individual cities and towns; however, the MDMF has the authority to regulate shellfish taken from contaminated areas (MDMF, 2002).

In general, summer and fall months tend to result in the largest recreational catches, when more people vacation and engage in recreational fishing activities. However, anglers targeting certain species plan fishing trips to coincide with the migratory activities of those species. Total landings and average landings (from 1994 through 2001) for recreational species harvested within the ZSF are presented in Table 3-32. For the ZSF, total recreational landings (from 1994 through 2001) were highest in August through November. During those years, the average pounds of recreational fish harvested were highest in January, suggesting that fewer people are catching more fish or are catching larger fish than those caught by many anglers during the summer months.

Table 3-32. Average Recreational Landings Within the ZSF by Month from 1994 through 2001.

Month	Total Pounds Harvested	Average Pounds Harvested
January	16,127	181.2
February	6,482	35.6
March	8,129	35.8
April	26,773	29.9
May	68,138	37.4
June	59,281	22.5
July	111,336	26.4
August	209,729	41.2
September	433,552	99.9
October	355,323	138.3
November	217,226	129.7
December	16,095	48.0

Source: NMFS VTR data from 1994 – 2001; NMFS, 2003b

Recreational Boating in the ZSF: Recreational boating contributed an estimated $730 million in Gross State Product (GSP) within the Economic Study Area (Corps, 2003o; Corps, 2004d) (Section 3.17.9). A Corps study published in 1996 (*Estimating the Local Economic Impacts of Recreation at Corps of Engineers Projects*) estimated the economic impact of boater spending. This study found that boaters spent $54.25 per day visit and $129.37 per overnight visit. This analysis assumed that the more typical day visit and its associated expenditures were representative of all visits. At 2003 price levels, boaters are expected to spend $62.20 per day visit and made an average of 33 visits per year (Corps, 2003o). The following sections discuss the number and size of recreational boats found in the Economic Study Area.

Rhode Island: The State of Rhode Island reports registered boats by location (as noted by applicants for state registration). Data from RIDEM for 2003 indicated that 22,422 boats were registered with the state and identified as being located in the Economic Study Area (Corps, 2003o). The numbers and sizes of the boats are shown in Table 3-33.

Table 3-33 shows that over 33 percent of all Rhode Island state-registered boats in the Economic Study Area are in the 0- to 16-ft category. The 17- to 26-ft group is the largest, with more than 45 percent of all registrations. Less than 1 percent are in the 65-ft ≥ category (Corps, 2003o).

Table 3-33. Boats by Length in Rhode Island Portion of Economic Study Area Using Slips and Moorings (2003).

Length (ft)	Total Boats by Length	Distribution of Boats by Length (%)	Portion of Boats in Economic Study Area (Boats at Slips/Moorings)
0 - 16	7,466	33.3	0[1]
17 - 26	10,179	45.4	5,090[2]
27 - 40	4,185	18.7	4,185
41 - 64	563	2.5	563
65 ≥	29	0.1	29
Total	22,422	100.0	9,867

Source: Corps, 2003o
[1] Total does not include 0– to 16-ft boats not in slips or at moorings.
[2] 17- to 26-ft boats one-half trailered.
Note: Includes U.S. Coast Guard documented vessels.

Massachusetts: Data from the Massachusetts Environmental Police for 2003 indicated that 27,592 boats were registered with the state and identified as being located in the Economic Study Area. The State of Massachusetts reports registered boats by location (as noted by applicants for state registration) (Corps, 2003o). The numbers and sizes of the boats located within southeastern Massachusetts are shown in Table 3-34.

Table 3-34. Boats by Length in Massachusetts Portion of the Economic Study Area (2003).

Boat Length (ft)	State Registered Boats by Length	Documented Boats[1]	Total Boats	Portion of Boats in ZSF Study Area (Boats at Slips/Moorings)
0 - 16	11,752	0	11,752	0[2]
17 - 26	12,861	1,286	14,147	7,074[3]
26 - 40	2,887	1,154	4,041	4,041
40 - 64	84	63	147	147
65≥	8	8	16	16
Total	27,592	2,511	30,103	11,278

Source: Corps, 2003o
[1] Documented boats are those boats that are registered with the U.S. Coast Guard (based on interviews).
[2] Total does not include 0- to 16-ft boats not in slips or at moorings.
[3] 17- to 26-ft boats one-half trailered.

Table 3-34 shows that approximately 39 percent of all Massachusetts state-registered boats in the Economic Study Area are in the 0- to 16-ft range; the 17- to 26-ft group accounts for almost 47 percent. Less than one percent is found in the greater length categories (Corps, 2003o).

These estimates for Rhode Island and Massachusetts suggest that about 21,145 boats between 17 ft and 64 ft+ are using slips and moorings within the Economic Study Area. Based on the estimated 174+ marinas in the Economic Study Area, this is an average of 125 slips and moorings per marina (Corps, 2003o).

3.17.2 Shipping

The ZSF is an active area of commercial shipping and port-related activities. Shipping and navigation in the ZSF generated over $150 million in economic activity in 2001 (Corps, 2001a). The ports of Point Judith and Newport, Rhode Island, are the most active, with 3,702 and 5,056 trips taken in 2001, respectively. The Port of Providence, Rhode Island, and Fall River, Massachusetts, in Narragansett Bay have larger vessels and perform both foreign and domestic commerce. These two ports combined accounted for 2,817 trips in 2001. Port-related activity for Providence, Fall River, and other ports in the region are shown in Table 3-35.

Shipping in the region dates back to the early 1700s, when Newport was the leading port in Narragansett Bay (Corps, 2001a). In the 19th century, the Port of Providence became the major port of the region, specializing in coal, lumber, and cotton. However, the types of commodities have shifted over the years, so that the Port is now oriented toward petroleum product delivery. Activity has in general declined in the port since 1970; however, trips increased from 1,357 to 2,166 between 1995 and 2000. In 2001, the Port of Providence employed over 2,000 people generating private and public revenues exceeding $150 million.

Table 3-35. Port Activity by Maximum Draft, Weight, and Total Trips.

Port (Maximum Draft)	Weight (Thousand Short Tons)	Trips
Providence River and Harbor, RI (40 ft)	8,870	2,166
Foreign Commerce		
Petroleum and Petroleum Product	1,646	-
Crude Materials	888	-
Primary Manufactured Goods	667	-
Other Commodities	34	-
Domestic Commerce		
Petroleum and Petroleum Product	5,273	-
Crude Materials	123	-
Primary Manufactured Goods	209	-
Other Commodities	30	-
Fall River Harbor, MA (35 ft)	3,402	651
Foreign and Domestic Commerce		
Coal	3,092	-
Petroleum and Petroleum Product	271	-
Chemical and Related Products	30	-
Crude Materials	9	-
Great Salt Pond, Block Island, RI (10 ft)	7	4,092
Point Judith, RI (14 ft)	6	3,702
Newport Harbor, RI (14 ft)	-	5,056
Bristol Harbor, RI (8 ft)	-	4
Seekonk River, RI (14 ft)	-	4
Warren River, RI (12 ft)	-	22
Wickford Harbor, RI (13 ft)	-	16

Source: Corps, 2000c

Corps Waterborne Commerce statistics for the year 2000 indicated that the Port of Providence accounted for 8.87 million short tons of foreign and domestic shipping activity. The majority of this movement was attributed to domestic petroleum and petroleum products. In total, 2,166 commercial vessel trips were recorded in 2000. Fall River, Massachusetts, followed the Port of Providence as the most active port in the region, accounting for 3,402 thousand short tons of commercial materials in 2000. Other active ports include Block Island, Point Judith, and Newport Harbor, which combined accounted for more than 12,000 commercial vessel trips.

Vessels entering the Providence River and Buzzards Bay from Rhode Island Sound use designated inbound and outbound shipping lanes or approaches (Corps, 2001a; Figure 3-74). These shipping lanes deliver vessels from Buzzards Bay to the east and the Atlantic Ocean to the south. Vessels navigating the inland waterways of the ZSF use well-defined shipping channels when entering and exiting their destinations. Many shipping channels approaching and inside local harbors require periodic maintenance dredging to allow for the continued passage of vessels throughout the region.

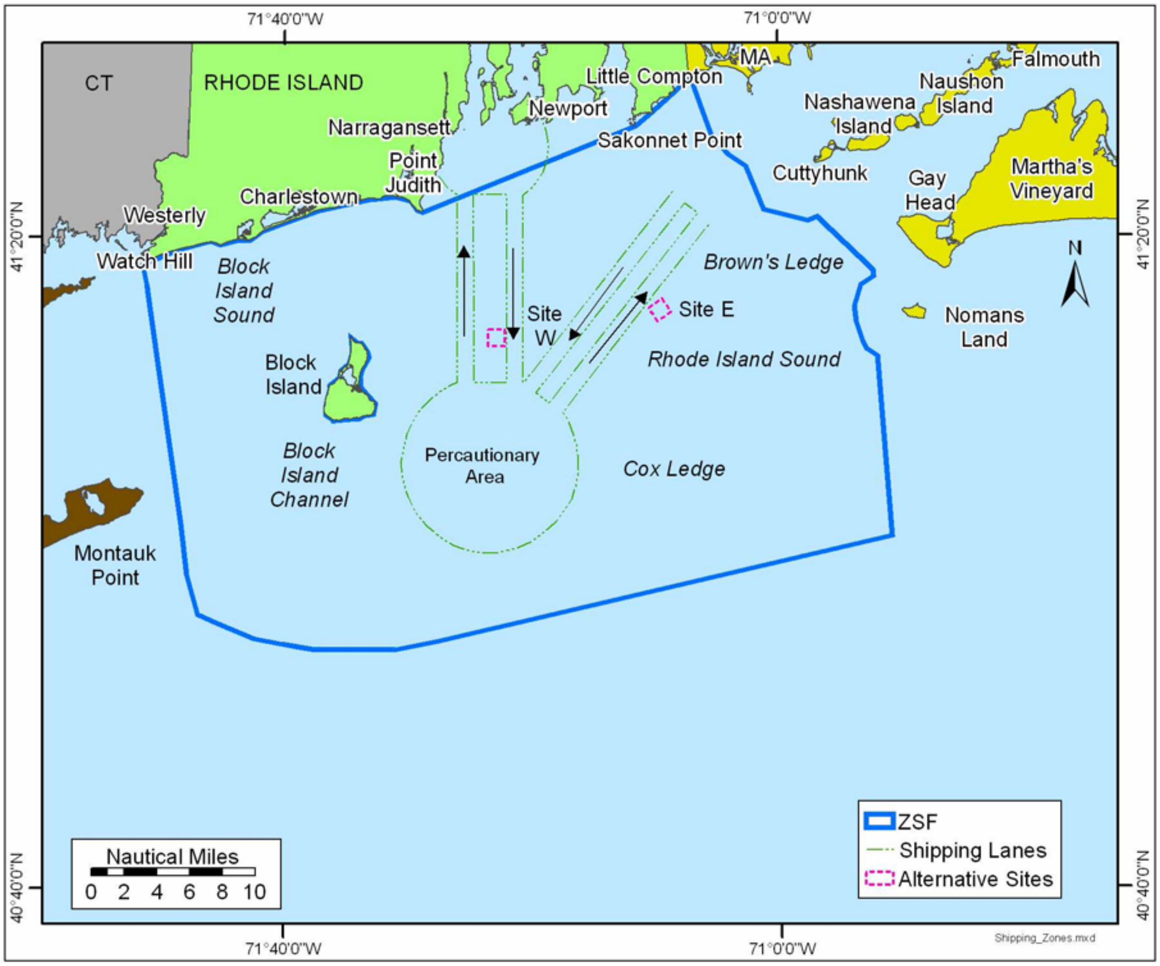


Figure 3-74. Shipping Lanes in the ZSF.

Alternative Sites E and W

Although there are shipping lanes within the ZSF that are adjacent to Sites E and W, no shipping lanes transect either alternative site.

3.17.3 Military Usage

The RIR is an area actively used by the U.S. Army, the U.S. Navy, the U.S. Air Force, the U.S. Coast Guard, and the Air Force National Guard. There are 20 military facilities located in Connecticut, Massachusetts, New York, and Rhode Island that may conduct military exercises within the ZSF (Table 3-36). The military exercises involve personnel and equipment transport, training exercises, search and rescue, and patrol.

The Naval Station Newport (NAVSTA) located in Newport, Rhode Island, has 16 area commands that could potentially use the ZSF for training. One of these installations, the Naval Undersea Warfare Center (NUWC) Division, focuses on the research and development of undersea warfare technologies. The forerunner of NUWC, the Torpedo Station on Goat Island,

Table 3-36. Military Installations by State, Branch, Major Unit or Activity, and City.

Branch	Installation	Major Unit or Activity	City
Connecticut			
Army	Camp Rowland	Ntl. Guard Training	Niantic
Navy	Naval Base, New London	Submarine Forces	Groton
Coast Guard	U.S. Coast Guard Academy	Academy	New London
Coast Guard	Research & Development Ctr.	R&D Activities	Groton
Coast Guard	Station New London	Group Long Island Sound	Ft. Trumbull
Massachusetts			
Air Force	Cape Cod AS	Space Warning	Bourne
Air Force	Otis AGB	Air National Guard	Falmouth
Army	Camp Edwards	Ntl. Guard Training	Bourne
Coast Guard	Station Cape Cod Canal	Group Woods Hole	Cape Cod
Coast Guard	Station Brant Point	Group Woods Hole	Nantucket
Coast Guard	Station Menemsha	Group Woods Hole	Menemsha
Coast Guard	ANT Woods Hole	Group Woods Hole	Woods Hole
Coast Guard	Air Station Cape Cod	Search and Rescue	Military Res.
New York			
Coast Guard	Station Fishers Island	Group Long Island Sound	Fishers Is.
Rhode Island			
Air Force	Quonest State APT AGS	143 Airlift Wing	N. Kingston
Army	Camp Fogarty	Ntl. Guard Training	Greenwich
Coast Guard	Station Block Island	Group Woods Hole	Block Island
Coast Guard	Station Point Judith	Group Woods Hole	Point Judith
Coast Guard	Station Castle Hill	Group Woods Hole	Newport
Navy	NAVSTA	Officer's Academy	Newport

developed torpedoes, torpedo equipment, explosives, and electrical equipment in Narragansett Bay from 1869 to 1951. NUWC was created in the 1950s to continue the torpedo research (NAVSTA, 2003). The Naval War College, the Naval Education and Training Center, the Naval Training Meteorology and Oceanography Detachment, the Surface Warfare Officers School, and the Navy Warfare Development Command are examples of some of the NAVSTA commands that could also train in the ZSF. In addition to those facilities, a naval submarine base that conducts local training is located in New London, Connecticut, and U.S. Coast Guard stations can be found in Block Island, Point Judith, and Newport, Rhode Island.

The Navy frequently conducts training exercises in Rhode Island Sound, making localized areas within the Sound restricted from public use. A 2-mile-wide torpedo range, regulated by NUWC, is located at the northern end of the Narragansett Bay Approach (Figure 3-75). This area is closed to vessel traffic only during daylight hours when optimum weather conditions exist for torpedo range use (U.S. Federal Government, 2002a; NPT, 2002).

Another restricted area (area 334.78) (Figure 3-75) in the ZSF is found approximately 3.5 nmi due south of Lands End, Newport, Rhode Island. No persons, vessels, or other watercraft are allowed to enter the designated area when minefield training is under way. The exercises are

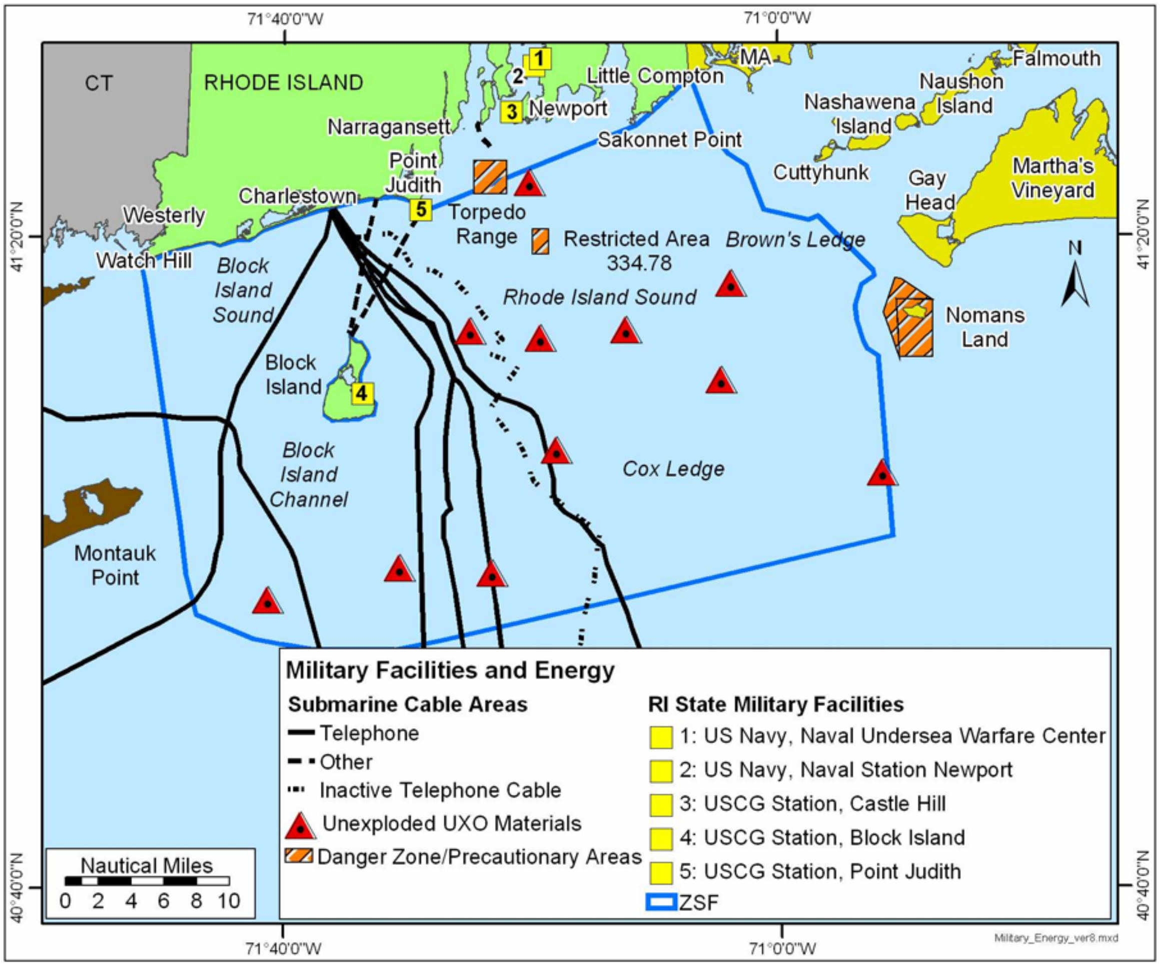


Figure 3-75. Military Facilities and Energy.

kept to a minimum from July 1 to mid-October, and a notice to mariners is provided by the Navy 6 to 8 weeks before a scheduled training exercise (U.S. Federal Government, 2002b).

Finally, just east of the ZSF lies a danger zone for naval operations called Nomans Land (Figure 3-75). During the period between November 1 and April 30, no vessel or person can enter or remain within the Nomans Land danger zone. The locations of military activities and training exercises are not always announced to the general public because of regulations associated with national security; therefore, military activities may be occurring in areas other than those mentioned above.

There are 11 identified locations of unexploded ordnance (UXO) in the ZSF. These include unexploded torpedoes, depth charges, and bombs (Figure 3-75). There is no evidence that these UXOs will be removed; some have been there since the 1940s.

Alternative Sites E and W

Rhode Island Sound is an area actively used by the military for training exercises, including equipment transport, training, search and rescue, and patrol. None of the military exercises are conducted within either Site E or Site W.

3.17.4 Mineral/Energy Development

Petroleum and propane resources are shipped into Rhode Island and southeastern Massachusetts. Tankers and barges for both products are brought into the Port of Providence (petroleum is also brought into East Providence and Tiverton) and dispensed from that location (Rhode Island Statewide Planning Program, 2002). Block Island, which generates its own electricity, receives its petroleum and oil shipments directly to the island (Block Island Power Company, 2003). There is no evidence of pipelines within the ZSF (Rhode Island Statewide Planning Program, 2002). There is a safety zone regulation for vessels carrying liquefied petroleum gas in the Rhode Island Sound, Narragansett Bay, and Providence River. The Captain at Port Providence alerts the maritime community when the safety zone is put into effect (National Ocean Service, 2001).

A number of cables, primarily telephone cables, run through the ZSF (Figure 3-75). Six of these are active and are owned by AT&T, Tyco, and Gemini. There are three cable areas (located on NOAA nautical chart 13218) whose identities have not been determined. Two of the cables run from Block Island to Point Judith and Matunuck, and one cable leaves from Beavertail Point and extends into Narragansett Bay (NOAA, 2001; NOAA, 2000). One of the cables runs directly across the Separation Zone Site (Site 69b) and was identified in the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a) as being inactive. Cable information was taken from NOAA Chart 12300, Approaches to New York, Nantucket Shoals to Five Fathom Bank, 42nd edition, February 17, 2001 provided by AT&T and International Cable Protection Committee (21st edition, September 15, 2001).

No large-scale sand or mineral mining is being conducted in the waters off the coast of Rhode Island or southeastern Massachusetts, including the ZSF (Spangenberg, 2003a; Spangenberg, 2003b).

Alternative Sites E and W

Active telephone cables, though present within the ZSF to the east of Block Island and west of Site W, are not located within the boundaries of either Site E or Site W.

3.17.5 Recreational Activities

Recreational activities in the ZSF contribute significantly to the surrounding local economies. Revenues are generated through use fees and organized tours, as well as through restaurants, hotels, and shopping. In addition to recreational fishing, beach use (swimming and sunbathing), boating, diving, and whale watching are popular recreational activities in the ZSF.

Beaches

There are more than 100 beaches in Rhode Island and 25 within the ZSF (RIEDC, 2003b; RIDEM, 2003). In southeastern Massachusetts, there are 59 public and private beaches and 20 public and private beaches on Martha's Vineyard (EPA, 2003). The majority of beach use takes place in the warmer summer months; however, beaches are used in the region year round.

Boating

Recreational boating in the ZSF accounts for an estimated $70.2 million of the GSP for the Economic Study Area (Corps, 2003o) (see Section 3.17.9). Rhode Island is home to at least 91 marinas and yacht clubs, which offer 6,485 slips and moorings to recreational boaters each year (Corps, 2001a). In addition, more than 97 boat launch ramps are located in Rhode Island. In 1994, Rhode Island had 1,452,845 visitors to boating facilities generating $2,190,245 in beach and park revenues and over 400 full- and part-time jobs. There are 38 boat launch ramps, 13 yacht clubs, and 76 marinas with a total of 9,393 slips and moorings along the southern coast of Massachusetts within the Economic Study Area (Corps, 2003o; Childress *et al*., 1996).

Powerboating and sailing are also popular in the region. For more than 50 years, the America's Cup has competed in the ZSF (RIEDC, 2003a). Each season, more than 100 boating-related events are held in the ZSF, including weekly yacht club regattas, trans-Atlantic ocean races, and canoe and kayaking tours. A number of offshore races take place within or pass through the ZSF, with the majority taking place in the months of May through October (Petruny-Parker *et al*., 2003).

Additional Recreational Activities

Diving is a popular activity in the rocky shores and reefs and at shipwrecks within the ZSF (Petruny-Parker *et al*., 2003). Shore diving is the most popular of these activities, especially in the rocky bays near Point Judith and Sakonnet Point (Corps, 2001a). Surfing and windsurfing take place at several beaches in the ZSF and are becoming increasing popular. Popular spots include Matunuck, Green Hill, Monahan's Dock, Point Judith, Narragansett, Newport, and Little Compton (NESurf, 2003; RIEDC, 2003a).

Whale watching trips take place in the ZSF during summer months (Petruny-Parker *et al*., 2003). Eco-tourism geared toward marine mammals often coincides with the months of August through October when the seasonal sea herring runs occur. In Rhode Island, whale watching tours are offered out of Galilee; in Massachusetts, whale watching tours depart from ports (Provincetown, Barnstable Harbor, Plymouth, Newbury Port, Gloucester, and Boston) that are located beyond the ZSF and Economic Study Area along the eastern coast of Massachusetts.

Ferry Boat Services

Several ferry services operate in the Economic Study Area, providing service to and from Block Island, Martha's Vineyard Island, and Nantucket Island (although Nantucket is not part of the Economic Study Area, ferries travel to the island from study area locations). Ferry service is the most economically practical means of transportation to and from the islands. The services operate throughout the year, and the frequency of service increases to meet seasonal demand (Corps, 2003o).

Block Island is located approximately 17 nmi from the mainland. Two ferry services operate out of Point Judith to Block Island. One of the ferry services also provides limited seasonal service between Block Island and Newport, Rhode Island, and New London, Connecticut (Corps, 2003o). Martha's Vineyard is located approximately 4 nmi from the mainland. The most active port on the mainland is Woods Hole, which is the only location offering auto ferry service. Ferries have regular service from three harbors on Martha's Vineyard—Edgartown, Oak Bluffs, and Vineyard Haven—to seven harbors off the island. Vineyard Haven is the primary port for year-round ferry service and freight (Corps, 2003o).

Alternative Sites E and W

Recreational activities that are performed in the area include swimming at shore beaches, powerboating and sailing, fishing, diving, and whale watching. It is anticipated that recreational boaters and fishermen would pass through the areas of Site E and Site W.

3.17.6 Natural or Cultural Features of Historical Importance

Cultural resources generally consist of sites of historic, architectural, or archaeological significance. They may include standing structures and buildings or sites of a historic and prehistoric nature that are located both above and below the ground. They may also include traditional cultural properties on Indian tribal lands that are of spiritual significance.

Cultural resources could also consist of submerged archaeological resources and historic shipwrecks. Due to sea level rise, many prehistoric settlements that were once located aboveground may now be submerged in waters within the ZSF. Additionally, due to the area's location along the southern New England coastline and its proximity to major ports in Massachusetts, Rhode Island, and Connecticut, shipwrecks are a distinct possibility.

The RIR was likely the site of numerous pre-Contact settlements during the period ranging from as far back as 12,000 years ago to the period of European contact. At present, however, there are no recorded underwater pre-Contact sites in Narragansett Bay or Rhode Island Sound. Pre-Contact sites within the general area date from approximately 10,500 years to European Contact. A review of archaeological site files for the seven towns included in the Providence River and Harbor Maintenance Dredging Project EIS (Providence, East Providence, Cranston, Barrington, Warwick, Bristol, and Portsmouth) indicated that a large number of pre-Contact sites are located on lands surrounding Narragansett Bay and the Providence Harbor area. This includes 330 sites in the Rhode Island Historic Preservation Commission's database ranging from as many as 89 sites in Warwick to 12 sites in East Providence. The more urbanized communities tended to have fewer sites than less densely populated areas (Corps, 2001d).

Known Shipwrecks and Obstructions within the ZSF: A review of the NOAA database of recorded wrecks and obstructions identified a total of 114 shipwrecks and obstructions located within the ZSF (NOAA, 2003c); 31 are documented shipwrecks (Table 3-37). An additional six shipwrecks were identified from a review of *New England's Legacy of Shipwrecks* (Keatts, 1988) (Table 3-37). Other shipwrecks and submerged resources that have not been recorded

Table 3-37. Recorded Shipwrecks Located Within ZSF.

Name	Type	Date	Location	Chart No.	Depth
NOAA Database of Recorded Wrecks and Obstructions					
Tennyson	Unknown	Unknown	Block Island Sound	13205	--
Elmo	Fishing Vessel	1988	Block Island Sound	13205	--
Appletree	Unknown	Unknown	Block Island Sound	13205	--
Grecian	Steamer	1932	Block Island Sound	13205	--
Larchmont	Cargo Vessel	1918	Block Island Sound	13205	--
Progress	Dredge	Pre-WW2	Block Island Sound	13205	--
Circassian	Unknown	Unknown	Block Island Sound	13205	--
USS Bass	Submarine	Unknown	Block Island Sound	13215	--
Vermillion	Unknown	1920	Block Island Sound	13215	--
Snug Harbor	Unknown	1920	Block Island Sound	13215	--
Lake Crystal	Barge	Unknown	Block Island Sound	13215	--
Amelia M. Pereira	Unknown	Pre-WW2	Block Island Sound	13215	--
One-Oh-One	Barge	1955	Block Island Sound	13215	--
Hercules	Unknown	Unknown	Block Island Sound	13215	--
Annapolis	Coal Barge	1945	Block Island Sound	13215	--
Shearwater	Unknown	Unknown	Block Island Sound	13215	--
Luther Hooper	Barge	Unknown	Block Island Sound	13215	--
Heroine	Unknown	Unknown	Block Island Sound	13215	--
Mary Arnold	Tug	Unknown	Block Island Sound	13215	--
Pocahontas	Unknown	Unknown	Block Island Sound	13217	--
Texas	Unknown	Unknown	Block Island Sound	13217	--
Essex	Unknown	Unknown	Block Island Sound	13217	--
Edward Luckenback	Unknown	1942	Block Island Sound	13217	--
Lightburne	Oil Tanker	1939	Block Island Sound	13217	--
Who Knows Who Cares	Power Boat	Unknown	Block Island Sound	13217	--
Spartan	Unknown	Unknown	Block Island Sound	13217	--
Princess Augusta	Unknown	Unknown	Block Island Sound	13217	--
Skimmer I	Unknown	Unknown	Block Island Sound	13217	--
Arnie Boy	Cabin Cruiser	Unknown	Mount Hope Bay	13221	--
Capital City	Barge	1933	Narragansett Bay	13223	--
Llewellyn Howland	Steamer	1924	Narragansett Bay	13223	--
Cape Fear	Unknown	1954	Narragansett Bay	13223	--
G-1	Unknown	Unknown	Narragansett Bay	13223	--
Richard Card	Unknown	1944	Narragansett Bay	13223	--
New England's Legacy of Shipwrecks					
U-853	Submarine	1945	7 m. E. of Block Island, RI	--	130 ft.
Black Point	Coal Hauler	1945	3.5 m. SE of Pt. Judith, RI	--	85-95 ft.
USS L-8	Submarine	1926	3 m. S. of Brenton Reef Light, RI	--	110 ft.
Trojan	Freighter	1906	4 m. WSW of Cuttyhunk, MA	--	100 ft.
HMCS St. Francis	Destroyer	1945	2 m. off Acozxet. MA	--	60 ft.
Angela	Cement Barge	1971	Horseneck Beach, Westport, MA	--	0-30 ft

Source: NOAA, 2003c; Keatts, 1988

may be present within the ZSF. Known shipwrecks and their locations within the ZSF are shown on Figure 3-76.

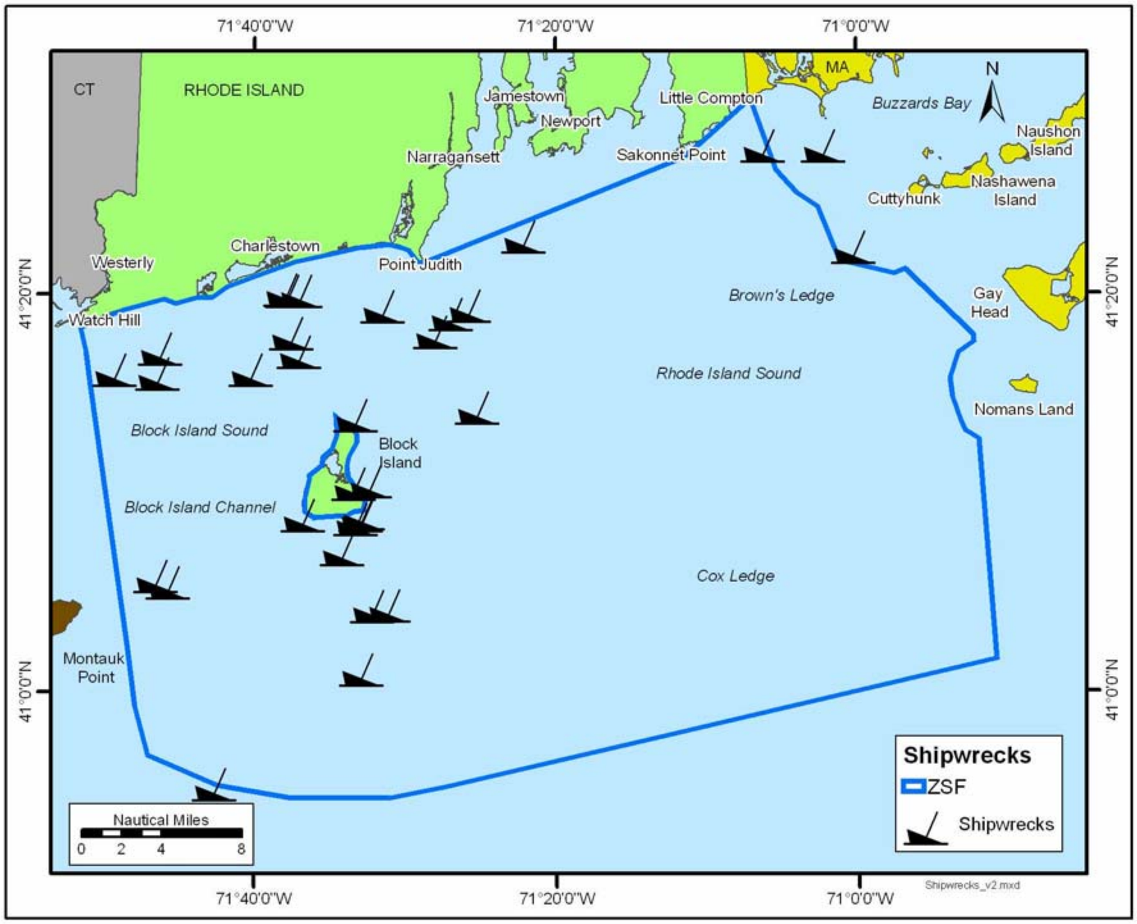


Figure 3-76. Known Shipwrecks Within the ZSF.

Review of Archaeological Records: A preliminary review of archival sources and archaeological records was conducted to assess the potential for pre-Contact and historic resources in the ZSF. Archaeological investigations were conducted in various locations within Rhode Island Sound for the Providence River and Harbor Maintenance Dredging Project Final EIS (Corps, 2001a). The findings of those investigations were documented in a report titled *Archaeological Assessment, Remote Sensing, and Underwater Archaeological Survey for the Providence River and Harbor Maintenance Dredging Project, Rhode Island, April 12, 2001* (Corps, 2001d). As documented in Appendix M of the Providence River and Harbor Maintenance Dredging Project Final EIS, and in correspondence dated February 6, 2003, from the State of Rhode Island and Providence Plantations - Historic Preservation and Heritage Commission (RIHPHC), the following determinations were presented.

In 2001, the Corps conducted archaeological assessments of three deep-water locations—Site 18 (Brenton-A), Site 69A (Jamestown Bridge Reef), and Site 69B (Separation Zone Site)—as part of the Providence River and Harbor Maintenance Dredging Project (Corps, 2001a). While the assessment determined that no significant submerged Native American sites were likely to be found at these locations, there was the potential for historic resources because of known shipwrecks in the vicinity. Remote sensing and an underwater archaeological investigation were conducted at Site 69B; no significant cultural resources were identified. Remote sensing and underwater archaeological investigations were not conducted at Sites 69A and 18; however, unknown shipwreck sites may be present in the vicinity of Sites 69A and 18 (Corps, 2001a; RIHPHC, 2003).

Agency Coordination: In accordance with Section 106 of the National Historic Preservation Act (NHPA), as amended, the Corps has initiated coordination with RIHPHC, the Massachusetts Historical Commission (MHC), and the Massachusetts Board of Underwater Archaeological Resources (MA BUAR) concerning the presence of historic, architectural, or archaeological resources in the ZSF. As previously mentioned, a response has been received from the RIHPHC confirming the sensitivity of the ZSF for historic shipwrecks. Additionally, the Corps has received a response from the MHC (dated January 27, 2003) recommending that the Corps consult the Inventory of the Historic and Archaeological Assets of the Commonwealth to determine whether known historical or archaeological resources could potentially be affected by the proposed project.

Alternative Sites E and W

The University of Massachusetts Archeological Services prepared a *Historic Shipwreck Background Study* (Corps, 2004e) for the ZSF. The findings from that study as they relate to Site E and Site W are summarized below.
Most records of shipwrecks include only the closest terrestrial location, such as “Block Island” or “Nomans Land.” Some references also include information such as an estimated distance in miles off a point of land, usually with no direction given. The historical research conducted by the University of Massachusetts did not locate reports of shipwrecks specifically within Site E or W.

A total of 358 historic shipwrecks at or off Cuttyhunk, Nomans Land, Martha’s Vineyard, Sakonnet Point, Block Island, Point Judith, and Rhode Island in the general area were identified (Table 3-38); an estimated 55 of these wrecks could be located within approximately 9 nmi of Sites E and W. A Bureau of Land Management study (Bourque, 1979) suggests a multiplication of at least 2 for the data used because, in addition to other factors, most shipwrecks earlier than the mid-19th century would not have been recorded. To estimate the number of shipwrecks in an area, the following assumptions were made: approximately one-fourth of the wrecks recorded at a location were not cast on shore or grounded in shallow water, and approximately one-fourth of shipwrecks listed for islands were in any particular quadrant around that island. The number of shipwrecks was divided by 4 to estimate for the proper quadrant.

Table 3-38. Number of Shipwrecks Estimated to be Within 9 Nautical Miles of Areas E and W.

Source	Recorded Location and Adjustment	Total Possible No. of Shipwrecks	Estimated No. Within 9 nmi of Sites E and W
WCRM	Cuttyhunk, divide by 8	41	5
WCRM	Nomans Land, 26/8 + 1	27	4
WCRM	Martha's Vineyard, 74/8	74	9
WCRM	Sakonnet Point	0	0
WCRM	Block Island, 149/8	149	19
WCRM	Off Block Island, 55/4	55	14
WCRM	Off Point Judith, 11/4	11	3
WCRM	Off Rhode Island, 1	1	1
AWOIS	Area E and Area W	0	0
Totals	--	**358**	**55**

Source: Corps, 2004d
WCRM = Warren C. Riess Marine, Inc.
AWOIS = Automated Wreck and Obstruction Information System

The closest known wrecks are *U 853*, a German submarine of World War II vintage resting approximately 0.9 nmi west of Site W, and *Barbara G*, possibly 0.9 nmi south-southeast of the site. In addition to those vessels found in the historical records, it is assumed that others were lost in the general study area and not recorded. Before radios and radar, many vessels were lost during storms and fogs. These events were recorded only as "missing at sea," whether they had just left the harbor, were returning after a long voyage, or were fishing in the area. The types of vessels included small and large fishing boats, coasters, and trans-oceanic merchantmen, whalers, and warships.

On the basis of background research concerning historic archaeological resources in the area, it is unlikely that any intact, significant historical archaeological resources or features other than shipwreck sites exist within Sites E and W. It was not possible to identify any shipwreck ruins that were specifically in either alternative site from historical research or interviews with local divers. Because little is known of the early vessels, the technologies and economies that created them, the onboard fishing processes, and life aboard the early merchant vessels, the remains of any historic ship or boat at Site E or Site W would be archaeologically and historically significant on a local, regional, and national level.

Numerous shipwrecks are known to exist in the areas surrounding Sites E and W, and additional shipwreck sites that have not been identified are likely. Side-scan sonar investigations did not locate any potential surface features related to cultural or historic events in either Site E or Site W.

3.17.7 Other Legitimate Uses

Tourism is currently Rhode Island's second leading industry. In 2001, 15.7 million visitors spent $3.26 billion dollars on tourism activities (RIEDC, 2003b). This included 5,440 businesses contributing 38,931 jobs and more than $669 million in full-time equivalent wages. In 1998, tourism activity supported 30,000 employees and produced revenues of $2.5 billion (Corps, 2001a). In the same year, 4,900 businesses employed 33,000 workers, accounting for more than $500 million in full-time equivalent wages.

The RIEDC states that Narragansett Bay is the key to a state tourism industry that generated approximately $1.7 billion in travel, tourism, and related sales in 1998 (RIEDC, 2003b).

The economies of Block Island, Rhode Island, and Martha's Vineyard, Massachusetts, depend on tourism and the ferry services that bring most of the tourists. About 300,000 tourists visit Block Island each year. Most tourists stay on the island for two or more nights. Tourism expenditures total about $60 million and generate the equivalent of about 450 jobs annually; in 1999, tourism expenditures generated $2.2 million in lodging and general sales tax revenues. On average, tourists spend about $200 per person on the island during each visit (Corps, 2003o).

According to the Massachusetts Travel Study, tourists visiting Martha's Vineyard each year spend over $105 million and are responsible for 1,300 jobs that generate $29 million in wages. Visitation figures comparable to those for Block Island are not available, but the Commonwealth of Massachusetts reports that Cape Cod, Nantucket, and Martha's Vineyard collectively host over 4.7 million visitors a year. Martha's Vineyard accounted for about 11.9 percent of the spending for the area, and approximately 10 percent of the payroll, employment, and state taxes attributable to the area, so it likely also accounts for an approximately equal percentage of visitors, or about 450,000 persons (Corps, 2003o).

3.17.8 Areas of Special Concern

Areas of special concern in the ZSF include several state and Federal parks and management areas. State parks include all of the state beaches and Fisherman's Memorial State Park in Point Judith. Several management and conservation areas exist within the ZSF and Economic Study Area (Table 3-39).

The ZSF is home to 12 barrier beaches that are Federally protected as units of the United States Department of the Interior's Coastal Barrier Resources System (Rhode Island Department of Administration, 1986). These include Quicksand Pond, Briggs Marsh, Long Pond, Round Meadow Pond, Sakonnet Point/Harbor, Card Ponds, Green Hill Beach, East Breach, Quonochontaug Beach, Mashaug Ponds, Napatree Point, and Block Island. There are no marine sanctuaries or other open-water refugees in the ZSF.

Table 3-39. Special Management Areas.

Special Management Areas	Location
Rhode Island	
Napatree Point Conservation Area	Watch Hill
Quonochontaug Conservation Area	Quonochontaug
Ninigret Conservation Area	Charlestown
Ninigret National Wildlife Refuge	Charlestown
Charlestown Management Area	Charlestown
Green Hill Management Area	Green Hill
Truston Pond National Wildlife Refuge	Green Hill
Matunuck Management Area	Matunuck
Galilee Bird Sanctuary	Galilee
Block Island National Wildlife Refuge	Block Island
Southeast Massachusetts	
Waquoit Bay National Estuarine Research Reserve Area of Critical Environmental Concern (ACEC)	Falmouth
Manuel F. Correllus State Forest	Martha’s Vineyard
Horseneck Beach State Reservation	Westport
Demarest Lloyd State Park	Dartmouth
Fort Phoenix State Reservation	Fairhaven
Fall River Heritage State Park	Fall River
Gay Head Cliffs National Natural Landmark	Martha’s Vineyard
Pocasset River ACEC	Bourne
Bourne Back River and Headwater Wetlands ACEC	Bourne
Chappaquiddick Island Important Bird Area (IBA)	Martha’s Vineyard
Bird Island IBA	Marion
Ram Island IBA	Ram Island IBA
Great Sippewisett Marsh and Black Beach IBA	Falmouth
Fixed buoy site (permitted by the Corps for deployment of up to 30 long lines for culturing blue mussels; currently used by Woods Hole for testing oceanographic instruments contained on fixed buoys)	Approximately 5 nmi east of Site E

Source: Pogue and Lee, 1993; Massachusetts Audubon Society, 2003; Massachusetts Parks, 2003; National Park Service, 2003; Massachusetts Department of Conservation and Recreation (formerly MA DEM) Division of State Parks & Recreation, 2003
ACEC = Area of Critical Environmental Concern
IBA = Important Bird Area

3.17.9 Economic Baseline

Economic data for navigation-dependent activities were evaluated for purposes of this EIS in a report titled *The Economic Significance of Navigation-Dependent Industries Within the Zone of Siting Feasibility (March 2004)* (Corps, 2004d). The findings of the economic study are summarized in this section.

For purposes of the economic study, an Economic Study Area was established to extend beyond the ZSF in order to capture all relevant economic data from southeastern Massachusetts that may influence the ZSF. The Economic Study Area (Figure 3-71) includes Rhode Island's coast, including Narragansett Bay and Block Island, and a portion of the southern coast of Massachusetts beginning at the Rhode Island state line and extending along the coast eastward to Falmouth, including Martha's Vineyard. Therefore, information presented in this section is not discussed in terms of the ZSF only, but rather as the Economic Study Area. Extending the area considered for the economic baseline beyond the ZSF ensured that economic factors (employment, taxes, labor income, output, and GSP) that are influenced by activities within the ZSF were considered.

The purpose of the economic study was to evaluate the economic significance of navigation-dependent activities within the Economic Study Area based on employment, income, output (total spending), GSP, and tax revenue. The analysis was conducted for small geographic areas, and in many cases, individual harbors, to be consistent with shoaling and dredging data, which are harbor-specific (Table 3-40). The number of slips or moorings for each geographical area is also given in Table 3-40 to indicate the relative size of each area studied. New Bedford and Fairhaven harbors and Taunton River, which lie within the Economic Study Area, were excluded from the economic analysis due to a finding by EPA that dredged materials taken from those locations are not suitable for open-water disposal (Corps, 2003o). The Economic Study Area includes harbors within Narragansett Bay, southern Rhode Island, Block Island, Buzzards Bay and southern Cape Cod and the Islands, as shown on Table 3-40.

The economic significance report (Corps, 2004d) divided economic activity within the Economic Study Area into four categories: boating, commercial fishing, water transportation, and other, as described below.

- "Boating" includes (1) boat building, which encompasses construction and repair of recreational and small commercial vessels, and (2) marinas, which includes all activity directly related to recreational boating (although not inclusive of shipbuilding).
- "Commercial fishing" includes finfishing, shellfishing, and sport fishing.
- "Water transportation" includes both the movement of foreign and domestic freight and associated water transportation services and operation of ferry services.
- "Other" includes activities not otherwise included above, the most significant of which was related to processing seafood for commercial sale (Corps, 2004d; Corps, 2003o).

Table 3-40. Geographic Areas within the Economic Study Area.

Location		Harbors	Slips and Moorings
RI	Narragansett Bay	Apponaug Cove	380
		Bullocks Point Cove	427
		Greenwich Bay	250
		Newport Harbor	706
		Pawtuxet Cove	120
		Providence River and Harbor	634
		Sakonnet Harbor	648
		Seekonk River	0
		Warwick Cove	1,581
		Wickford	387
		Other Narragansett Bay, RI	2,030
		Total Narragansett Bay, RI	**7,163**
	Southern Rhode Island and Block Island	Point Judith	900
		Pawcatuck River, Little Narragansett Bay, Watch Hill Cove	658
		Other So. Rhode Island & Block Island	347
		Total So. RI & Block Is.	**1,905**
		Total RI	**9,068**
MA	Narragansett Bay	Fall River	1,124
	Buzzards Bay	Southern Cape Cod Canal	0
		Onset Bay	492
		Wareham Harbor	525
		Other Buzzards Bay	4,118
		Total Buzzards Bay	**5,135**
	Southern Cape Cod & the Islands	Vineyard Haven Harbor	165
		Falmouth Harbor	2,019
		Other So. Southern Cape Cod & the Islands	950
		Total So. Southern Cape Cod & the Islands	**3,134**
		Total MA	**9,393**
		STUDY AREA TOTAL	**18,461**

Source: Slips and Moorings from *Boating Almanac, Long Island, Connecticut, Rhode Island and Southern Massachusetts*, Volume 2, 1993, Boating Almanac Company.
Corps, 2004d

For each industry noted above, the economic analysis evaluated 11 industry groups that contribute to boating, commercial fishing, water transportation, and other navigation-related activities. The 11 industries are:

- Agriculture
- Mining
- Construction
- Manufacturing
- Transportation, communications, and public utilities (TCPU)
- Trade
- Finance, insurance, and real estate
- Services
- Government
- Other
- Institutions

The "agriculture" category includes commercial fishing. Agriculture and the other categories are consistent with Standard Identification Classification (SIC) codes and conform to the parameters of the economic model (IMPLAN Pro 2.0), as described below.

IMPLAN Pro 2.0 Model

To estimate the economic contribution of navigation-dependent activities to the Economic Study Area (Corps, 2004d), the Minnesota IMPLAN Group's IMPLAN Pro 2.0 Model, a widely used economic impact model, was used. Employment values to model (or estimate) labor income, output (total spending), GSP, and tax revenue were also used. Employment is a good indicator of the magnitude of the navigation-dependent activities and is compatible with the economic impact model used. The RIEDC provided employment information for each Rhode Island harbor within the study area. Comparable employment data for the Massachusetts harbors was not available. However, because activities in both Rhode Island and Massachusetts harbors were very similar, employment for the navigation-dependent activities in Rhode Island was used to estimate the level of similar activities for harbors in Massachusetts (Corps, 2004d).

Modeling Results

For each economic factor measured, direct, indirect, and induced values were determined:

- Direct values are values that that can be measured directly, such as wages earned per employee.
- Indirect values include any contribution that has an effect on the production of navigation-dependent activities. For example, water transportation requires fuel, and the production of fuel may require chemical production.
- Induced values account for the spending of incomes earned by the employees who produce the direct and indirect products. For example, employees in water transportation spend their incomes on consumer goods, which is received as income by the businesses where the spending occurs, which in turn accounts for further spending by the businesses (Corps, 2003o).

Using the IMPLAN Pro 2.0 Model, economic factors (employment, labor income, GSP, output [total spending] and taxes) were evaluated for the Economic Study Area. Direct, indirect, and induced values were estimated by industry (Table 3-41, Table 3-43, Table 3-45, and Table 3-47) and summarized for each navigation-dependent activity (boating, commercial fishing, water transportation, and other) (Table 3-42, Table 3-44, Table 3-46, and Table 3-48).

Employment and Income

Employment was measured in terms of full-time jobs; therefore, a larger number of individuals might be employed than were accounted for because some are employed part-time. For 2000, it was estimated that navigation-related activities in the Economic Study Area accounted for a total of 56,377 jobs (Table 3-41) (Corps, 2004d). The TCPU and service industries (e.g., restaurants) accounted for the most jobs, providing 16,182 and 16,164 jobs, respectively.

Table 3-41. Employment (by Industry) for Navigation-Dependent Activities Within Economic Study Area (2000).

Industry	Direct	Indirect	Induced	Total
Agriculture	1,242.0	63.4	84.9	1,390
Mining	0.0	3.7	0.8	5
Construction	39.0	478.3	283.3	801
Manufacturing	9,437.0	1,372.7	504.1	11,314
TCPU	12,042.0	3,622.5	517.0	16,182
Trade	440.0	1,082.3	5,014.4	6,537
Finance, Insurance and Real Estate	0.0	1,292.7	1,062.1	2,355
Services	576.0	8,071.2	7,516.6	16,164
Government	282.0	258.0	928.0	1,468
Other	0.0	0.0	163.0	163
Institutions	0.0	0.0	0.0	0
Total	24,058.0	16,244.6	16,074.2	56,377

Source: IMPLAN model based on Rhode Island Economic Development Center data (Corps, 2004d.)
TCPU = transportation, communications and public utilities.

Table 3-42 summarizes the number of jobs provided by the boating, commercial fishing, water transportation, and other navigation-dependent activities within the Economic Study Area.

Table 3-42. Summary of Employment for Navigation-Dependent Activities within Economic Study Area (2000).

Activity	Direct	Indirect	Induced	Total
Boating	8,409.0	1,826.0	3655.9	13,891
Commercial Fishing	1,242.0	36.9	444.2	1,723
Water Transportation	12,042.0	13,031.8	10,210.6	35,284
Other	2365.0	1349.9	1763.5	5,479
Total	24,058.0	16,244.6	16,074.2	56,377

Source: IMPLAN model based on Rhode Island Economic Development Center data (Corps, 2004d)

Water transportation provided the most jobs, employing an estimated 35,284 people. Boating provided employment to almost 14,000 persons, while 1,723 jobs depended on commercial fishing and 5,479 jobs depended on “other” navigation-dependent activities (Table 3-42).

The navigation-dependent activities in the Economic Study Area were found to employ approximately 24,058 individuals *directly*. This translated to an employment multiplier of 2.3 (56,377/24,058), which means that every navigation-dependent job generated an additional 1.3 jobs in the Economic Study Area (Corps, 2004d; Corps, 2003o).

Direct and indirect labor income was derived from employment data and reflects wage, salary, and other labor payments. These incomes generate induced income based on estimates of the dollars spent by navigation-dependent workers at local business establishments. The labor income generated from navigation-dependent industries was estimated to be $2.4 billion in 2000, with manufacturing and TCPU contributing the most revenue ($471 million and $640 million, respectively) (Table 3-43) (Corps, 2004d).

Table 3-43. Labor Income (by Industry) for Navigation-Dependent Activities Within the Economic Study Area (2000).

Industry	Direct ($ millions)	Indirect ($ millions)	Induced ($ millions)	Total ($ millions)
Agriculture	46.5	0.9	1.3	48.7
Mining	0.0	0.3	0.0	0.3
Construction	2.0	23.9	13.9	39.8
Manufacturing	368.2	73.5	29.4	471.1
TCPU	445.0	164.1	31.0	640.1
Trade	27.3	63.5	140.9	231.7
Finance, Insurance and Real Estate	0.0	76.3	60.4	136.7
Services	26.0	450.6	277.4	753.9
Government	18.6	14.4	45.2	78.2
Other	0.0	0.0	2.2	2.2
Institutions	0.0	0.0	0.0	0.0
Total	933.5	867.5	601.7	2,402.7

Source: IMPLAN model based on RIEDC data (Corps, 2004d)
TCPU = transportation, communications and public utilities.

Table 3-44 summarizes income generated by boating, commercial fishing, water transportation, and other navigation-dependent activities. The largest contributor to labor income was from the water transportation industry, which provided approximately $1.5 billion in labor income in the year 2000, accounting for over 60 percent of labor income attributed to navigation-dependent activities in the Economic Study Area (Table 3-44).

Table 3-44. Summary of Labor Income for Navigation-Dependent Activities Within the Economic Study Area (2000).

Activity	Direct ($ million)	Indirect ($ million)	Induced ($ million)	Total ($ million)
Boating	318.5	94.1	136.8	549
Commercial Fishing	46.5	1.8	16.6	65
Water Transportation	445.0	698.4	382.3	1,526
Other	123.5	73.2	66	263
Total	933.5	867.5	601.7	2,403

Source: IMPLAN model based on Rhode Island Economic Development Center data (Corps, 2004d)

Output

Output, or total spending, shows the total sales by all the navigation-dependent industries without regard to double-counting and overstates the actual economic contribution of an activity to its economy (Corps, 2004d). As shown in Table 3-45, total spending for the Economic Study Area exceeded $7.6 billion in 2000 (Corps, 2004d). Output from three industries—manufacturing ($1.6 billion), TCPU ($3.3 billion), and services ($1.3 billion)—accounted for more than 80 percent of total spending within the Economic Study Area (Table 3-45).

Table 3-45. Output (by Industry) for Navigation-Dependent Activities Within Economic Study Area (2000).

Industry	Direct ($ millions)	Indirect ($ millions)	Induced ($ millions)	Total ($ millions)
Agriculture	75.2	2.3	3.7	81.2
Mining	0.0	1.3	0.3	1.7
Construction	3.0	37.7	25.0	65.6
Manufacturing	1,217.0	247.2	106.2	1,570.5
TCPU	2,647.4	579.7	117.0	3,344.1
Trade	64.7	150.5	309.8	525.0
Finance, Insurance and Real Estate	0.0	221.7	322.8	544.4
Services	49.2	734.1	483.0	1,266.3
Government	132.6	44.6	71.7	248.9
Other	0.0	0.0	2.2	2.2
Institutions	0.0	0.0	0.0	0.0
Total	4,189.2	2,019.0	1,441.6	7,649.7

Source: IMPLAN model based on Rhode Island Economic Development Center data (Corps, 2004d)
TCPU = transportation, communications and public utilities.

Table 3-46 summarizes spending for boating, commercial fishing, water transportation and other navigation-dependent activities. The largest contributor to output for these four categories was from the water transportation industry, which provided approximately $5.1 billion in spending in the year 2000, accounting for 67 percent of total spending (Table 3-46). Total spending for boating activities was the second largest contributor to revenue spending at $1.6 billion in 2000.

Table 3-46. Summary of Output (Total Spending) for Navigation-Dependent Activities within Economic Study Area (2000).

Activity	Direct ($ million)	Indirect ($ million)	Induced ($ million)	Total ($ million)
Boating	986.8	266.7	327.9	1,581.4
Commercial Fishing	75.2	4.0	39.9	119.1
Water Transportation	2,647.4	1,572.7	915.7	5,135.7
Other	479.8	175.6	158.1	813.5
Total	4,189.2	2,019.0	1,441.6	7,649.7

Source: IMPLAN model based on Rhode Island Economic Development Center data (Corps, 2004d)

Gross State Product (GSP)

The GSP is the economic measure of production or output. The GSP measures the contribution that selected industrial activities make to the economies of which they are part. GSP, the regional equivalent of Gross Domestic Product (GDP) at the national level, is the most comprehensive measure of economic value or contribution for economic activities.

Table 3-47 lists the industries that contributed to the major navigation activities shown in Table 3-48. The largest contributors were TCPU ($974.8 million), followed by services ($846 million), and manufacturing ($588.3 million) (Corps, 2004d).

Table 3-47. GSP Impacts (by Industry) of Navigation-Dependent Activities Within the Economic Study Area (2000).

Industry	Direct ($ millions)	Indirect ($ millions)	Induced ($ millions)	Total ($ millions)
Agriculture	70.6	1.5	2.0	74.1
Mining	0.0	0.7	0.2	0.8
Construction	2.1	26.2	15.4	43.7
Manufacturing	443.5	100.2	44.6	588.3
TCPU	667.2	238.4	69.2	974.8
Trade	44.9	104.2	224.1	373.2
Finance, Insurance and Real Estate	0.0	148.9	227.2	376.0
Services	28.5	502.7	314.8	846.0
Government	61.8	19.5	57.4	138.7
Other	0.0	0.0	2.2	2.2
Institutions	0.0	0.0	0.0	0.0
Total	1,318.6	1,142.3	957.1	3,418

Source: IMPLAN model based on RIEDC data (Corps, 2004d)
TCPU = transportation, communications and public utilities.

Table 3-48 shows the GSP for the major industries associated with navigation (boating, commercial fishing, water transportation, and other) within the Economic Study Area.

Table 3-48. Summary of the Economic Value (GSP Contribution) of Economic Study Area Navigation-Dependent Activities (2000).

Activity	Direct ($ million)	Indirect ($ million)	Induced ($ million)	Total ($ million)
Boating	371.5	141.1	217.6	730.2
Commercial Fishing	70.6	2.3	26.4	99.3
Water Transportation	667.2	896.0	607.9	2,171.2
Other	209.4	102.8	105.0	417.2
Total	1,318.7	1,142.2	956.9	3,417.9

Source: IMPLAN model based on RIEDC data (Corps, 2004d)

As Table 3-48 shows, navigation-dependent activities in the Economic Study Area *directly* accounted for about $1.32 billion of the GSP in 2000, and produced a total GSP of $3.42 billion. The data illustrate that water transportation is the most important navigation-related activity in the Economic Study Area in terms of both direct and total GSP impact, representing over 50 percent of the direct GSP and over 63 percent of the total GSP.

Overall, in 2000, navigation-dependent activities within the Economic Study Area contributed a total of $3.4 billion to the GSP. Rhode Island and Massachusetts had a combined GSP of $321 billion (Rhode Island: $36 billion; Massachusetts: $285 billion) in 2000 (Corps, 2004d). Therefore, navigation-dependent industries within the Economic Study Area accounted for one percent of the total GSP for Rhode Island and Massachusetts.

Tax Revenue

In 2000, navigation-dependent jobs in the Economic Study Area generated $2.4 billion of labor income, which in turn generated tax revenue at the Federal, state, and local level of $974 million. At the Federal level, $709 million of taxes were generated, mostly as personal income tax ($309 million). At the state and local level, $265 million in taxes were generated, with personal income taxes ($88 million) and business property taxes ($84 million) being the largest contributors (Corps, 2004d).

3.18 AIR QUALITY AND NOISE

This section describes the general air quality and noise levels currently found in the ZSF and the two alternative sites. Changes in air quality can have implications for the health of humans working in or traveling through the general disposal operations area. Wildlife, such as birds and marine mammals and reptiles, could also be impacted by changes in the air quality. An increase in noise in the disposal operations area can be aesthetically unpleasing to humans passing through and damaging to humans who have longer exposure periods. Excessive noise can also cause wildlife to avoid the area.

The EPA designates an area as being "in attainment" for a particular pollutant if ambient concentrations of that pollutant are below its National Ambient Air Quality Standards (NAAQS).

The State of Rhode Island is currently considered a non-attainment zone for ozone (O_3)[3], meaning the NAAQS for O_3[4] have not been met. O_3 forms when nitric oxide, hydrocarbons, oxygen, and sunlight combine in the atmosphere. Nitrogen oxides are released during the combustion of fossil fuels (e.g., operation of gasoline- and diesel-powered construction equipment, including dredges, scows, and dump trucks). O_3 non-attainment zones are classified, in increasing degrees of severity, as marginal, moderate, serious, severe, and extreme. The entire State of Rhode Island is located in a serious non-attainment zone, meaning that it has an O_3 value between 0.16 and 0.18 ppm. This means that there was more than one day per year when the highest hourly O_3 measurement in Rhode Island exceeded the threshold of 0.12 ppm. If an area exceeded this threshold by no more than one day, then it is considered in attainment. To be in attainment, an area must meet this O_3 standard for three consecutive years.

The RIDEM monitors ambient air quality and creates and enforces air pollution control programs contained in its state implementation plan (SIP). One part of the RIDEM SIP[5] is an attainment demonstration that shows that by 2007, the Rhode Island non-attainment zone will meet EPA's O_3 NAAQS due to pollution control programs implemented by the state and EPA.

3.18.1 Rhode Island Region ZSF

There are varying levels of background noise in and around the ZSF. Noise in the vicinity of the Federal navigation channels can include that generated by vessels such as tankers, barges, and general cargo vessels. Noise created in the navigation channels is distant from shore and rarely noticeable to people and wildlife. Other parts of the ZSF are very quiet, open-water areas located far from the Federal navigation channels.

3.18.2 Alternative Sites

Sites E and W are located in an open-water area near a Federal shipping channel. The noise at these alternative sites includes sounds generated by a variety of large vessels, including tankers, barges, and cargo ships. Other noise in these areas is primarily natural in origin and considered normal background noise. The noise (vessel-generated and otherwise) originating at these sites is not audible from land.

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[3] Reference for RI's non-attainment area: EPA designated this area as such in a final rule published in the *Federal Register* on November 6, 1991 (56 FR 56694).

[4] EPA's O_3 NAAQS standards: 40 CFR 50.9 (1- hour standard), and 40 CFR 50.10 (8-hour standard).

[5] RIDEM's State Implementation Plan (SIP): 40 CFR 52.2070

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4.0 ENVIRONMENTAL CONSEQUENCES AND PREFERRED ALTERNATIVE SELECTION

This section forms the scientific and analytic basis for comparing the effects of the disposal alternatives considered in this document. It presents information about the disposal process and also about the generally known impacts of dredged material disposal to the marine environment. Environmental and socioeconomic impacts that may result from taking no action (i.e., not designating a long-term ocean disposal site) and from disposing of dredged material at either of the alternative sites (i.e., Site E and Site W) are also considered. Finally, this information, along with the information from previous sections, is used to identify the preferred alternative, defined as the alternative that provides the least environmental impact and the greatest socioeconomic benefit.

Sediment disposal activities can cause physical, chemical, or biological impacts to the environment. The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) recognizes this and requires the U.S. Environmental Protection Agency (EPA) to consider five general and 11 specific criteria (40 CFR Section 228.5 and 40 CFR Section 228.6) during the evaluation and designation of ocean dredged material disposal sites. These requirements, described in Section 2.0 of this Final Environmental Impact Statement (EIS), have been followed to avoid or minimize the potential for the designation of a dredged material disposal site in an area that may impact ecologically sensitive organisms or be located in an incompatible use area. The MPRSA also provides specific guidance to EPA regarding the evaluation of impacts at or near a site from disposal of dredged material. While not part of the site designation process, the criteria to identify impacts during and after disposal are provided in 40 CFR Section 228.10 of the Ocean Dumping Regulations.

4.1 KNOWN IMPACTS OF DREDGED MATERIAL DISPOSAL

The impacts of dredged material disposal at a designated site must be evaluated periodically as required by Section 40 CFR Section 228.10(a). Section 40 CFR Section 228.10(b) specifically requires consideration of the following types of potential effects when evaluating impacts at a dredged material disposal site: (1) movement of materials into such areas as sanctuaries or beaches and shorelines or productive fishery or shellfishery areas; (2) absence from the disposal site of pollutant-sensitive biota characteristic of the general area; (3) progressive changes in water quality or sediment composition at the disposal site when these changes are attributable to materials disposed of at the site; (4) changes in the composition or numbers of pelagic, demersal, or benthic biota at or near the disposal site; and (5) accumulation of constituents in marine biota at or near the site (i.e., bioaccumulation).

The following discussion of the known environmental consequences from disposal of dredged material was developed from a review of relevant literature that describes the impacts of dredged material disposal in the marine environment as they pertain to the impact criteria listed above. Many programs concerned with the impacts of dredged material disposal have been conducted across a broad range of spatial and temporal scales. The most relevant programs referenced in this Final EIS include:

- **Dredged Material Research Program (DMRP)** (Wright, 1978) – The multidisciplinary DMRP, conducted by the U.S. Army Corps of Engineers (Corps), was the earliest national program designed specifically to develop information on dredged material disposal impacts. The major factors evaluated under this early program included wave fields, ocean currents, changes in topography, and sediment geochemistry. These factors may influence the transport and fate of the material, releases of contaminants and nutrients from sediments both during and after disposal, and the interaction between the sediments and the living resources (e.g., plankton, invertebrates, fish, and shellfish) both in the water column and on the seafloor.
- **Long Island Sound Programmatic EIS** (Corps, 1980) – This study was conducted by the New England Division (now called the New England District) in the Long Island Sound and Block Island Sound regions of New England to characterize the impacts from open water disposal of dredged material. Factors such as turbidity in the water column, burial of benthic organisms, habitat alteration, and potential for bioaccumulation were considered from short- and long-term and cumulative impact perspectives.
- **The Field Verification Program** (FVP) (Peddicord, 1988) – The FVP was a 6-year EPA and Corps research program completed in 1988 that was designed to document and verify existing and predictive techniques for evaluating long-term effects of dredged material disposal at upland, wetland, and open-water disposal sites
- **Disposal Area Monitoring System** (DAMOS) (Fredette *et al*., 1993; Fredette and French, 2004) – DAMOS is a program that began in 1977 by the Corps New England Division to manage and monitor offshore dredged material disposal sites from Long Island Sound to Maine. DAMOS is a multi-disciplinary environmental monitoring program managed by the Marine Analysis Section of the Regulatory Division, New England District. The program also participates in relevant applied studies and conducts bathymetric and side-scan sonar surveys, underwater photography, sediment analyses, sediment profile photography, and biological analyses, among other techniques, to evaluate the impacts of dredged material disposal under a multi-tiered monitoring plan. A comprehensive review of the DAMOS program and the environmental consequences of dredged material disposal in New England are presented in Fredette and French, 2004.

Collectively, the programs cited above as well as other papers and reports provide a considerable amount of information on short-term and long-term impacts of dredged material disposal. These impacts can be classified as direct, indirect, and cumulative as defined in the Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) and can be beneficial or adverse.

Sections 4.1.1 through 4.1.4 summarize the overall processes that occur during disposal of dredged material in open water and the direct, indirect, and cumulative impacts associated with this disposal. Discussion of the impacts is organized around the following areas:

- Water column
- Topography
- Erosion and transport of deposited dredged material
- Bioaccumulation of contaminants

4.1.1 Open Water Disposal Processes

To assess the potential impact of dredged material disposal to the marine environment, it is important to understand the dynamics of the dredged material as it is transferred from barges operating on the surface to a disposal site on the seafloor. Several factors influence the behavior of the descending plume, including the properties of the sediment (e.g., mud, sand, clumps, etc.), water depth, water column stratification, and interplay of the descending sediment with the water through which it passes. In general, the behavior of the plume can be described as occurring in three general phases—convective descent, dynamic collapse, and passive diffusion—shown in Figure 4-1 and discussed below (Scorer, 1957; Woodward, 1959; Csanady, 1973; Brandsma and Divoky, 1976, Tsai and Proni, 1985; Ecker and Downing, 1987; Kraus, 1991).

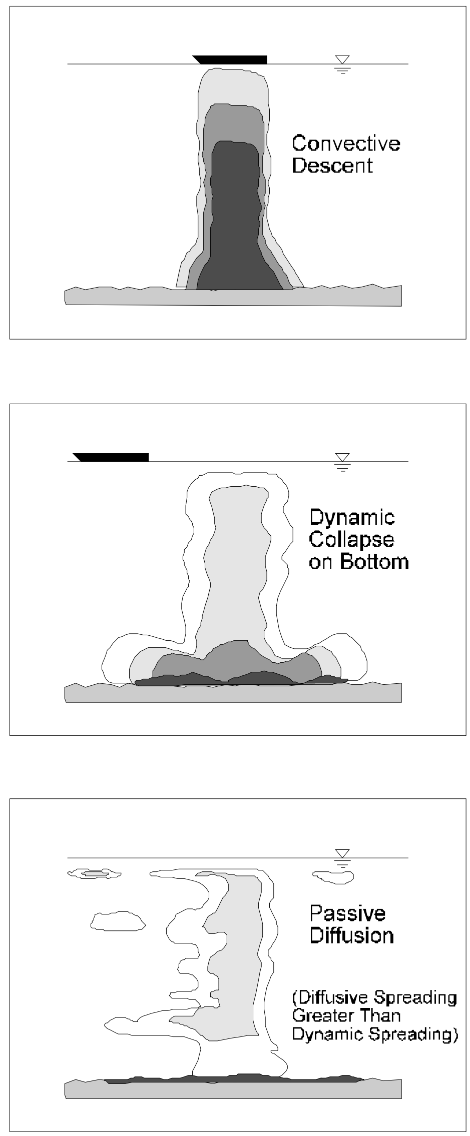


Figure 4-1. Examples of Convective Descent, Dynamic Collapse, and Passive Diffusion (not to scale).

The behavior of the plume follows three phases during release of a volume of dredged material from a barge into the water column:

- ***Convective descent***. This phase begins with the release of the material from the transport device (disposal scow). During this phase, the material descends through the water column under the influence of gravity, generally maintaining its identity as a single mass (Brandsma and Divoky, 1976; Figure 4-1). During its descent, the area occupied by the plume expands as the local water is entrained into the descending cloud of dredged material. Kraus (1991) found that plumes resulting from the disposal of up to 5,000 cubic yards (CY) of sediment (most scows fall in this range of size) in waters up to 65 feet (ft) deep spread 300 to 600 ft during the convective descent phase. In addition, the suspended sediment concentration was reduced by turbulence and dilution with the surrounding water mass. The duration of this phase depends on the depth of the water, lasting from seconds in relatively shallow areas to minutes in waters over 300 meters. Field and laboratory studies indicate that approximately 1 to 5 percent of the sediment discharged from a barge remains in the water column following the convective descent phase (Ruggaber and Adams, 2000a; Ruggaber and Adams, 2000b; Tavolaro, 1984; Corps, 1986).

- ***Dynamic collapse***. This phase occurs when the descending plume impacts the bottom or reaches a neutrally buoyant position in the water column and diffuses horizontally under its own momentum (Figure 4-1). In areas with strongly stratified water columns, particularly in water columns of several thousand feet, this process is complicated because portions of the plume may attain neutral buoyancy before hitting the seafloor. In those situations, a portion of the descending mass loses its downward momentum and comes to reside as a plume at its neutrally buoyant depth. The plume can oscillate around the depth of neutral buoyancy, creating a vertical oscillation of material. The residence of the materials within such an oscillation results in increased turbulence in the water column and increases the speed with which the plume dilutes and spreads horizontally as it comes into hydrostatic equilibrium. Studies have shown that this condition does not occur in waters less than 80 meters. This is because the sediment impacts the bottom regardless of the water stratification. This is due to the fact that the initial momentum and specific gravity are too great to be overcome by the plume buoyancy. Depending on water depth, dredged materials may have sufficient momentum to travel laterally for hundreds of feet upon impacting the bottom.

- ***Passive diffusion***. Passive diffusion refers to the transport and dispersion of the disposed material by the ambient oceanographic conditions (currents and turbulence) rather than the hydrodynamics occurring during the descent of the plume body (Figure 4-1). This phase results in the dispersion and transport of the suspended sediments and may last for several hours. Numerous field studies have confirmed that plumes are transient features of dredged material disposal from barges (Dragos and Lewis, 1993; Dragos and Peven, 1994; SAIC, 1988).

Verification of Dredged Material Disposal Plume Dynamics

During the disposal operation, a portion of the dredged material released (generally a fraction of any fine silt and clay particles present) may remain in the water column as a turbid plume for several hours, where it will drift with the current. Dredged material plume dynamics have been verified at several sites in New England and in other locations in the United States. For example:

- 500 to 5,000 CY of dredged material released in shallow depths of 50 to 66 ft in the Gulf of Mexico (Kraus, 1991) had an associated plume spread (widening) of 110 to 220 yards during the convective descent phase.
- Increased turbidity from the plumes in the water column has been documented for up to 2 hours (hrs) after the disposal of 4,000 to 6,000 CY of dredged material in the New York Bight (water depth approximately 92 ft) (Dragos and Lewis, 1993; Dragos and Peven, 1994). Dilution of the dredged material within 2½ hrs of disposal had achieved ratios of 3,000:1 to 600,000:1 (based on total suspended solids (TSS) analyses of water samples). Observed plume spreading at that time was generally less than 550 yards, and local currents carried the plumes up to about 0.6 mile (mi) from the discharge point, which was

consistent with the current velocities at the time of the survey. Turbidity profiles collected throughout the disposal site and surrounding areas before and after disposal events did not find elevated turbidity in the vicinity of the disposal site that could be attributed to dredged material disposal (Dragos and Lewis, 1993; Dragos and Peven, 1994).

- Plume transport at the Rockland Disposal Site (RDS) in Maine was limited to approximately 0.3 mi (approximately 500 yards) from the point of discharge for a 1,900-CY disposal event (SAIC, 1988). However, the plume from a larger barge volume (3,640 CY) was transported at least 1,800 yards (approximately 1 mi) from the disposal point over a 2-hr period, with suspended solids concentrations decreasing by 99 percent of those initially measured (~1,500 milligrams per liter [mg/L], decreasing to 14 mg/L).
- Recent studies at the Massachusetts Institute of Technology (MIT) (Ruggaber and Adams, 2000a; Ruggaber and Adams, 2000b) used “flow visualization” devices in a laboratory setting to confirm that a small percentage of sediment remains in the water column after a disposal event. This laboratory study evaluated how plumes form and how sediment particle characteristics affect the plume formation. The study was also designed to determine how much material is incorporated into the descending cloud and how much is lost during convective descent. The study estimated that less than 1 percent of the original mass exiting the barge separates from the material contained within the collapse phase during the discharge and remains in the water column. This is in the lower range reported from field studies (Tavolaro, 1984; Corps, 1986)

These studies show that only a small amount of sediment remains in the water column after a disposal event and that, in general, the material is rapidly diluted and dispersed and is not discernible after 2 to 3 hrs.

4.1.2 Direct Impacts

CEQ regulations define direct impacts as those “which are caused by the action and occur at the same time and place” (40 CFR Section 1508.8). The following sections summarize the direct impacts of open water disposal of sediments to the water column and to topography (both physical and biological effects). Effects on the physical and biological environments due to erosional changes and bioaccumulation of contaminants are a result of indirect impacts and are discussed in Section 4.1.3.

Water Column

One of the primary impacts to the water column from open water disposal of dredged material results from residual particles that remain in the water column (i.e., turbidity) after most of the dredged material reaches the seafloor. Other impacts include (1) reduced light penetration induced by the residual sediment in the water column, which may reduce photosynthesis, and (2) the possible release of nutrients or contaminants from the sediments during the descent phase. Reduction in light penetration is usually short in duration (on the order of hours). Studies of the nutrient and other contaminant releases from the descending dredged materials show that the release is limited. The incremental addition of nutrients or contaminants from dredged material disposal, relative to other sources such as rivers, wastewater treatment facilities, and nonpoint sources, is small and inseparable from ambient conditions (Corps, 1982). The intermittent nature of the disposal operations, the short time period that material stays in the water column (usually less than 2 to 3 hrs), along with rapid dilution and settling further limit any potential effects.

Impacts to organisms in the water column from the disposal of dredged material in shallow waters are limited by the rapid descent and limited cross-sectional area of the descending material (i.e., the convective phase). Some entrainment of organisms, particularly phytoplankton, zooplankton, and larval stages of fish and invertebrates, may occur but is small compared to the number of organisms remaining in the surrounding water column in a particular area. Impacts from the descending sediment plume on pelagic fish, reptiles, and mammals has not been demonstrated but are expected to be small because these organisms either live at the sea surface (e.g., planktivorous fish) or are mobile enough to avoid the descending material. Wright (1978) noted that avoidance of disposal plumes by fish was suggested in some of the 1970s DMRP studies.

Topographic Changes

Topographic change occurs within dredged material sites over the course of site history. Initially, the disposed material creates a mound, changing the local topography. Mound building may be intermittent or continuous, depending on dredging cycles and projects. Final site topography depends on site management practices. Several long-term processes can reduce mound height or modify the mound topography after disposal is complete. These include physical and biological processes that act to "smooth" the roughness of the mound (Rhoads, 1994). Also, newly deposited dredged material compacts under its own weight and often deforms the seafloor beneath it. Both actions reduce the mound height. Bottom currents winnow, transport, and redistribute materials from the mound surface. The amount of transport and redistribution depends on the sediment texture (grain size), sediment cohesiveness, and current strength. Biological processes such as colonization (including burrowing) and foraging by megafauna also act to smooth the mound's surface, modify its resistance to erosion, and change its topography. These physical and biological processes may also modify the nature of the surface sediments on the mounds over time. Many studies have demonstrated that the upper inch or two of dredged material mounds can be winnowed of fine-grained sediments, leaving behind coarse sediments that are more resistant to erosion. Such winnowing eventually reaches an equilibrium distribution that reflects the critical erosion velocity at the site. (See also a more complete discussion of winnowing on page 4-12).

Numerous studies, including those of the DAMOS program, have documented the general stability of dredged material mounds through high-precision bathymetry surveys before and after active disposal operations, and periodically thereafter. Repeated high-precision bathymetry surveys (1992, 1995, 1997, 1998, and 2000) of the New London Disposal Site (NLDS), an active disposal site in eastern Long Island Sound located in 45 to 78 ft of water, have shown that the bathymetry (e.g., topography) of historic mounds is not changing (SAIC, 2001a, SAIC 2001b; and SAIC, 2001c). Similar observations have been made over the past 30 years at Site 16, the former Brenton Reef disposal site, in Rhode Island Sound. Bathymetric studies of the mound, created by the disposal of 9 million to 10 million (M) CY of dredged material in the late 1960s (Pratt *et al*., 1973), show that the mound dimensions (height and footprint) have not changed substantially (Corps, 1979; SAIC, 2001a) even though this site, located in approximately 100 ft of water, has been repeatedly exposed to major wave energy and currents of the mid- and north Atlantic Ocean in the 35 years since the mound was created. Sediment samples collected across the mound suggest that it had become armored with sand, which is more resistant to erosion from currents (Corps, 1979).

Another example of mound erosion and stability is an evaluation of sediment resuspension at the former Mud Dump Site in the New York Bight (Clausner *et al.*, 1996). This and other studies of this former dredged material disposal site found an absence of fine-grained sediments at depths shallower than 65 ft in the Bight Apex. Sediments shallower than 65 ft (e.g., on top of the inactive dredged material disposal mounds in the area) consisted primarily of coarser/sandy material. Sediments in deeper waters were more heterogeneous, with some areas in sheltered topographic depressions dominated by fine-grained sediments or mud. In this site, storm-induced erosion was determined to be significant at depths shallower than 65 ft. The areas of fine-grained sediments were attributed in part to the gradual removal of fine sediments from the mound tops and deposition in deeper, more sheltered waters. The erosion and winnowing caused the shallower areas to become progressively sandy, armoring the seabed and making it less prone to erosion. As a result, material deposited on the tops of the mounds in this area over the past century has formed a distinct topographic mound on the seafloor.

Site 16, in Rhode Island Sound, and the Mud Dump Site are similar in that they are located in waters exposed to a long fetch and can be more severely influenced by major storms. Both sites have also shown that distinct and stable disposal mounds can exist at these highly energetic locations even though some erosion of the mound may occur. The stability can be attributed in part to armoring, which enhances the mound's protection against resuspension, and thus transport.

Impact from mound building may be physical (changes in water depth) or biological (burial of organisms). Water depths above the dredged material disposal sites are set through the site designation process and the Site Management and Monitoring Plan (SMMP). Thus, interference with shipping and other vessel traffic is avoided. Disposal can bury organisms that are not able to avoid the descending dredged material cloud or to burrow through the deposited mound at rates that allow them to extricate themselves after burial by multiple disposal operations (Carey *et al*., 1997; Rhoads and Carey, 1997).

Burial can impact benthic organisms to varying degrees. Some organisms possess the ability to move through the sediment layer that deposits over them and others do not. Vertical migration through the deposited sediments is influenced by several factors including sediment type, sediment depth, burial duration, temperature, and adaptive features such as an organism's ability to burrow and to survive in low-oxygen conditions. Maurer *et al*. (1986) indicated that major taxa such as mollusks (clams), crustaceans (e.g., crabs, lobsters), and polychaetes (worms) responded differently to burial. Sediment type (e.g., mud, sand, and mixtures of mud and sand) greatly influenced the ability of buried organisms to migrate though the sediment to their normal depths of habitation. The type of disposed sediment compared to ambient sediment is also important to site recovery and the diversity of the community that recolonizes the area.

Also important are life habits of benthic organisms, such as feeding type (e.g., surface suspension feeders, deep-burrowing siphonate suspension feeders, infaunal non-siphonate suspension feeders, burrowing siphonate feeders). Organisms that burrow deeply into sediments tend to be able to survive greater burial depths, often up to 20 inches, and are thus less susceptible to impact from burial. Larger decapod crustaceans (e.g., shrimp species, lobster) have been particularly able to penetrate deeply into the sediment. Suspension feeders such as those above generally can survive only a few inches of burial (0.4 to 4 inches).

Burial becomes problematic if the buried organisms constitute a significant shellfishery, such as occurred in the late 1960s at Site 16, where an ocean quahog shellfish area was partially covered by a dredged material disposal mound (Pratt *et al*., 1973). The loss of this resource in Rhode Island Sound is not known to have altered the ecological communities of that area, but it did change the predominant fishery in and near the site (Pratt *et al*., 1973). Identification and avoidance of such resources during site designation will prevent a recurrence of this type of situation.

Erosion

Erosion does not generally result in a direct impact to deposited dredged material unless major storms cause catastrophic movement of deposited material. Understanding the potential for mound erosion based on storm frequency, intensity, and duration is a critical aspect of designating dredged material sites and implementing appropriate site management strategies (i.e., not allowing mounds to build higher than the critical erosion depth for a site). Historically, disposal sites located in water depths below the critical erosion depth potential have not been affected by major storms. For example, mound erosion from the passage of Hurricane Gloria over the Central Long Island Sound Disposal Site in 1985 did not result in significant loss of mound material from its historic mounds (Rhoads, 1994).

4.1.3 Indirect Impacts

Indirect impacts are those "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR Section 1508.8). This section discusses indirect impacts from the dredged material to the water column, the physical and biological environments caused by changes in topography and erosional effects, and indirect impacts to organisms through bioaccumulation of contaminants.

Water Column

Potential indirect effects on the water column from dredged material disposal include the release of nutrients or contaminants during the descent phase and changes in the light penetration (i.e., increased turbidity) that could reduce photosynthesis. However, as noted above, the releases are minor in volume, and the effects on phytoplankton activity are limited by that reality and the intermittent nature of disposal, which reduces the duration of exposure, particularly in surface waters where the majority of phytoplankton growth occurs. Rapid dilution and settling further limit this type of indirect effect.

Other indirect impacts may include interference with normal physiological processes of fish, shellfish, and other invertebrates. For example, the turbidity resulting from disposal was speculated as a possible impact to animals through mechanical damage to respiratory surfaces (Saila *et al*., 1971). Saila pointed out, however, that "aquatic animals are able to tolerate high concentrations of suspended sediments for short periods" and discussed several experimental studies demonstrating that (1) damage to fish did not occur at suspended solids concentrations of up to 300 grams per liter (g/L), and (2) mortality of lobster, attributable to exposure to high sediment concentrations, was not observed after exposure for 24 hrs at up to 3,200 parts per million (ppm) (3.3 g/L) of clean estuarine silt. Because the tolerance level for suspended solids is high, and fish and lobster experience major changes in turbidity during storms, Sissenwine and Saila (1973) concluded that mortality due to elevated particulate matter concentrations in the water column from dredged material disposal is not likely. Harding (1992) concluded that disposal of dredged material is too localized and infrequent to represent much of a threat to the planktonic larvae of the lobster.

Topographic Changes

In addition to topographic changes within a disposal site, dredged material disposal may result in physical changes to the sediment characteristics within the site, including texture (e.g., grain size) and organic carbon content. This may indirectly affect the types and quantities of organisms that live there. Such changes may be an outcome of the actual disposal (e.g., mud on sand, sand on mud, or intermediate sediment texture) or may result from alteration in the sediment texture through erosion. This and other changes define the type of habitat that is available for benthic organisms to colonize, and thus may influence the types of organisms and benthic community that can live and thrive on the mounds. This in turn may influence the use of the disposal site by higher trophic levels and potentially affect the response of commercially and recreationally important species to the mound. For example, fine-grained sediments from harbor dredging may alter the preferred habitat of juvenile and adult lobsters in the short term by disrupting their shelter and food resources.

Recolonization of the surface sediments by benthic organisms is an important indicator of potential impacts from disposal. Sediments disturbed by natural processes or dredged material disposal operations may be recolonized by aquatic organisms through several mechanisms. As summarized in Maurer *et al*. (1986), recolonization mechanisms may include (1) emigration of adults from undisturbed areas, (2) seasonal reproduction and larval recruitment from undisturbed areas, (3) vertical migration through the sediments, and (4) nocturnal swimming. Each mechanism can influence the rate of recolonization as they depend on natural reproductive cycles and active or passive transport to the affected sediments. The relative importance of the above recolonization mechanisms to site recovery is specific to the conditions in the site, the communities in sediments adjacent to the disposal site, and the life cycle of the various organisms.

The recolonization and rate of dredged material disposal mound recovery has been studied extensively over the past 30 years. Sediment recolonization may follow a systematic progression similar to that described by Rhoads and Germano (1982, 1986) or other progressions as suggested by others (Zajac and Whitlach 1988, 1989; Pranovi *et al*., 1998, among others). This successional progression forms the basis for evaluating benthic community recovery on dredged material mounds in the northeast and is amenable to rapid assessment using sediment profiling camera systems, commonly referred to as sediment profile imaging (SPI). The successional process is generally categorized as proceeding from Stage I (pioneering assemblages) through Stage II (infaunal deposit feeders) to Stage III assemblages (typically head–down, deposit-feeding organisms). The measurement tool used in these assessments is often supplemented with traditional benthic community analysis of grab samples to verify the remotely sensed information. Studies in Long Island Sound at the NLDS in the late 1990s documented general agreement between results from traditional benthic infaunal grab sample methods and the successional and assemblage information obtained from the camera system (SAIC, 2001a).

DAMOS and other programs have repeatedly documented rapid recolonization of mound surfaces with infaunal assemblages typical of the sediments surrounding the disposal site. For example, monitoring at the NLDS (SAIC, 2001a; SAIC, 2001b; SAIC, 2001c) showed that the impact to infaunal community was confined to the deposition footprint of the mound and that a gradient in benthic assemblages and communities existed across a mound within 1 to 2 years of disposal. Initial mound recolonization may be rapid (months) and often proceeds from Stage I to Stage II/Stage III assemblages within a few years. These studies also documented that the recovery of the mound apex, which is generally the most disturbed area, tended to be slower than recovery at the mound apron, where deposited sediments are thinner and physical disruption of the seafloor is lower. Such gradients are consistent with the findings of Maurer *et al*. (1986) relative to the ability of organisms to migrate through various thicknesses of sediments after burial. Mounds that have been in place at the NLDS for several years consistently supported mature benthic assemblages similar to reference areas outside of the disposal site (SAIC, 2001c).

Saila *et al.* (1971) studied benthic infauna populations in and around the Brenton Reef (Site 16) disposal site in Rhode Island Sound in the early 1970s and found that much of the original material that had been dredged and deposited at Site 16 contained few organisms. However, after 1 to 3 years of exposure, sediment surfaces had been colonized by large numbers of species, including those assemblages found naturally in the area (e.g., the tube-building amphipod *Ampelisca agassizi*) as well as some species not naturally occurring in great abundance in the surrounding sediments (e.g., several species of deposit-feeding polychaetes and the amphipod *Leptocheirus pinguis*). Repopulation of the site was not complete after 1 year (Pratt *et al*., 1973); however, colonization of the mound was well under way within 3 years of final disposal activities (Saila *et al*., 1971). In addition, even though the material at the disposal site was generally silty, most of the species colonized on the disposal mound were members of the surrounding sand bottom assemblage. Saila *et al.* (1971) concluded that the dominant amphipod species that characterized the sandy sediment in the disposal area outside of the mound (*Ampelisca agassizi*) would eventually dominate the disposal site, as it had the surrounding area.

Recent studies (Corps, 2002a) showed that infaunal communities at Site 16 consisted of the same two general faunal assemblages found elsewhere in Rhode Island Sound (see Section 3.9). These community types bore little resemblance to the communities present on the disposal mound shortly after disposal ceased in the early 1970s. Many of the taxa present at the site in the 1970s were not found there in 2001. Therefore, it appears that the infaunal communities at Site 16 in 2001 were more similar to present-day Rhode Island Sound benthic infaunal communities than to those that initially colonized the disposal mound 30 years ago, indicating a progression on the mound from a disturbed community to one that is typical of the Sound today.

DAMOS has documented similar recovery at other dredged material sites in New England. Of particular interest is the RDS located within West Penobscot Bay, Maine. The site, which is in about 230 ft of water, received dredged material through the 1980s, with about 27,000 CY disposed of in the 1990s (SAIC, 2001d). The 2000 survey concluded that the "seafloor within the RDS has recovered from the disturbance caused by past dredged material placement and that the benthic conditions were now equal to or better than the surrounding areas of seafloor" (SAIC, 2001d).

Features such as sharp temperature changes, abrupt changes in topography or bottom type, or artificial structures (artificial reefs) are said to be indicators of the best locations to find and land fish and motile shellfish such as lobster. Clark and Kasal (1994) explored the concept of stable dredged material mounds providing substantial fisheries resource benefits as a long-term management objective for dredged material disposal. The basis of their hypothesis (i.e., that mounds create conditions conducive to enhanced fisheries production) also appeared in earlier anecdotal reports of fishery utilization of dredged material mounds as habitat (Corps, 1979).

Few definitive scientific studies of this phenomenon have been conducted since publication of Clark and Kasal's early concept paper. However, abundant anecdotal evidence from other areas adds credence to the theory. Fishermen from Long Island Sound (Corps, 2003a) repeatedly and consistently reported that trawling and lobstering near active disposal sites was more productive than when disposal was not active. This is consistent with early studies on impacts of dredged material disposal by the Corps Waterways Experiment Station (WES) as part of the DMRP (Wright, 1978), which included reports that the former Eaton's Neck Dredged Material Disposal Site in western Long Island Sound was one of the best lobstering locations in the Sound. It was believed that this was primarily due to the changes in topography and bottom type from the disposal of sediments and other material. Finfishing in the vicinity of Site 16 was not worse following dredged material disposal, although quantitative studies were not reported. Sissenwine and Saila (1973) found no linkage of a declining scup fishery to the disposal activity at Site 16. Interviews with fishermen and available reports also confirmed that fishing in the vicinity of mounds was no worse than in areas away from the mounds, and at times was better.

Erosion – Indirect Physical and Biological Impacts

Erosion may result in movement of the deposited sediments away from the point of impact with the seafloor and, if extensive enough, out of the disposal site. Factors influencing erosion include water depth, duration, and strength of storm disturbances, intensity of local currents (tidal currents), mound configuration, and sediment characteristics. Erosion may occur at a disposal site through two processes. The first process is intermittent and related to storm events, which may impart energy to the seafloor, causing deposited particles to lift into the water column. Erosion caused by storms depends greatly on the water depth; intensity, duration, and direction of winds; and the type of material on the mound (sand, silt, etc.). Erosion caused by this process may resuspend and transport a few inches of sediments, although the amount resuspended and transported is site- and storm-specific.

Understanding the potential for erosion based on storm frequency and intensity is a critical aspect of designating dredged material sites and implementing appropriate site management strategies (i.e., not allowing mounds to build higher than the critical erosion depth for a site). Sites located in water depths below the critical erosion depth potential are typically not affected by major storms. For example, mound erosion from the passage of Hurricane Gloria over central Long Island Sound in 1985 did not result in measurable loss of mound material from its historic mounds (Rhoads, 1994), although possible changes of several inches in mound height may have occurred.

The second erosion process is related to the normal movement of bottom water by tidal and other local currents. Erosion associated with these currents is periodic and less intense than that experienced during storms. Current velocity, mound configuration, and sediment type greatly influence the amount of erosion that occurs. This type of erosion can cause a change in the texture of sediments on the mound surface over time. Armoring, which results when the fine-grained sediments and organic matter are removed, creates sediment that consists of coarser material, which requires more energy to erode, further reducing the potential for erosion to occur.

The changes in sediment texture and loss of organic particles affect the habitat, and thus may influence the assemblage of organisms that eventually inhabit the sediment. The long-term monitoring results from the NLDS (SAIC, 2001c) documented the interplay between the surface sediments and benthic community that inhabited the mounds. The flow of currents over bottom material sifts and separates the fine material from the heavier sediments; this effect is called winnowing. Winnowing of fine material from the sediments at other sites has been noted in several monitoring reports from the New England region. For example, the apex of the Site 16 mound changed from relatively fine material to a sand cover by 1978 (Corps, 1979), probably as result of winnowing. The winnowing effect extended across the mound to a water depth of 95 ft. The sand armor was believed to have increased resistance to further erosion.

The biological community associated with the sediments also influenced whether erosion can occur (e.g., organisms may loosen the sediments, allowing easier resuspension, or form mats that restrict the ability of the currents to lift the sediments). The interplay between erosion and benthic organisms may also affect higher trophic levels (a feeding stratum in the food chain) by providing more or less prey at a given location or prey that is more or less suitable for a variety of species. Over time, and in the absence of major physical disturbances, this interplay would establish or reestablish biological communities on the mounds as described previously. The time frame for the changes in these benthic communities has been extensively studied on dredged material mounds. Thus, mound erosion has three elements that relate to indirect impact of dredged material disposal: (1) recovery of benthic communities following disposal, (2) habitat changes on the mound through time, and (3) influence of these change on the food web, including commercial and recreational fisheries in and near a site over time. All of these impacts are localized to the disposal site and immediately adjacent areas.

Bioaccumulation

Bioaccumulation is defined as the uptake and retention of contaminants (e.g., metals and organic compounds) into the tissues of organisms from all possible external sources (Brungs and Mount, 1978; Spacie and Hamelink, 1985). While bioaccumulation of a contaminant by an organism may or may not result in detrimental impacts to that organism, it can be an indicator that the population, similar organisms, and higher trophic-level organisms that prey on the contaminated organisms may be at risk of adverse impacts. Understanding pathways by which contaminants may bioaccumulate is essential for evaluating the effects of dredged material disposal and the cumulative impact of historical dredged material and other disposal activities and other contaminant sources to a region.

There are five major sources for contaminant entry into organisms: (1) contact with interstitial pore water of the sediments, (2) contact with particles (detrital or resuspended), (3) consumption of sediment, (4) ingestion of pore water, and (5) consumption of food (herbivorous or carnivorous). The importance of each source depends in large measure on the life history of the organism and the bioavailability of the contaminant. For example, benthic infaunal and epifaunal organisms are in close and immediate contact with bottom sediments and are more likely to assimilate contaminants through the bulk sediment and pore water routes. For these organisms, feeding mode (i.e., filter or deposit) also influences the initial entry pathway (resuspended particulates and detrital particles) and dictates exposure to contaminants. Because many of these organisms are nonmigratory, they can be chronically exposed to local concentrations of contaminants in the sediments.

Demersal (bottom-dwelling) species may be exposed through sediment and food pathways, depending on the trophic level (e.g., primary or secondary carnivores) that they occupy. These organisms are more motile than benthic infauna and can encounter varying levels of contaminants through different prey species and feeding ranges.

Further removed from the sediment environment are the pelagic organisms. Pelagic organisms generally prey on other pelagic organisms. Thus, these organisms are primarily exposed to contaminants present in the water column and their water-column food. Additionally, because many pelagic fish move across large coastal areas, they may be exposed to different types and levels of contaminants throughout their life cycle.

The food pathway is a source of contaminant entry at all trophic levels. Herbivorous organisms feed on primary producers (e.g., plankton) and plant detritus. These primary consumers can include zooplankton and filter-feeding benthic species (e.g., bivalves) as well as higher organisms such as whales. Small and large fish and crustaceans feed on zooplankton and benthic infauna and are in turn eaten by larger fish. The ultimate trophic level includes the carnivorous fish, some marine mammals, and humans.

In aquatic environments, contaminants are bioavailable only if they are in a form that can be transferred into an organism, usually through its skin, gill epithelium, gut epithelium, or other cell membranes (Newman and Jagoe, 1994). Nearly always, contaminants in solution in the water are much more bioavailable than those bound to sediment particles or present in food (Neff, 1984). Most bioaccumulative contaminants of concern (e.g., polychlorinated biphenyls [PCBs], dichlorodiphenyltrichloroethanes [DDTs], dioxins) are hydrophobic (i.e., they dissolve in water at only ultra-low concentrations, if at all) and are strongly bound to sediment particles. Some of these sediment particles enter the water column by natural processes such as river outflow or are resuspended by currents and storm events. Others are resuspended by human activity (e.g., dredged material disposal events, fish trawling, underwater mining, etc.).

For bioaccumulation to occur, the rate of uptake must be greater than the rate of loss (excretion) of the contaminant from the organism. Highly soluble contaminants often occur in bioavailable forms in the environment and rapidly penetrate the tissues of aquatic organisms. However, at sublethal concentrations, these contaminants may not be retained and are lost just as rapidly from the tissues by diffusion or active transport. As a result, their concentrations in tissues are equal to or lower than their concentrations in the ambient medium. For other contaminants, organisms' metabolic processes regulate contaminant levels independent of concentrations in the ambient medium (Chapman *et al.,* 1996). This is especially true for many metals. Other bioavailable contaminants are taken up rapidly, but then are transformed and excreted rapidly; these contaminants therefore do not bioaccumulate.

A component of bioaccumulation is biomagnification—the transfer of a chemical through trophic levels, resulting in elevated concentrations with increasing trophic level (Connell, 1989; Gobas *et al.*, 1993). Recent studies have shown that very few chemicals biomagnify in aquatic environments (LeBlanc, 1995). Generally, even though higher trophic levels have higher contaminant concentrations relative to lower trophic levels, the increase can be explained in many cases by the relative increase in lipid content as trophic level increases or by decreased chemical elimination efficiencies of higher trophic-level organisms (LeBlanc, 1995). Lipids (or fats) often have chemical structures similar to these pollutants, and organisms consolidate the two in similar locations in the body.

Although bioaccumulation is a naturally occurring process within the aquatic environment, the placement of dredged material at a disposal site can alter the conditions controlling bioaccumulation (e.g., chemical concentrations, grain size, total organic carbon [TOC], etc.), resulting in a change in the rate and magnitude of uptake, and possibly in the risk associated with adverse health affects. The potential impact to pelagic and demersal species has been evaluated by bioaccumulation in caged mussels. Arimoto and Feng (1983) deployed caged mussels within a few hundred yards of a disposal buoy and farther afield. This study demonstrated that the mussels close to the disposal buoy bioaccumulated contaminants such as PCBs above background levels, although mussels deployed farther away did not. The study showed that once disposal ceased, the contaminant levels in newly deployed caged mussels were the same as levels measured at the reference locations, indicating that contaminant levels in the water column were not different after disposal ceased. The authors concluded that the dredged material disposal had a short-lived influence on PCB uptake and that even though the level of PCB in the caged mussels in the disposal site was related to the volume of dredged material, the levels were also related to the rate of discharge of a nearby river. During the Corps' and EPA's 1986 Field Verification Program (FVP), bioaccumulation was measured at a dredged material disposal mound created within the Central Long Island Sound disposal site and at the NLDS in eastern Long Island Sound; these measurements showed similar short-term increases in contaminants in caged mussels (Gentile *et al*., 1987; Peddicord, 1988; Arimoto and Feng, 1983).

Together, these studies demonstrated that disposal of dredged material might result in short-term, spatially limited increases in bioavailable compounds in the water column. Adverse impacts to mussels and other organisms from dredged material disposal were not demonstrated, but such potential impacts remain the subject of broader research on bioaccumulation effects on individual organisms and communities.

4.1.4 Cumulative Impacts

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR Section 1508.7). Understanding the cumulative impact of dredged material disposal on complex coastal systems requires an extensive understanding of all sources of perturbation as well as the environmental response to these perturbations across a broad range of spatial and temporal scales. A review of the results from programs discussed in this section and the literature based on these studies led to the following general conclusions regarding the consequences to the environment.

Water Column

Direct and indirect impacts to the water column are temporary and spatially limited to a small volume of the ocean in the region of the disposal site. Moreover, dredged material disposal sites are generally close to shore and influenced by local and regional sources of contaminants and nutrients. Only 1 to 5 percent of the sediment material enters the water column in the transfer process and is resident at dilute concentrations for only short periods. This introduction is also highly episodic and local; thus, incremental or cumulative impacts may be considered small and localized. The Corps (1982) studied the cumulative impacts in Long Island Sound from dredged material disposal but was unable to describe effects from the cumulative view because of "complex and interrelated environmental factors" that made it difficult to separate the influence of dredged material disposal from other possible perturbations.

Topographic Changes

Other potential cumulative impacts include the changes in topography within sites from the mound building and alteration of the local habitat through changes in substrate. Such impacts may be more severe when the texture of the dredged material is dissimilar from ambient sediments or when the mounding creates structure previously absent from an area. The latter impact may affect ecological communities and commercial and recreational resources through a variety of trophic interactions. However, broad-scale, long-term changes in biological communities within a water body have not been linked to dredged material disposal (Corps, 1980). This is primarily due to (1) the limited degree of contamination allowed in sediment dumped offshore, (2) the small footprint of sites relative to the area of the water body in which the site is located, and (3) rapid recovery of the sites to conditions typical of the area. The short-term nature of benthic impact, regardless of changes in substrate type and topography, has been documented in the New England area through studies showing that initial recolonization of newly created mounds occurs within months, with return to communities typical of the areas surrounding the disposal sites within 2 to 3 years.

Erosion

Properly designated disposal sites should limit the probability of large-scale erosion and transport of mounds within and from the disposal site. However, erosion and winnowing of the surface sediments (upper 1 to 2 inches) is a normal response to tidal and long-term currents and may provide beneficial attributes (such as armoring the surface against further erosion and creating micro-habitats within the disposal site) that may provide greater variability in benthic habitat and infauna, leading to great utilization of the area from fish and shellfish.

Bioaccumulation

Bioaccumulation of contaminants by organisms inhabiting dredged material disposal mounds is possible, particularly for material disposed of prior to promulgation of the 1991 version of the "Green Book" (*Evaluation of Dredged Material Proposed for Ocean Disposal — Testing Manual* [EPA and Corps, 1991]), the national guidance manual developed by EPA and the Corps for testing acceptability of dredged material proposed for disposal in the ocean. However, data from historic mounds indicated that the type and concentrations of chemicals associated with surface sediments, where exposure was most likely to occur, often could not be separated from those in the ambient sediments in the particular coastal region. This limited the potential for the sites to contribute significantly to bioaccumulation. Moreover, scientific studies have found it difficult to separate the contribution to biota body burdens associated with dredged material sites from other local and regional factors. Proper management of the permitting and dredging process has been found to substantially improve the quality of material placed in these sites and contributes to limiting the contribution of compounds that might bioaccumulate into the coastal environment.

In summary, dredged material disposal is one of many potential perturbations to a system. Because of their localized nature, impacts from the disposal of dredged material are difficult to isolate from other factors, including storms, which cause coastal ecosystems to change. Available information provides evidence that major system-wide effects resulting from disposal have not occurred in the past, and that when carefully managed, the impacts of disposal are typically near-field and short-term (Fredette and French, 2004). It is known that the sediments within disposal sites do recover and develop biological communities that are healthy and able to support species typically found in the ambient surroundings. Except in the case where sediments have been placed over major shellfisheries, adverse long-term impacts to fin and shellfisheries have not been demonstrated in the literature. Furthermore, it is possible that changes to topography and sediment type have contributed to biological productivity within coastal areas. Current guidelines requiring rigorous testing of sediments to determine suitability of the material for ocean disposal ensure that only dredged material that is found acceptable for ocean disposal is placed at dredged material disposal sites and serve to limit potential impacts to the physical, chemical, and biological environment in and around the disposal location.

4.2 IMPACTS ASSOCIATED WITH THE NO ACTION ALTERNATIVE

As discussed in Section 2.3.1, NEPA requires that an EIS evaluate a "No Action Alternative." Evaluation of this alternative involves identifying the environmental and socioeconomic impacts that would result if the proposed action did not take place. These impacts can then be assessed and compared with the impacts of the proposed action and the other "action" alternatives. For this Final EIS, the No Action Alternative, defined in detail in Section 2.3.1, consists of not designating an ocean site for the long-term disposal of dredged material in the Rhode Island Region (RIR).

The environmental and socioeconomic impacts of the No Action Alternative are considered in Sections 4.2.1 and 4.2.2, respectively.

4.2.1 Environmental Impacts of the No Action Alternative

Under the No Action Alternative, no adverse direct, indirect, or cumulative environmental impacts would be expected to affect the following oceanic features: sedimentation and erosion, sediment characteristics, water quality, plankton, benthic invertebrates, finfish, shellfish, lobster, marine and coastal birds, marine mammals and reptiles, endangered and threatened species, and air quality and noise. In addition, contaminant levels in selected species found in the ocean would not change from the current condition.

The lack of a designated long-term ocean dredged material disposal site does not mean that all dredging would stop, because other disposal options, such as upland disposal, could occur. As described in the recently completed Providence River and Harbor Maintenance Project Final EIS (Corps, 2001a), the use of such sites could result in some terrestrial impacts, even though upland sites with sufficient volume to address the long-term dredged material disposal needs in Rhode Island could not be identified. For example, that evaluation found potential impacts to water quality in areas adjacent to upland sites and to groundwater from runoff at land-based disposal sites. Other issues identified under that EIS included slight increases in impacts to coastal birds and to coastal and terrestrial endangered or threatened species. Significantly, impacts to air quality caused by emissions from vehicles required to transport the dredged material to an upland site were also identified, as well as intermittent and temporary increases in terrestrial noise if an upland disposal site were available.

Use of a currently selected disposal site (Site 69B) could also continue until 2008 plus an additional 5-year period. Material placed at Site 69B must be found suitable for ocean disposal under the MPRSA Federal (EPA and Corps, 1991) and Regional (EPA and Corps, 2004) testing programs (and subsequent updates) and a permit issued for use of the site by the Corps. While the permitting process is designed to ensure that no unacceptable adverse impacts occur from ocean disposal of dredged material, some changes to the environment may occur. These known potential impacts are discussed in Section 4.1. However, the duration of these impacts caused by using the selected Site 69B would be reduced when compared with the alternative of designating a site, due to its potential shorter period of use. Thus, the quantity of material disposed of offshore would be limited when compared with the designation of a long-term site.

In contrast, the use of selected sites would increase the potential that additional sites in the ocean would be necessary over the long term and would increase the potential for disturbance of additional areas in the ocean (greater cumulative impact) when compared with the use of a designated long-term ocean disposal site. The availability of a designated long-term dredged material disposal site also would reduce the costs associated with finding and selecting other sites, minimize the potential for dredging delays, and eliminate project-specific uncertainty (including project review time and cost) of the site selection process by evaluating the cumulative impacts of all proposed dredged material from the RIR to be placed at the proposed site.

4.2.2 Socioeconomic Impacts of the No Action Alternative

Analyzing the socioeconomic impacts of the No Action Alternative involves evaluating (1) economic losses from a lack of dredging, and (2) subsequent impacts to navigation-dependent industries and those individuals depending on those industries for their livelihood. This evaluation was conducted by the Corps (Corps, 2003b) and considered the worst-case scenario, one in which no dredging would occur because of the lack of a viable disposal location. As a result, shoaling in navigation channels, harbors, and marinas would continue to reduce channel depths. Severe shoaling could potentially reduce the depths of channels enough to increase the likelihood of vessel groundings, the occurrence of pollution events, and increased risk to humans. That threat would curtail commercial and private navigation-dependent uses, reducing the facilities' economic contribution to the region.

The only ascertainable Gross State Product (GSP) loss within the Economic Study Area under the No Action Alternative was to Pawtuxet Cove, with a projected GSP loss of $26.3 million (Corps, 2003b). Although no impacts to GSP were projected for other areas within the Economic Study Area, other impacts to the economy could occur (Table 4-1). For example, the evaluation found that closures at facilities with material suitable for open-water disposal would be limited to specific non-Federal marinas. By 2021, these closures would reduce annual boater spending by more than $4 million. The other major impact of the No Action Alternative on the economy would be an increase in the cost of delivering goods. This would be reflected in increased operating costs to the commercial tonnage (commercial delay), increased casualties, and additional costs to ferries and commercial shipping. The following discussion details these estimated impacts by navigation-related activity.

Commercial Shipping

Under the No Action Alternative, increased shoaling and the subsequent restriction of vessel operations at commercial ports could cause some businesses to (1) close or shift to other ports within and outside of the Economic Study Area, or (2) take measures to reduce needed vessel draft, such as shifting cargo to barges, lightering cargo, or light-loading at the point of origin. All of these actions would increase the cost of waterborne transport, and some could require substitution of land-based transport, mainly trucks, to move the goods.

Table 4-1. Summary of Annual Economic Impacts of the No Action Alternative at the End of the 20-Year Study Period (2021 Conditions).

2021 Conditions	State	Last Year Dredged	Projected Total Volume (1,000 CY)	Commercial Delay ($)	Casualty[1] ($)	Ferries ($)	Commercial Fishing ($)	Boater Spending ($)
Project High (>50,000 CY)								
Providence River and Harbor	RI	2003	1,000.0	176,000	X	-	-	-
Fall River Harbor (MA)	MA	1980	905.8	384,954	X	-	-	-
Fall River Harbor (RI)	RI	1974				-	-	-
Cape Cod Canal[2]	MA	2002	600.0	514,890	X	-	-	-
Seekonk River	RI	1954	542.6	-	-	-	-	-
Point Judith	RI	1971	409.5	-	-	3,000,000	184,000	7,408
Pawcatuck River, Little Narragansett Bay, Watch Hill Cove	RI	1997	60	-	-	-	-	110,118
Medium (15,000 - 50,000 CY)								
Newport Harbor	RI	1941	35.7	-	-	-	-	-
Onset Bay	MA	1957	26.1	-	-	-	-	-
Wareham Harbor	MA	1894	22.7	-	-	-	-	-
Greenwich Bay	RI	1891	20.0	-	-	-	-	-
Vineyard Haven Harbor	MA	1937	17.7	-	-	-	-	-
Low (<15,000 CY)								
Wickford (9 ft)	RI	1964	12.5	-	-	-	-	78,210
Wickford (12 ft at Mill Cove)	RI	1963		-	-	-	-	-
Apponaug Cove	RI	1963	12.0	-	-	-	-	418,510
Bullocks Point Cove	RI	1995	5.3	-	-	-	-	-
Warwick Cove	RI	1966	5.2	-	-	-	-	-
Sakonnet Harbor	RI	1983	3.3	-	-	-	-	-
Falmouth Harbor	MA	1977	2.5	-	-	-	-	-
Non-Federal			5,100	NC[3]	-	-	-	3,949,655
Total			8,781	1,075,844	75,000	3,000,000	184,000	4,563,901

[1]The increase in costs due to casualties was predicted to result for shipping in Providence River, Fall River, and Cape Cod Canal only.
[2]Dredged material from the Cape Cod Canal, for the most part, can be used for beneficial purposes or disposed of elsewhere and may not be affected by the No Action Alternative.
[3]Not counted – impacts to non-federal channels were accounted for under the Federal Channel estimates.

Only two deep-draft navigation projects (Providence and Fall River) in the Economic Study Area would potentially be affected by the No Action Alternative. While there are deep-draft navigational needs in Cape Cod Canal, dredged material from the canal, for the most part, can be used for beneficial purposes or disposed of elsewhere. Under the No Action Alternative, shoaling would affect commercial oil and coal transport vessels for Providence and Fall River. However, because shoaling would be gradual and the depths at these projects are greater than

30 ft at the beginning of the study period, shoaling would affect only deep-draft vessels in these harbors. The total costs of tidal delay and rerouting shipping in the Economic Study Area are expected to increase from $253,000 in 2006 to $1.1 million in 2021. Table 4-2 shows these added costs by harbor over the study period (Corps, 2003b).

Table 4-2. Commercial Shipping Cost Increases.

Year	2002 ($)	2006 ($)	2011 ($)	2016 ($)	2021 ($)
Providence	0	0	9,900	29,200	176,000
Cape Cod Canal	44,250	86,480	117,330	246,136	514,890
Fall River	144,062	167,412	233,320	263,072	384,954
Total	188,312	253,892	360,550	538,408	1,075,844

Casualty Loss and Petroleum Spills

Marine casualties include collisions and groundings of vessels. Because these transits occur in areas outside the Economic Study Area, the area used to assess casualty loss was expanded. Fall River and Providence Harbor could also require additional trips due to shoaling.

The analysis identified 78 collisions and groundings during the 10-year period from 1992-2002. These accidents were associated with damages totaling $3.7 million. The No Action Alternative may have only a limited effect on the number of casualties; however, even a limited impact on the number of casualties may lead to significant economic costs. A simulation model was developed to estimate the economic costs resulting from a 1-percent annual increase in casualty rates, which was attributed to conditions under the No Action Alternative. The economic costs predicted by the model ranged from $28,000 to $2.7 million. The expected mean value of damages is about $350,000 (Corps, 2003b).

Increased groundings would also likely increase petroleum spills, which would result in approximately 234,000 gallons of petroleum spilled, or approximately 20,000 gallons more than would occur under normal dredging conditions (an increase of 10.8 percent) over the study period (Corps, 2003b). The increase of about 20,000 gallons spilled over 20 years would be expected to consist of several small events, which likely would not cause significant socioeconomic impacts.

Ferries

The economies of Block Island in Rhode Island and of Martha’s Vineyard in Massachusetts depend on tourism and the ferry services that bring most of the tourists. Only service to Block Island from Point Judith is expected to be impacted by shoaling at the latter harbor. About 300,000 tourists visit Block Island each year. Most tourists stay on the island for two or more nights. Tourism expenditures total about $60 million and generate the equivalent of about 450 jobs annually. In 1999, such expenditures generated $2.2 million in lodging and general sales tax revenues. On average, tourists spend about $200 per person on the island during each visit.

A passenger-only (i.e., no vehicles transported) high-speed catamaran ferry, drafting between 4 and 7 ft, provides service from Galilee in Point Judith to Block Island in approximately 30 minutes (min) for a one-way adult fare of $14. The traditional ferry service, drafting 12 ft, offered by a competing firm has a sailing time of 55 min and a one-way adult fare of $8.30. Shoaling would be expected to decrease water depths enough to preclude the use of standard, deeper-draft ferries. This could preclude or severely restrict transport of vehicles and freight to the islands. Shallower-draft, high-speed catamaran ferries could operate under these conditions; however, this would increase the costs to tourists by approximately 5 percent of the average expenditure per tourist on Block Island, with a total increase of almost $3 million annually once the shoaling became severe enough to warrant the switch in service.

Commercial Fishing

For the purposes of this discussion, commercial fishing includes charter fishing for hire to recreational fishermen. Significant impacts would be expected to affect only commercial fishing activities based upstream of the Point Judith Harbor of Refuge and Pond project that draft more than 10 ft. The lack of dredging and resultant shoaling would be expected to reduce the channel depth to 11 ft at Mean Low Water (MLW). Periods of low water would expect to require rerouting the deepest draft fishing boats to alternative ports and thus increase operating costs by almost $200,000 annually by 2021 (Corps, 2003b).

Recreational Boating

The measurement used to assess impacts on recreational boating is boater spending. The measure used in this EIS analysis is based on a methodology outlined in a 1996 Corps study titled *Estimating the Local Economic Impacts of Recreation at Corps of Engineers Projects*. While spending used for recreational boating and increased costs associated with commercial navigation are both measures of economic impacts, they are different measures and their sum is not a meaningful measurement of impacts.

Reduced navigation access at smaller harbors would limit recreational opportunity and, over time, would contribute to a reduction in vessel size and drafts of the fleets using these harbors. The analysis of recreational boating impacts estimated the number of boats, by draft, affected by shoaling at each Federal and non-Federal facility. Most non-Federal facilities are marinas located such that they rely on a Federal main channel for access to the sea.

By the end of the study period, shoaling without normal dredging (i.e., dredging continued at current levels without regard to limitations on the availability of appropriate disposal sites) would be expected to reduce boater spending by $4.5 million annually (Corps, 2003b). The most significant loss caused by shoaling of a Federal main channel would be expected to occur at Apponaug Cove, where boater spending would decline by $419,000.

Employment

Shoaling would affect annual employment losses gradually, from 29 in 2002 to 93 by 2021. These losses would result from decreased boater spending.

Military Usage

Military uses within the zone of siting feasibility (ZSF) would remain unchanged under the No Action Alternative. No major military facilities were identified that would be affected by shoaling; therefore, no restriction to navigation of large military vessels would be expected.

Mineral/Energy Development

Currently, no mineral or sand mining occurs within the Economic Study Area, and such activities are not likely to occur in the foreseeable future. Active cables that lie within the ZSF are not expected to be adversely affected by the No Action Alternative.

Recreational Activities

Most recreational activities and beaches would have minimal or no adverse impacts under the No Action Alternative. However, impacts to recreational boating (discussed above) could be significant in specific harbors. Shoaling of access channels and facilities would result in reduced boat use, with a resulting loss of recreational opportunities, revenue to marinas, other services, and destinations, affecting both the local and regional economy.

Natural or Cultural Resources

Under the No Action Alternative, historic and archaeological resources that exist within the ZSF would not be altered.

Other Legitimate Uses

Under the No Action Alternative, socioeconomic impacts to other legitimate uses (tourism on Block Island and Martha's Vineyard) would be expected to remain relatively unchanged. The only ferry service likely to be impacted would be service to Block Island from Point Judith, where the cost of ferry service would be expected to increase slightly.

Areas of Special Concern

The socioeconomic impacts to parks and natural areas would remain unchanged or be minimal under the No Action Alternative. The only exceptions would be areas that can be accessed only by boat that would shoal and require dredging. However, if areas accessible only by boat were no longer accessible to the human population, the natural environment of such areas would improve.

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population," (1994) provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations." Because this study focuses on the economic impacts of reduced dredging and the effects of shoaling on deep-draft navigation and recreational boating, environmental justice impacts would occur if
(1) recreational boating by low-income and minorities were disproportionately impacted, or
(2) deep-draft navigation impacts (mostly oil transport in this case) disproportionately affected these groups.

As discussed above, shoaling of ports and harbors would have direct economic impacts on businesses that rely on deep channels for transport of raw materials and supplies, as well as on businesses that support recreational activities. These impacts would cause suppliers' costs to rise and force decisions that would divert supplies to other routes. Some of the direct suppliers would be affected severely, and their businesses would fail. Others would adjust and pass on the additional costs to customers. In either case, customers would face increasing costs if shoaling limited access to ports and harbors. Cost-driven economic consequences would tend to most particularly affect low-income groups and minorities with limited abilities to pay. Recreational impacts would be borne primarily by higher-income owners of large powerboats and deep-draft sailing vessels.

Disrupted commercial businesses would mostly be affected by rerouting of supply routes. Price increases would be minimal because of competition among sellers. Heating oil, however, could be affected, and low-income buyers could see significant price increases.

Summary

Depending on the availability of other disposal sites, economic and socioeconomic impacts under the No Action Alternative could be mitigated to some degree. However, the environmental and economic disadvantages of some of the other disposal options, evaluated and discussed in more detail in the Providence River and Harbor Maintenance Project Final EIS (Corps, 2001a), could be substantial. In addition, the costs of finding another acceptable site, either onshore or offshore, would be substantial and would likely delay the timeliness and efficient maintenance of channels and harbors within the Economic Study Area.

4.3 IMPACTS ASSOCIATED WITH THE ALTERNATIVE SITES E AND W

Potential environmental and socioeconomic impacts from disposal of dredged material at the two proposed alternative disposal sites (Sites E and W) are discussed below. Some impacts are not specific to either alternative site. In those instances, the discussion is presented in terms of impacts to the marine environment within the ZSF in general.

4.3.1 Sedimentation and Erosion

As discussed in Section 4.1, the disposal of dredged material at open ocean sites results in the deposition of non-native sediments in a “footprint” or mound on the seafloor. Over time, as currents move over this mound, hydraulic forces act on the sediment particles in the form of shear and lift. The response of the particles to these forces is related to current speed, to particle size, shape, and density, and to any friction or cohesion exerted by adjacent sediment grains. At some point, the fluid may exert sufficient force to cause the grains to move, and the sediment is eroded from the bottom and suspended (usually said to be resuspended) into the water column for transport. Once resuspended, the distance and direction that particles are transported primarily depend on the speed and direction of the currents and the characteristics of the particles. Once currents slow, the particles fall back onto the sediment surface because of gravity.

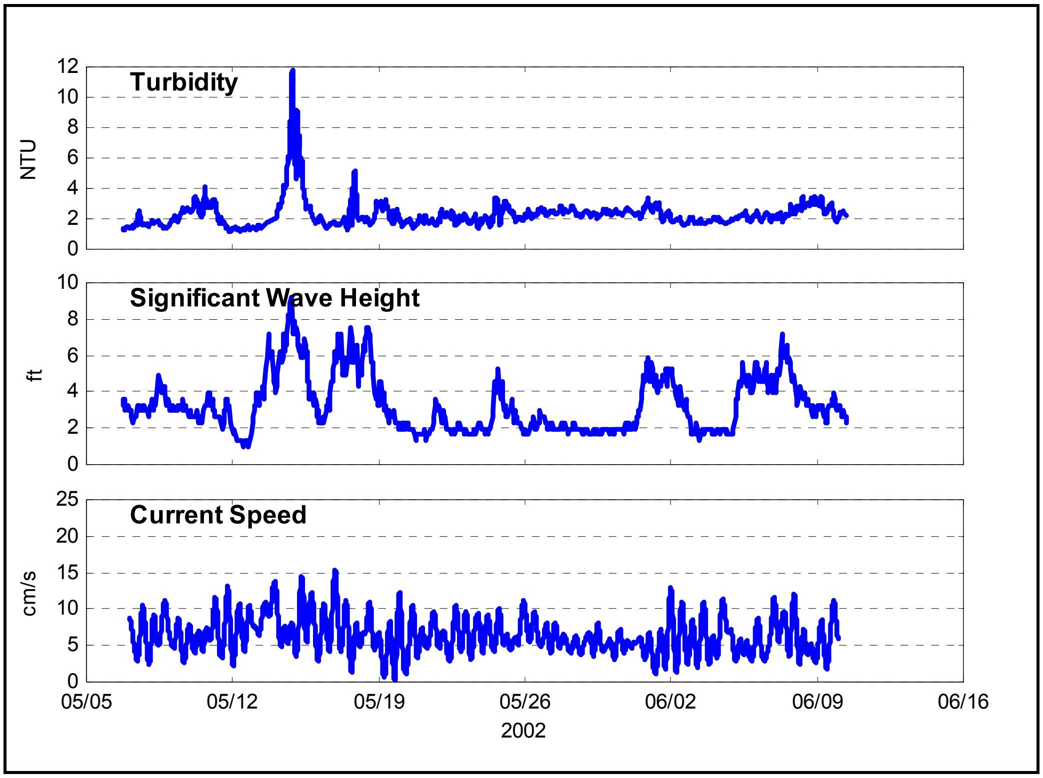
Two models were used to determine if currents at the two alternative sites are strong enough to resuspend and transport deposited dredged material. The Grant Madsen model of sediment transport, which was applied to the entire ZSF for various grain sizes, tidal current, and wave conditions (see Section 3.6), estimated that both alternative sites are in the depth range that corresponds to areas of occasional sediment transport and reworking. To determine the frequency with which bottom sediments are resuspended and the degree to which dredged material would behave differently from local sediments, a more site specific model was needed. The Long-Term FATE (LTFATE) model (Corps, 2004a) was used to predict any long-term sediment erosion and transport that might be expected for dredged material deposited in the alternative sites. A full description of the modeling study methods and results for both Grant-Madsen and LTFATE is presented in a recent modeling report (Corps, 2004a).

LTFATE was developed to estimate sediment dispersal during storms for cohesive, fine-grained sediments. Sediments with a significant clay fraction are cohesive. Moreover, any undisturbed fine sediments will tend to become cohesive over time by consolidation and biological reworking. The LTFATE model incorporates the effects of sediment cohesion and hydrodynamics in its simulation of sediment transport. It also predicts changes in mound geometry if erosion and deposition of dredged material cause bathymetric changes (i.e., mound evolution). Because a model is a simple representation of physical reality, its predictive ability may be limited. Quantitative sediment transport modeling is complicated by uncertainties in current speed; in particle size, shape, and density; and in friction terms. Site-specific field measurements are needed for model calibration and verification. When extensive field measurements are not available, LTFATE predictions should not be considered actual expected values. Rather, because the model represents physical processes consistently, its value lies in the systematic, conservative means it provides of comparing the potential for sediment erosion between two sites.

Current meter and turbidity data from a 2-month measurement period in the spring of 2002 at Site 69B (Corps, 2004b), provide some evidence that the alternative sites, which are located at depths between 125 ft and 135 ft deep, could experience occasional resuspension of local sediment. During the May–June 2002 measurement period, the background turbidity at Site 69B was observed to be 2 to 3 nephelometric turbidity units (NTUs)[1] (Figure 4-2). During two relatively small storms that passed on May 15 and May 17, near-bottom turbidity was recorded at 2 to 6 times background levels. The peaks in turbidity corresponded to periods of high waves (wave heights between 7 and 9 ft) but did not correspond to an increase in near-bottom currents.

These two storms were small compared to a typical large winter storm, a hurricane, or a powerful nor'easter. Wave heights of over 10 ft occur approximately 10 percent of the time during the months of December and January and over 15 percent of the time during the month of March, according to historical records at the Buzzards Bay Tower. Wind speeds reached about 30 knots on May 15 and about 25 knots on May 17. Historic records of wind speeds at Buzzards Bay Tower (see Section 3.3) indicate that wind speeds of 30 knots or more occur about 0.7 percent of

[1] As a point of reference, in the United States the allowable standard for turbidity in drinking water is 1 NTU.



Source: Corps, 2004b

Figure 4-2. Near-Bottom Turbidity, Near-Bottom Current, and Wave Height Measured at Site 69B in May and June 2002.

the time during May. Moreover, wind speeds of greater than 30 knots occur 7.6 percent of the time in December. Turbidity events that are proportionally higher and more frequent than those measured in the spring can thus be expected during the winter months. Note also that small peaks in turbidity above background that correspond to wave heights as small as 5.5 ft to 7 ft are visible in the 2002 data. This is clear evidence that fine particles (probably surface floc from the upper few millimeters of sediment) are frequently resuspended. While these data are highly suggestive of at least occasional storm-related sediment resuspension at Site 69B, they do not prove that dredged material sediments are being resuspended and transported there. The increase in turbidity may have been caused by the intrusion of turbid water from elsewhere. In addition, this short-term data set does not provide a full picture of sediment resuspension in the long-term.

Side-scan, multi-beam (high-resolution bathymetry), and sediment profile imagery data collected within Site W in February and July 2003 (Corps, 2003a), and in September and October 2003 (Corps, 2004c), showed that recent dredged material deposits (silty sand mottled with white clay) are widespread over the southeast central portions of Site W. Sediment profile images frequently showed a depositional layer of fine sand over underlying dredged material, suggesting an occasionally active bedload transport of ambient fine sand during storm events.

To determine the frequency with which bottom sediments are resuspended the LTFATE model was applied to each alternative site for a series of simulations. The modeling results (Corps, 2004a) are summarized in the following subsections for each alternative site. For all simulations, the model assumed that ~ 9 MCY (total estimated future disposal needs) were deposited in 10 mounds distributed throughout each site. Each simulated mound was configured as an idealized flat-topped cone (frustum), each with a volume equal to 0.88 MCY. The mounds were configured with a central height of 18 ft above the seafloor, the height necessary to hold the requisite material assuming a shoulder slope of 1:20 and an approximately 10-percent margin between mounds and between the mounds and the site boundary (Figure 4-3). This scenario represents one possible configuration of each site at some future time after disposal operations have been ongoing. The exact configuration is not critical because the primary interest of the model analysis is the differences in model predictions for the two sites under similar conditions. The height of the mounds is important, however, because significantly higher mounds may result in significantly more predicted erosion. But mound height would not change with larger volumes of material, since disposal operations would result in fewer distinct mounds, to the point where the entire site would be filled with just one mound (i.e., site capacity would be reached). A single 18 ft-high mound covering the entire site would contain 20 MCY.

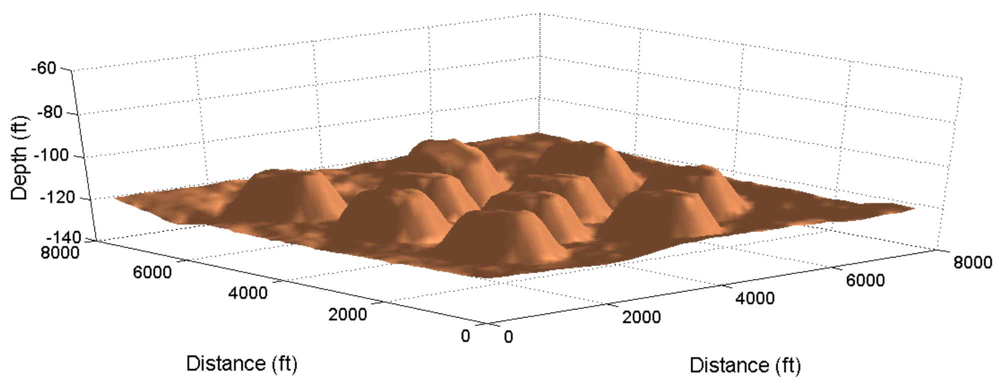


Figure 4-3. Bathymetry of Site W Showing Configuration of Proposed Dredged Material Mounds (vertical exaggeration 50x).

A data set of severe storms that passed near Rhode Island Sound from 1933 through 1985 (Corps, 2001b) provided model input for waves and currents. The data set included nine hurricanes and two extra-tropical storms. Gailani *et al.* (Corps, 2001b) used historical storm tracks, wind speed, and central pressure values to predict wave fields at Site W (Site 69B) using a wave model and current time histories by combining tidal currents and modeled storm currents. Wave heights in Site E were set approximately 8 percent higher and wave periods 5 percent longer than those in Site W, based on the results of the ZSF-wide wave model results (Corps, 2004a). LTFATE simulations were performed for Sites W and E using five storms (Table 4-3).

Table 4-3. Storms Modeled with LTFATE Including Historical Storm Events Impacting Rhode Island Sound and Simulated Storms.

Storm ID	Maximum Significant Wave Height (ft)		Peak Wave Period (sec)		Maximum Current Magnitude (cm/s)	Minimum Tidal Elevation (ft)	Maximum Tidal Elevation (ft)
	Site E	Site W	Site E	Site W			
H1.7	5.8	5.4	7.7	7.3	20	-2.1	2.0
H2.5	7.6	7.1	5.6	5.3	8	-1.4	1.7
748 (1976 Hurricane Belle)	14.7	13.7	8.4	8.0	8	-1.4	1.7
712 (1972 Hurricane Agnes)	16.0	14.9	9.5	9.0	25	-1.6	2.6
370 (1936)	23.3	21.7	11.6	11.0	20	-2.1	2.0

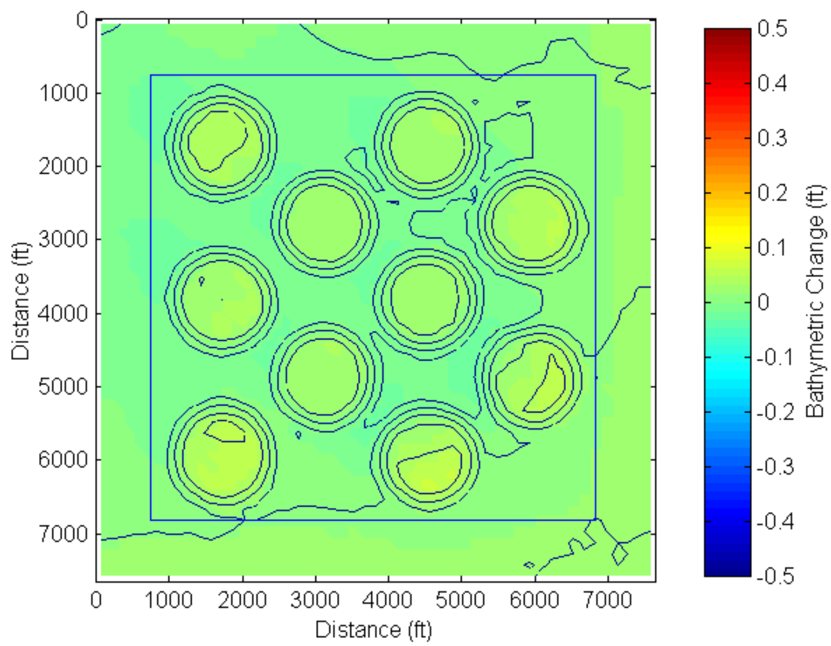
LTFATE is sensitive to certain geotechnical parameters of the sediments, which are a measure of the critical shear stress above which sediments are mobilized. These erosion potential parameters are normally derived from laboratory measurements using undisturbed sediment cores collected in the field. They characterize the resistance to erosion and the rates of erosion as a function of depth in the sediment. The measurements are complicated to make and are therefore not widely available, but they are necessary to accurately calibrate cohesive sediment transport models like LTFATE. Erosion potential parameters from the Portland, Maine, Disposal Site (Corps, 1998a) were used in the LTFATE model simulations described here. The Portland samples are representative of the sediment types seen in the ZSF. A set of sediment values was also available from a laboratory study of Providence River sediments (Corps, 2001b); however, the samples used in that study were extremely cohesive compared to typical harbor sediment, resulting in likely low predictions of erosion. While the erosion potential parameter data for Portland sediments are not specific to the Rhode Island Sound alternative sites, they represent the best available data for New England (Fredette, 2003) and are reasonably representative of potential dredged material to be placed in the alternative sites. The use of non-site specific parameters where no local data are available is valid, given that the models are intended to show the relative differences between the two alternative sites. It is important to recognize that the model was not set to reflect site erosion during its filling. The value presented represents the possible loss over the life of the disposal site.

The following sections summarize the results of the LTFATE modeling for each alternative site.

Site W

The array of mounds modeled was overlain on recent (April 2003) high-resolution plots of the bathymetry at Site W. The model-predicted erosion and deposition for a storm simulation with a peak wave height of 5.4 ft shows a small amount of erosion on the crests of the mounds and a small amount of deposition in the troughs between mounds (Figure 4-4). The average depth of erosion was 0.02 ft; the net volume of erosion, defined as the net mass of sediment eroded and deposited outside of the site, was 11,200 CY of sediment (Table 4-4). This degree of resuspension of bottom sediments (0.1 percent of the deposited material used in the model) corresponds approximately to the 4.9-ft wave height events seen during the May and June 2002 field observations (Figure 4-2). The model results show a slight elevation in suspended material, which corresponds well with slight elevation in the turbidity when surface floc was resuspended by 4.9-ft-high waves.

It should be noted that the model overpredicts the net erosion, because it does not account for material that would be transported from the surrounding area into the site. However, the model results suggest that it is largely (though not entirely) dredged material that is transported out of the site.



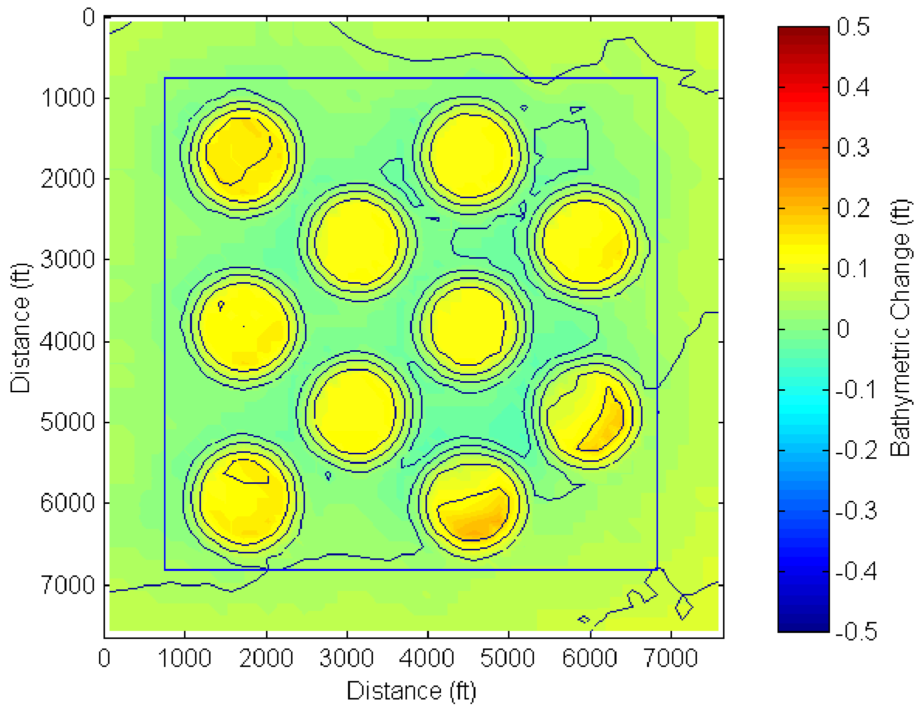
Note: Positive values indicate erosion; negative values indicate deposition.

Figure 4-4. Change in Bathymetry at Site W Predicted for 5.4-ft Peak Wave Height Storm Simulation.

Table 4-4. Model-Predicted Erosion and Deposition over Site W for Five Storm Scenarios.

Storm ID	Average Depth Change (ft)	Average Depth Erosion (ft)	Max Depth Erosion (ft)	Average Depth Deposition (ft)	Max Depth Deposition (ft)	Net Erosion (CY)	Gross Erosion (CY)	Gross Deposition (CY)
H1.7	0.01	0.02	0.07	0.01	0.02	11,200	16,692	5,492
H2.5	0.05	0.07	0.21	0.02	0.05	63,092	66,908	3,817
748 (Belle)	0.15	0.18	0.43	0.04	0.12	210,608	215,608	5,000
712 (Agnes)	0.45	0.45	0.69	0	0	632,817	632,817	0
370 (1936)	Simulation failed							

The erosion on the crests of the mounds for a storm simulation with a peak wave height of 7.1 ft is clearly visible, with deposition between the mounds particularly in the southeast part of the site where water depths are deepest (Figure 4-5). This is due to the fact that the to-and-fro currents under waves become weaker with increasing depth. The total amount of erosion is still small, with a predicted maximum erosion depth of 0.21 ft on the highest edge of the mounds and an average erosion depth over the model grid of 0.07 ft. The net volume of erosion was approximately 63,000 CY, or 0.7 percent of the deposited material. This simulation corresponds to roughly the 7.1-ft wave heights seen during the May and June 2002 field study (Figure 4-2).

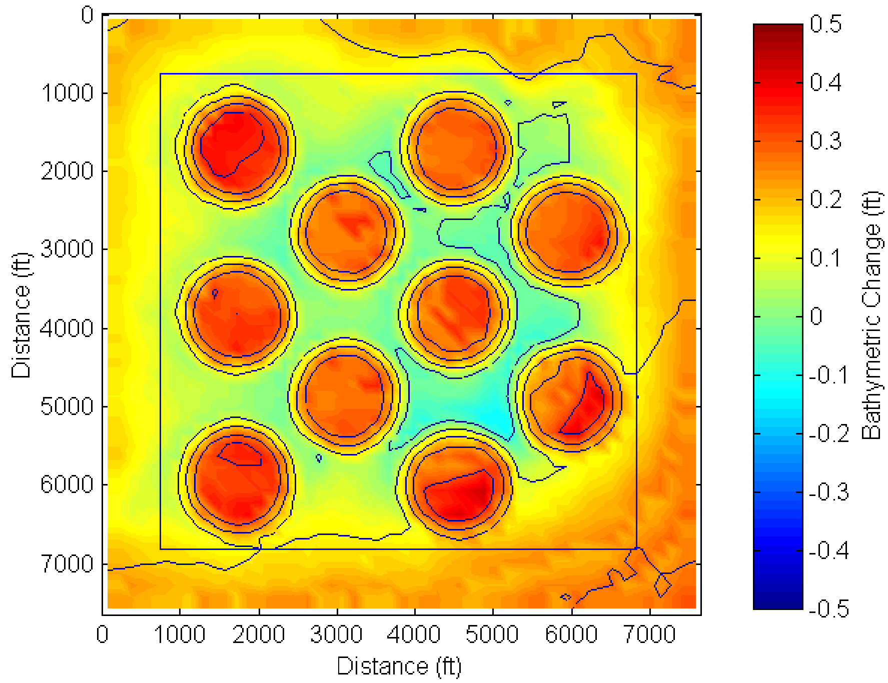


Note: Positive values indicate erosion; negative values indicate deposition.

Figure 4-5. Change in Bathymetry at Site W Predicted for 7.1-ft Peak Wave Height Storm Simulation.

Finally, the model predicted erosion and deposition for the Hurricane Belle simulation, during which the maximum significant wave height reached 13.7 ft (Figure 4-6). Hurricane Belle represents a storm with a return period of 5 to 10 years. Erosion is predicted across the crests in the mounds; deposition is predicted between the troughs and is concentrated primarily in the southeast part of the site, where the bathymetric depression is located. The predicted average depth of erosion was 0.18 ft, with the maximum depth of erosion of 0.43 ft concentrated on the portions of the mounds at the shallowest depth of water. The total volume of material transported out of the site was 210,000 CY, or approximately 2 percent of the total volume of dredged material in the mounds. The Hurricane Agnes simulation (Table 4-4, figure not shown) resulted in a net erosion of 632,000 CY of sediments from the site, or 7 percent of the total volume of dredged material. Hurricane Agnes approximates a storm with a return period of

15 years. LTFATE was unable to successfully model the 1936 storm. Numerous attempts to numerically model the storm revealed that the combination of storm and sediment parameters was outside the functional range of LTFATE.



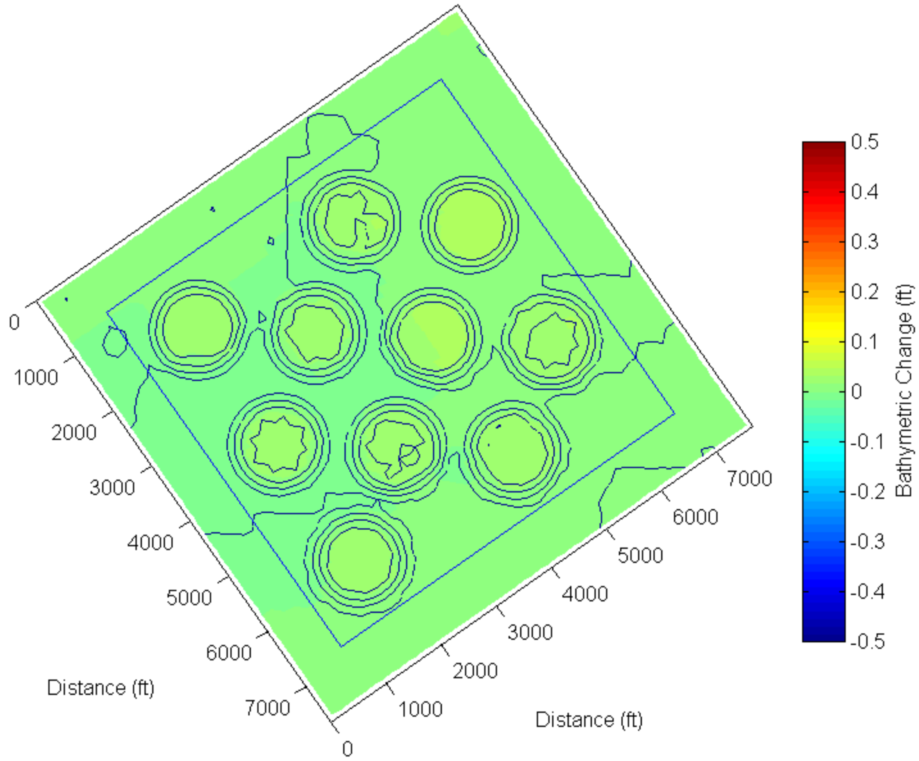
Note: Positive values indicate erosion; negative values indicate deposition.

Figure 4-6. Change in Bathymetry at Site W Predicted for 13.7-ft Peak Wave Height Storm Simulation, Hurricane Belle.

Site E

Using the same mound configuration and storm scenarios, LTFATE simulations were developed for Site E. There were two significant differences in the set of simulations created for the two alternative sites. The first is the difference in the natural bathymetry of the two sites; the second is the difference in wave heights, which are slightly higher at Site E because of the site's greater potential for exposure to storm winds and waves from the south (Section 3.4). For the purposes of the model simulations, wave heights in Site E were set approximately 8 percent higher and wave periods 5 percent longer than those in Site W (Corps, 2004a). As was the case for Site W, ten 18-ft-high mounds were overlain on recent high-resolution bathymetry at Site E.

The model predicted a small amount of erosion on the crests of the mounds and a small amount of deposition in the troughs between mounds for a storm simulation with a peak wave height of 5.8 ft (Figure 4-7). The average erosion depth was 0.02 ft, with net erosion out of the site of 9,900 CY (see Table 4-5) (~0.1 percent deposited outside the site). As was the case with Site W, the model results show a slight increase in suspended material during 5.9-ft waves.



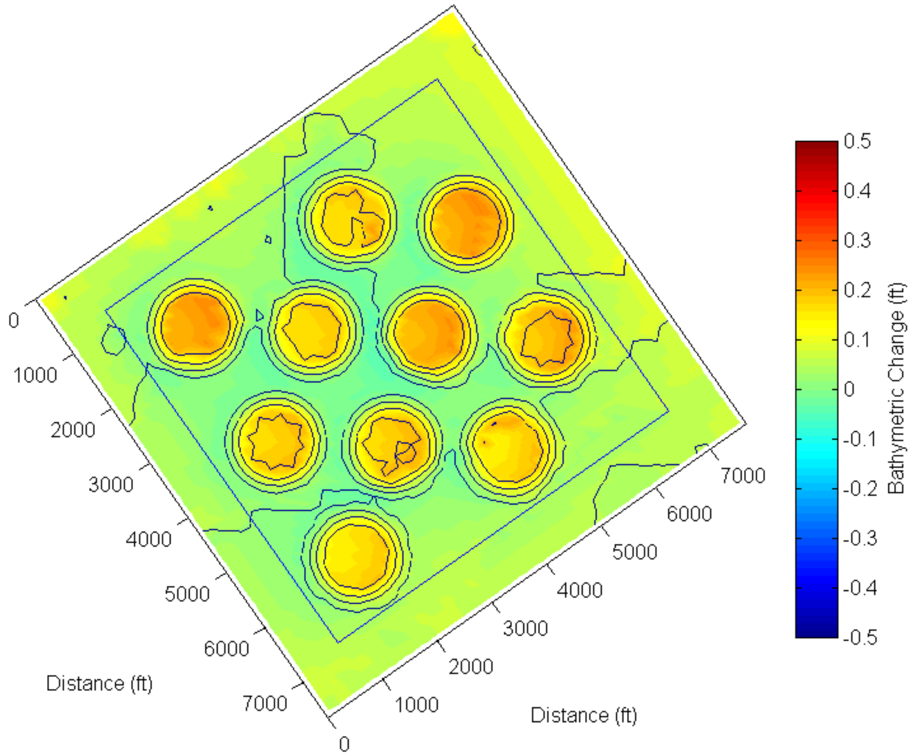
Note: Positive values indicate erosion; negative values indicate deposition.

Figure 4-7. Change in Bathymetry at Site E Predicted for 5.8-ft Peak Wave Height Storm Simulation.

Table 4-5. Model-Predicted Erosion and Deposition over Site E for Five Storm Scenarios.

Storm ID	Average Depth Change (ft)	Average Depth Erosion (ft)	Max Depth Erosion (ft)	Average Depth Deposition (ft)	Max Depth Deposition (ft)	Net Erosion (CY)	Gross Erosion (CY)	Gross Deposition (CY)
H1.7	0.01	0.02	0.04	0.01	0.01	9,917	12,542	2,625
H2.5	0.07	0.09	0.25	0.02	0.05	101,342	103,900	2,558
748 (Belle)	0.23	0.23	0.49	0.03	0.05	315,442	315,650	208
712 (Agnes)	0.44	0.47	0.76	0	0	634,142	634,142	0
370 (1936)	Simulation Failed							

The model predicted erosion on the crests of the mounds and deposition between the mounds for a storm simulation with a peak wave height of 7.6 ft (Figure 4-8). The highest erosion occurred on the shallowest mounds to the north. The total amount of erosion was small, with a predicted maximum erosion depth of 0.25 ft and an average erosion depth of 0.09 ft. The net volume of erosion over the entire site was approximately 101,000 CY (1.1 percent).

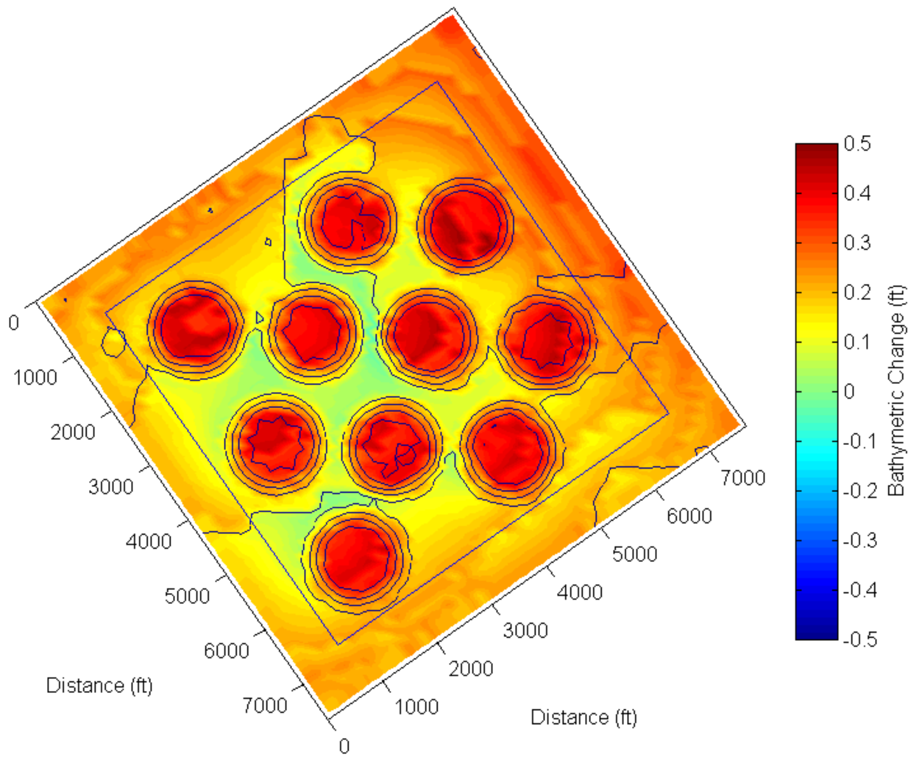


Note: Positive values indicate erosion; negative values indicate deposition.

Figure 4-8. Change in Bathymetry at Site E Predicted for 7.6-ft Peak Wave Height Storm Simulation.

Finally, the model predicted erosion and deposition for the Hurricane Belle simulation, during which the maximum significant wave height reached 14.7 ft (Figure 4-9). Significant erosion is predicted to occur throughout the site, except for a small amount of deposition between the troughs in the east-central portion of the site. The average erosion depth was 0.23 ft, with a predicted maximum erosion depth of about 0.5 ft concentrated on the shallowest portions of the mounds. The total volume of material transported out of the site was 316,000 CY, or approximately 3.5 percent of the total volume of dredged material in the mounds. The Hurricane Agnes simulation (Table 4-5, figure not shown) resulted in a net erosion of 634,000 CY of sediments from the site, or 7 percent of the total volume of dredged material in the mounds. LTFATE was unable to successfully model the 1936 storm. Numerous attempts to numerically model the storm revealed that the combination of storm and sediment parameters was outside the functional range of LTFATE (see modeling report [Corps, 2004a] for additional details).

In summary, numerical model predictions of sediment transport by storm waves and currents show that frequent, moderately sized storms resuspend and transport fine bottom sediment within the entire area, but the total volume of material eroded is very small (probably limited to only the upper 0.04 or 0.08 inches). This result is consistent with field observations of near-bottom turbidity and surface waves without an operational dredged material disposal site. Model predictions suggest that during storm conditions expected to occur in Rhode Island Sound



Note: Positive values indicate erosion; negative values indicate deposition.

Figure 4-9. Change in Bathymetry at Site E Predicted for 14.7-ft Peak Wave Height Storm Simulation, Hurricane Belle.

three to five times per year (maximum wave height of 7.1 to 7.6 ft, approximately 5-percent frequency of occurrence of storm conditions [Section 3.4]), under a scenario of 18-ft-high disposal mounds, an average of up to 0.21 ft of disposal mound would erode in Site W and 0.25 ft in Site E. For the case of a storm with a return period of from 5 to 10 years, 18-ft-high mounds would erode an average of 0.49 ft in Site E and 0.43 ft in Site W, with a total of 4 percent of the 8.8 MCY of dredged material predicted to be eroded at Site E and 2 percent at Site W. As the erosion occurred, the mounds would be winnowed of their erodible sediments, leaving a substrate much like that which is currently at and around the site.

All simulations showed some deposition of dredged material in the troughs between disposal mounds. This is consistent with our understanding of processes at work and the importance of depth in determining resuspension under storm waves and currents. This suggests that sediment stability could be improved at both sites with a site management approach that limits the height of disposal mounds.

Although numerical models have a limited ability to predict quantitative results, the model results in this case compare well with a short record of field observations, which provides additional credibility to the model predictions. In addition, the model predictions provide an opportunity to qualitatively compare the two alternative sites. The relative differences between the predicted results indicate that Site E has a slightly higher potential for resuspension of dredged material than Site W.

4.3.2 Sediment Characteristics

The sediment properties at both Sites E and W are within the ranges observed in sediments throughout the RIR ZSF. However, there are some variations in grain size and TOC between the sites, with Site E having a higher sand content and Site W having a higher gravel content. The fine fraction was similar between the two sites. Laboratory toxicity test data are not available for the alternative sites. However, concentrations of organic contaminants and metals found in sediments at the two alternative sites were well below their respective sediment quality benchmarks established by Long *et al.* (1995), and there is no evidence that either area has received materials that could degrade the local sediment quality. The available data do not demonstrate any significant differences in sediment characteristics between the two alternative sites.

Direct impacts resulting from disposal activities at either of the alternative sites would likely include changes to sediment texture over time as dredged material accumulated and buried the natural sediments. Dredged material generally consists of fine-grained, muddy sediments, although coarser sediment can occur, especially from improvement dredging. As a result of disposal activities, surface sediment texture at either of the alternative sites would likely change from naturally coarse-grained material to more fine-grained material until winnowing re-established the natural conditions within the site and its adjacent seafloor.

Indirect impacts resulting from disposal activities at either of the alternative sites could include changes in sediment toxicity resulting from disposal activities. However, this would not be likely because any dredged material taken to the alternative disposal sites must be found acceptable for ocean disposal in accordance with MPRSA regulations, as described in Section 1.0. As a result, dredged sediments that are toxic or have elevated levels of contaminants would not be found suitable for ocean disposal. Therefore, disposal of dredged material at the alternative sites would not be expected to affect sediment quality.

4.3.3 Water Quality

Short-term (up to several hours) water quality impacts at either Site E or Site W could result from changes in particle concentrations within the dredged material plume following disposal. These changes would result in infrequent and temporary increases in suspended solids in the water column.

Suspended sediments present in the water column during and after disposal operations could affect the feeding activities of fish and benthic organisms and, at extremely high concentrations, could kill or injure fish and benthic organisms. Contaminants present in the dredged material disposal plume could also be available to marine organisms. However, particles that became suspended in the water column after a dredged material release would not remain suspended indefinitely; rather, they would sink to the bottom at settling rates that would depend on their size and density and on the turbulence present in the water column.

Organic and inorganic particulate matter present in the water column is measured as TSS in milligrams of solids per liter of water (mg/L). The term "turbidity" is often used when referring to TSS; however, turbidity is more correctly defined as an optical property of water referring to the blockage of light as it passes through water. The higher the levels of particulate matter in the water, the higher the turbidity. In general, turbid water interferes with recreational use and aesthetic enjoyment of water. Higher turbidity also increases light extinction, thereby reducing the penetration of sunlight down through the water column, which reduces the depth of the euphotic zone. This could decrease primary production, the growth of phytoplankton at the base of the food chain.

Typical sediments from ports and harbors around the RIR consist of very fine sand to silt and clay (Corps, 2001a). As discussed in Section 4.1.1, while the bulk of the dredged material would settle to the bottom in the first few minutes after release, low concentrations of fine particles could persist for several hours in the water column, during which time they would be available to be moved by the local currents. The maximum amount of sediment that could be released to the water column by a disposal event has been estimated as 1 to 5 percent of the released dredged material (dry mass) (SAIC, 1994; Tavolaro, 1984). Dragos and Lewis (1993) demonstrated that a plume was detectable following disposal events at the New York Mud Dump Site in the New York Bight (water depth approximately 92 ft) for only a few hours.

To better define the potential impact of disposal on the water column and to compare the potential impacts across the alternative sites, the Short-Term FATE (STFATE) dredged material disposal model was applied to characteristic dredged material from the New England region for each alternative site to predict disposal plume behavior (Corps, 2004a). The STFATE modeling study methods and results are described in a recent modeling report (Corps, 2004a). STFATE is a numerical model that is used to simulate plume behavior, including physical mixing, transport, settling, and contaminant dilution in and around a disposal site during the first few hours after the release of dredged material. It is based on the work of Brandsma and Divorky (1976) and Koh and Chang (1973). The model is also applied on a project-specific basis, and the results can be used to establish conditions for management of disposal.

STFATE was used previously to model plume behavior in the area of Site W (Corps, 2001b). In that study, the model was used to simulate conditions specific to the Providence River dredged material; assumptions included a very high degree of cohesiveness and, as a worst case, a highly contaminated material. The model results showed that nearly all the dredged material would settle to the bottom in close proximity to the release point and that TSS concentrations in the residual plume would generally fall below background levels within 1.5 to 3 hrs.

The STFATE model simulations were also performed for each of the two alternative sites (Site E and Site W) using oceanographic conditions appropriate to the sites and dredged material properties representative of harbor dredging projects that might be expected throughout the region (Corps, 2004a). STFATE requires information on water depth, current velocity, sediment characteristics, and results of toxicity tests to estimate the water quality resulting immediately after disposal. Because a stratified water column may cause greater loss of material during the descent phase, the most conservative case of a strongly stratified water column was modeled. A stratified density profile representing typical summer conditions was determined from historical data (Williams, 1969; unpublished data) and used for all model runs (a surface layer salinity of 32 practical salinity unit [PSU] and temperature equal to 19 °C; and a bottom layer salinity of 32.5 PSU and temperature of 8 °C). It was also assumed that water from the dredging site would be slightly less saline than water at the disposal site. The disposal operation parameters, including the volume of dredged material and the barge dimensions, were based on information from typical barge configurations and sizes previously used in the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a). Estimates of the current velocities were determined from the statistical analysis of current meter data described in Section 3.4.

Sediment samples collected for the recent harbor dredging projects in the Providence River, Rhode Island, and at New Haven, Norwalk, and Guilford, Connecticut, were used to establish grain size and contaminant toxicity parameters (Corps, 2001c; Corps, 2001d; Corps, 2001e) and are considered representative of typical dredged sediments that might be disposed of at the alternative sites. The average geotechnical composition of the sampled sediments was selected and consisted of a mix of 10 percent fine sand, 76 percent silt, and 14 percent clay. Field experience shows that the clamshell dredging operations typically used to dredge sediments in the region results in a significant portion of the cohesive sediment remaining as clumps within the barge and during disposal. For that reason, mixes of 40 percent and 60 percent clumps were used for all STFATE modeling runs.

During dredged material evaluations for the four harbor sites, biological testing was used to determine the sensitivity of indicator organisms to eluted (extracted) contaminants. This was done by determining the dilution required for sediment samples to reach elutriate levels fatal to 50 percent of the test organisms (i.e., LC_{50}). Of the nearly 40 elutriate analyses done in the four studies using two species (*Americamysis bahia* and *Menidia beryllina*), the average of the two most toxic samples had LC_{50}'s of 28 and 26 percent. The lower of these two values (26 percent) was selected as a worst case. To represent more typical values, the LC_{50} value corresponding to the 85th percentile of samples was also selected (LC_{50} = 38 percent). The "Green Book," *Evaluation of Dredged Material Proposed for Ocean Disposal — Testing Manual* (EPA and Corps, 1991), sets a dilution criterion of 1/100th of the elutriate LC_{50} concentration. This criterion is not expected to be exceeded after the period of initial mixing (4 hrs after dumping) anywhere in the designated disposal site or at anytime outside the disposal site. The STFATE model was used to evaluate water quality by tracking the predicted plume dilution in the water column and comparing it to the water quality criteria of 1/100th of the elutriate LC_{50} (0.26 percent and 0.38 percent). STFATE model runs were performed that varied the percentage of clumps and water content of the sediment in the barges, plus the strength of the currents. This provided a matrix of conditions against which to compare the alternative sites for water quality impacts.

Site E

For Site E, the STFATE model calculations were performed on a 7,080-ft by 7,080-ft grid rotated 35° counter-clockwise to align the grid with the site boundaries. The grid resolution was set to 177 ft by 177 ft. The water depth was set to a uniform depth of 125 ft. No current data are available from Site E. A short-term current meter record was made at a location several miles east of the Site E in the spring of 1995 (Paul, 2003). The information from that deployment is limited but shows that the tidal currents are between 10 to 20 centimeters per second (cm/s) and are directed north or northeast and south or southwest. Currents observed during the 45-day deployment period reached approximately 45 cm/s, but exceeded 25 cm/s only about 10 percent of the time. Depth-averaged currents of 25 cm/s directed toward the northeast were selected for the period of the simulation as corresponding approximately to a 10-percent frequency of occurrence (currents of 25 cm/s or less measured 90 percent of the time). The current speed was adjusted downward slightly in a second set of simulations to account for the diminishing of the tidal current that would occur during the 2 to 3 hrs of plume advection.

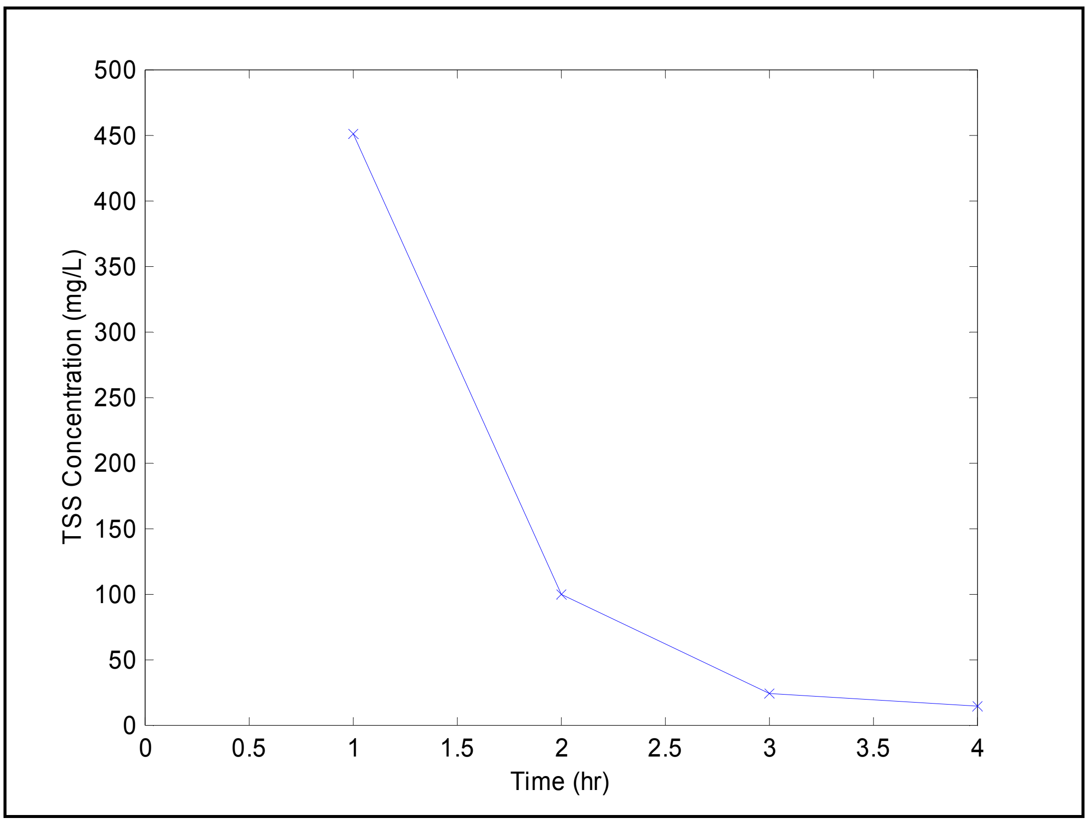
Model simulations showed that most of the released dredged material settled to the bottom near the point of release. The results of the STFATE model predictions for Site E for dilution relative to the toxicity criteria are presented in Table 4-6. The dilutions were within the limits after the 4-hr initial mixing period within the boundaries of the site. The toxicity criteria were exceeded when the plume passed out of the site boundaries. These occurred for the lower $1/100^{th}$ of the LC_{50} limit (0.26 percent) for all higher current speed simulations and in the case of one of the lower current speed simulations. This was the case for both barge sizes. The use of a smaller barge size was not sufficient to overcome the time requirement needed for adequate dilution. For Site E, the model results suggested that dilution of contaminants below the prescribed $1/100^{th}$ of the LC_{50} level for worst-case projects could be achieved only by (1) limiting operations to times of minimal currents, (2) expanding the site boundaries, or (3) possibly using still smaller-capacity barges.

The potential effects of elevated TSS concentrations were gauged by comparing model-predicted concentrations to background levels. The TSS concentrations from a model simulation of disposal of a 3,000-CY barge in Site E are predicted to return to background levels within 4 hrs after disposal (Figure 4-10).

Table 4-6. STFATE Model Parameters and Dilution Results for Site E.

1/100th of the LC_{50}	Barge Volume (CY)	Current Speed (cm/s) and Direction[1]	Clumps (% vol)	Free Water (% vol)	Elutriate Toxicity Criteria Exceeded?
0.26%	3,000	20	40%	10%	Exceeded Outside Boundary
0.26%	3,000	20	60%	30%	Exceeded Outside Boundary
0.26%	3,000	17	40%	10%	Not Exceeded
0.26%	3,000	17	60%	30%	Not Exceeded
0.26%	5,000	20	40%	10%	Exceeded Outside Boundary
0.26%	5,000	20	60%	30%	Exceeded Outside Boundary
0.26%	5,000	17	40%	10%	Exceeded Outside Boundary
0.26%	5,000	17	60%	30%	Exceeded Outside Boundary
0.38%	3,000	20	40%	10%	Not Exceeded
0.38%	3,000	20	60%	30%	Not Exceeded
0.38%	3,000	17	40%	10%	Not Exceeded
0.38%	3,000	17	60%	30%	Not Exceeded
0.38%	5,000	20	40%	10%	Exceeded Outside Boundary
0.38%	5,000	20	60%	30%	Exceeded Outside Boundary
0.38%	5,000	17	40%	10%	Not Exceeded
0.38%	5,000	17	60%	30%	Not Exceeded

[1] All current directions are west-southwest.



Note: This figure shows the maximum concentration over the entire model grid for a 3,000-CY release in Site E with 40 percent clumps, 10 percent free water, and no current.

Figure 4-10. Predicted Change in Dredged Material Plume TSS Concentration After Release at Site E.

Site W

For Site W, the STFATE model calculations were performed on a 7,080-ft by 7,080-ft grid encompassing the disposal site and surrounding area with grid resolution of 177 ft north by 177 ft east. The water depth was set to a uniform depth of 125 ft.

Current data from Site W were used to characterize current velocities for the site (see Section 3.4). Tidal currents at the site are directed northwest and southeast, with an average diurnal tidal flow of 12 to 13 cm/s near-surface. However, only 40 to 50 percent of the current variance measured during the 2-month late spring deployment period was due to the tide (Section 3.4). The remainder was caused by wind stress and atmospheric pressure gradients associated with storms. Depth-averaged currents of 20 cm/s resulting from the influences of the wind and the tide, which are directed toward the northwest, were selected for the period of the simulation. This corresponds to a 10-percent frequency of occurrence (currents of 20 cm/s or less were measured 90 percent of the time). These conditions are consistent with dredged material release during peak flood tide with a wind-driven current running in the same direction. The current speed was adjusted downward slightly in a second set of simulations to account for the diminishing of the tidal current that would occur during the 2 to 3 hrs of plume advection.

STFATE predicted the spread of the material in the water column during settlement, the footprint of the material on the bottom, and the distribution in space and time of the residual plume of suspended solids and contaminants relative to background conditions. Model simulations showed that most (90 percent) of the released dredged material settled to the bottom near the point of release.

The current conditions chosen for the simulation were the most significant factor in determining the residual plume behavior. This might be expected given that a current of 20 cm/s will cross half the width of Site W in approximately 1.25 hrs. For all simulations, the release point was chosen as the center of the site. The results of the STFATE model predictions for dilution relative to the toxicity criterion ($1/100^{th}$ of the LC_{50}) showed that all dilutions were well within the limits after the 4-hr initial mixing period (Table 4-7). However, the toxicity criterion was exceeded in two cases when the plume passed out of the site boundaries, approximately 2 hrs after release. This represents the worst case of sediment contamination properties, combined with large barge volume and high current speed (see Corps, 2004a). For this case, dilution returned to permissible levels within 10 to 20 min after the plume crossed the site boundary. If a larger upcurrent distance from the release point to the site boundary were used, the dilution criterion would not have been exceeded. This model result might be difficult to apply to Site W, however, since the tidal currents account for only 40 percent to 50 percent of the total current variance, making it difficult to predict actual currents at the site at any given time. Barge size was another significant factor, but the percent volume of clumps and percent volume of free water used in the simulations were not significant within the ranges simulated. The results suggested that dilution of contaminants below the prescribed $1/100^{th}$ of the LC_{50} level for worst-case projects could be achieved by adjusting the management approach either by (1) limiting barge size, (2) properly positioning the release point according to the ambient currents, or (3) expanding the site boundaries. Dredged materials with contaminant levels equal to the

85th percentile rank for the four harbors reviewed (LC_{50} = 38 percent) were not shown to exceed water quality criteria under any of the modeled conditions.

Table 4-7. STFATE Model Parameters and Dilution Results for Site W.

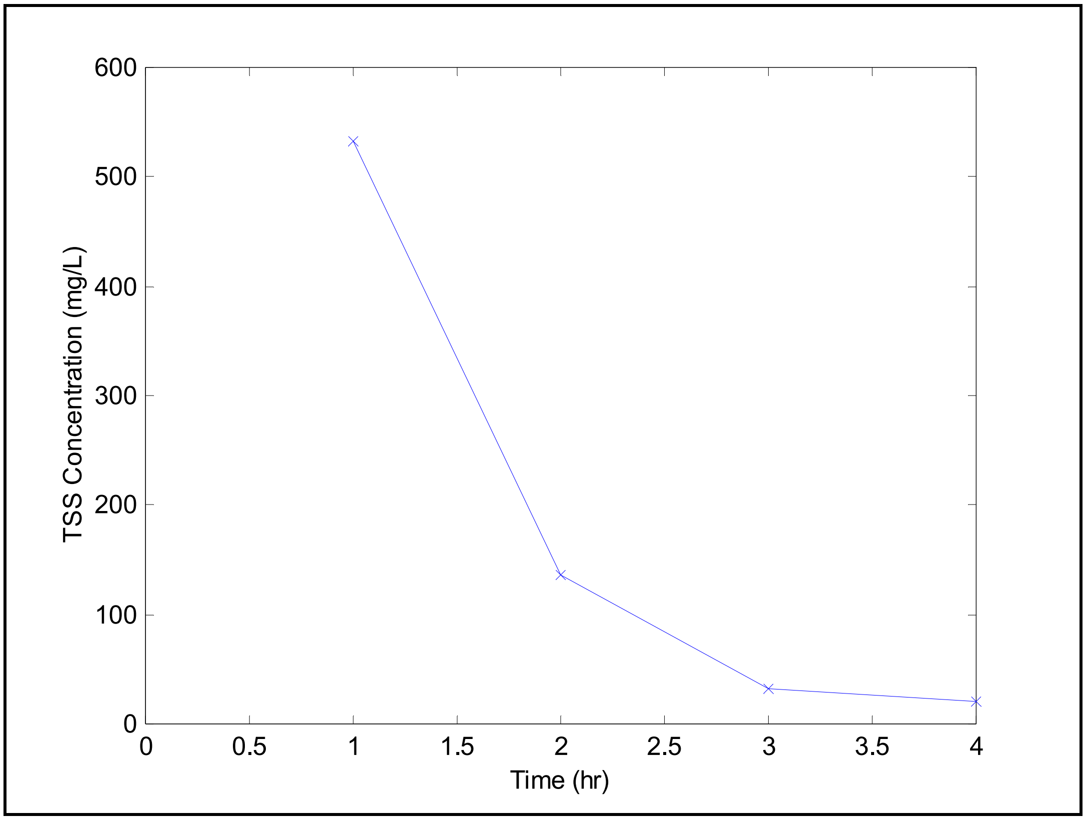
1/100th of the LC_{50}	Barge Volume (CY)	Current Speed (cm/s) and Direction[1]	Clumps (% vol)	Free Water (% vol)	Elutriate Toxicity Criterion Exceeded?
0.26%	3,000	20	40%	10%	Not Exceeded
0.26%	3,000	20	60%	30%	Not Exceeded
0.26%	3,000	17	40%	10%	Not Exceeded
0.26%	3,000	17	60%	30%	Not Exceeded
0.26%	5,000	20	40%	10%	Exceeded Outside Boundary
0.26%	5,000	20	60%	30%	Exceeded Outside Boundary
0.26%	5,000	17	40%	10%	Not Exceeded
0.26%	5,000	17	60%	30%	Not Exceeded
0.38%	3,000	20	40%	10%	Not Exceeded
0.38%	3,000	20	60%	30%	Not Exceeded
0.38%	3,000	17	40%	10%	Not Exceeded
0.38%	3,000	17	60%	30%	Not Exceeded
0.38%	5,000	20	40%	10%	Not Exceeded
0.38%	5,000	20	60%	30%	Not Exceeded
0.38%	5,000	17	40%	10%	Not Exceeded
0.38%	5,000	17	60%	30%	Not Exceeded

[1] All current directions are northwest.

The potential effects of elevated TSS concentrations were gauged by comparing model-predicted concentrations to background levels. Several investigators have measured TSS in the ZSF since 1975 (see Table 3-7). The concentrations of TSS from these studies ranged from 0.1 mg/L to 7.4 mg/L. The TSS concentrations expected from a model simulation of disposal of a 3,000-CY barge in Site W are predicted to return to background levels within 4 hrs after disposal (Figure 4-11).

4.3.4 Plankton

The plankton communities at the two alternative sites are not expected to differ from other waters of the ZSF. Because disposal operations are not expected to differ from the description provided in Section 4.1, the impacts from dredged material disposal at both alternative disposal sites would be expected to be as described for planktonic organisms in general (Section 4.1). The primary direct effect on the plankton would be entrainment by the disposal plume as it descended through the water column. However, the intermittent timing of disposal events, the rapid descent of the plume, and the limited area it occupied would keep these effects to a minimum. Thus, the numbers of organisms entrained by the plume would be small relative to those unaffected in the surrounding waters. The localized extent and infrequent occurrence of disposal would minimize the impacts to the planktonic larvae of lobsters (Harding, 1992) and other commercially important species.



Note: This figure shows the maximum concentration over the entire model grid for a 3,000-CY release with 40 percent clumps, 10 percent free water, and no current.

Figure 4-11. Predicted Change in Dredged Material Plume TSS Concentration After Release at Site W.

Dredged material disposal at the alternative sites would also be expected to increase water column turbidity for a short time. The increased turbidity would lower light transmission through the water column within the plume, which could then reduce phytoplankton photosynthesis. However, the rapid dilution of the plume and infrequent occurrence of disposal would minimize indirect impacts on phytoplankton photosynthesis.

Dredged material disposal could also include the release of nutrients from sediments during the plume's descent phase. Nutrient levels released during a disposal event could exceed levels found in the surrounding water column, which could result in a localized, increase in plankton productivity. However, the nutrient mass released would be intermittent and small relative to that in the water within the site and the surrounding area. Therefore, dredged material disposal would not be expected to have an identifiable effect on the plankton communities at either alternative site.

4.3.5 Benthic Invertebrates

The disposal of dredged material at the alternative sites would have a variety of direct and short-term impacts on the benthic community. For example, the descending dredged material plume could dislodge small surface-dwelling animals (e.g., some amphipod and polychaete species) and transport them some distance along the bottom as the plume collapsed. Such disturbance would probably be very similar to that experienced by these animals during storms. Increased suspended sediment levels could affect respiration and feeding, although these conditions would be relatively short-lived. The primary direct impact of dredged material disposal to the benthic community would likely be associated with burial of some organisms and changes in topography. As described in Section 4.1, topographic changes would occur primarily by the building of mounds as the disposed material landed on the bottom. As this occurred, the benthic animals remaining under the descending plume would be buried. This burial would likely kill or damage many of the animals directly, but the overall impact to the benthic community would depend on the depth of burial, the nature of the material (fine versus coarse), the taxa involved, and their ability to burrow back to the surface. For example, Kranz (1974) found that nut clams (*Nucula annulata*, an important member of the infaunal communities at both alternative sites) could successfully emerge from 20 inches of their native sediment burial (mud, composition not specified) but could not recover after burial under 16 inches of fine sand. Mauer *et al.* (1981a) found that the nut clam could reach the sediment surface from a depth of 6 inches, but not from 12 inches, when buried in sediment composed of about 51 to 56 percent silt-clay. Many polychaete worms actively burrow through sediment and are thus predisposed to escaping from burial. For example, an active crawler, *Nephtys incisa*, was able to reach the surface of sediment after burial to 8 inches depth (Saila *et al*., 1971). Even some tube-dwelling worms could reach the surface simply by extending their feeding tubes.

However, indirect impacts on infauna that survived initial burial by the dredged material would likely occur. Probably the most important of these would be that the increased energetic cost of recovering from burial under the mound could decrease reproductive output and increase susceptibility to predation (Hall, 1994). Changes in food availability resulting from disposal could also adversely impact animals that survived the initial burial. These indirect impacts could become expressed as changes in population densities, recruitment, and dispersion (Hall, 1994). Indirect impacts may not be immediately recognizable through traditional benthic monitoring. Zajac and Whitlatch (1989) found that although population abundance data for the polychaete worm *Nephtys incisa* showed no differences between dredged material and reference sites in Long Island Sound, the populations had very different age and size-class structures that were related to dredged material disposal.

Because the native species would be buried, the nature of the community present immediately after disposal would be determined primarily by the animals that were present in the dredged material and that were able to survive the process of dredging, transport to the site, and disposal. However, the likelihood of surviving this process is not known with any degree of certainty. Therefore, for at least a short period of time immediately after disposal, the community would likely be effectively eliminated or would consist of very different species. The most immediate and intense effects would occur at the center of the disposal mound, where the native fauna would be buried the deepest and populations would be severely impacted (Zajac and Whitlatch, 1988). Zajac and Whitlatch (1988) speculated that some of the population changes occurring near the center of a disposal site might result from migration of some taxa from the area. The effects would lessen at increasing distance from the center of the disposal mound. Rhoads *et al.*

(1978) suggested that disturbance by dredged material disposal resets the progression of benthic community development in a fashion similar to storm events.

Often, these impacts to the benthos are temporary, as the native community either burrows to the surface or recolonizes the area. However, long-term effects to the benthos within a disposal footprint may result. The rate at which a community returns depends on many physical and biological factors. The first consideration is the texture and organic content of the deposited material, as discussed in Section 4.3.2. Any substantial change in texture reduces the chances that the community present after disposal would be similar to that present before disposal. Physical disturbance to the seafloor by storms could also affect the timing, and perhaps the nature, of recovery. McCall (1978) concluded that seafloor disturbances from natural events had considerable influence on the benthos in Long Island Sound.

Biological factors strongly influencing recovery of a benthic community include the variability naturally inherent in the general Rhode Island Sound ecosystem. This variability is expressed by spatial and temporal differences in the availability of larvae, juveniles, or adults to colonize newly established habitats (Ólafsson *et al.*, 1994). It is often presumed that larval recruitment constitutes the primary mechanism by which recolonization occurs. However, Zajac and Whitlatch (1988) found that initial recruitment after disposal at their study station in the Central Long Island Sound Disposal Site was by adults migrating from other areas. Subsequent population increases then would occur by recruitment of new age classes to the area. Importantly, Zajac and Whitlatch discovered that this recruitment was low at the disposal site, but that it was not related to the disposal events as recruitment was also low elsewhere. Therefore, while it may appear that recovery of a mound may be slower than anticipated, that delay may be related to factors (e.g., temperature, dissolved oxygen [DO]) other than those arising from disposal (Zajac and Whitlatch, 1988). Post-recruitment processes such as predation on larvae by resident suspension feeders, predation on infauna disturbed by physical events, variation in the food supply, and emigration and immigration also influence the community that eventually develops in new habitats (Ólafsson *et al.*, 1994). Thus, initial recruitment into and subsequent community development on a dredged material mound may not follow predicted successional models such as that offered by Rhoads and Germano (1982; 1986).

Because of the uncertainties regarding the physical nature of the dredged material (i.e., grain size, organic content) to be disposed of and those associated with the biological factors mentioned above, it is difficult to predict the specific benthic community assemblage that would inhabit the alternative disposal sites after the completion of disposal. However, the discharges subsequently would be modified by physical forces existing at the site or by biological activities as organisms migrated into or settled onto the new substrates. During that period, the dredged materials would be reworked and eventually could begin to resemble the surrounding area in many characteristics (SAIC, 2001a; SAIC, 2001b; SAIC, 2001c).

Site E

The benthic community at Site E consists primarily of three major taxonomic groups: Mollusca, Crustacea, and Annelida. Although many species belonging to these groups have shown remarkable abilities to burrow up through deposited dredged material, the predominant species are relatively small and have limited burrowing abilities. Mortalities would increase with increasing depth of burial (Maurer *et al*., 1981a; Maurer *et al*., 1981b; Maurer *et al*., 1982). The numerically dominant animal at Site E was the small nut clam *Nucula annulata* (Table 3-11), which has been shown to be able to reach the sediment surface from a depth of 6 inches to 20 inches, depending on the nature of the sediment (Kranz, 1974; Maurer *et al*., 1981a). The predominant small crustaceans, *Ampelisca agassizi* and *Byblis serrata*, are suspension-feeding tube dwellers with limited burrowing capabilities and could be adversely affected by burial. The most common polychaete species, *Polygordius* sp. and *Tharyx acutus*, are small and would likely be adversely affected by burial. Restoration of the infaunal community would rely primarily on colonization by migration from adjacent habitats or by larval settling rather than vertical migration. Recovery of the biological community would likely be well under way within a few years after use of the site ceased.

Because of the current community assemblage at Site E, the sudden change in community type experienced during and immediately after disposal probably would be similar to that experienced at Site W. Site E had similar, although marginally higher, infaunal abundance, similar numbers of species per sample, and similar species diversity to Site W (see Tables 3-11 and 3-12). The predominant species at Site E were similar to those at Site W. There was slightly less variability in the sedimentary habitats at Site E, which had a higher sand content than habitat at Site W, but the fine fraction was similar between the two sites.

Site W

The benthic community at Site W consists primarily of three major taxonomic groups: Mollusca, Crustacea, and Annelida. As discussed for Site E, although many species belonging to these groups have shown remarkable abilities to burrow up through deposited dredged material, the predominant species are relatively small and have limited burrowing abilities, and mortalities would increase with increasing depth of burial. The numerically dominant animal at Site W was the small nut clam *Nucula annulata* (Table 3-12), which can reach the sediment surface after burial to a depth of 6 inches to 20 inches, depending on the nature of the sediment. The predominant small crustaceans, *Ampelisca agassizi* and *Byblis serrata*, are suspension-feeding tube dwellers with limited burrowing capabilities and could be adversely affected by burial.

Because of the current community assemblage at Site W, the sudden change in community type experienced during and immediately after the ongoing disposal would be similar to that at Site E. Site W had similar infaunal abundance, numbers of species per sample, and species diversity to Site E (see Tables 3-11 and 3-12). The predominant species at Site W were similar to those at Site E. There was slightly more variability in the sedimentary habitats at Site W, which had a higher gravel content than that at Site E, but the fine fraction was similar.

However, this scenario has been changed by the ongoing use of much of the area for the deposition of clean sediments associated with the maintenance dredging of the Providence River Federal Navigation Channel. It is unlikely that little more than a remnant of the natural community described above now exists at Site W. However, with the completion of the Providence River Channel disposal activity, weathering of the recently added materials, immigration by motile species, and larval settlement will commence. These events would be destroyed by subsequent discharges of dredged material. But, with a large area of similar character surrounding Site W available to provide recolonizing organisms, recovery of an infaunal community having a structure similar to the predisposal condition is expected to follow normal patterns.

4.3.6 Finfish

Localized short- and long-term impacts to finfish may result from the disposal of dredged material in Rhode Island Sound. While the impacts to finfish would range from acute mortality associated with burial to temporary displacement during periods of high turbidity at the disposal site, the direct impacts from dredged material disposal would generally be limited to the area of the disposal. The most immediate impact to fish would be the possible burial by the descending dredged material. Many fish, because of their relative mobility and the hydrodynamics of the descending plume, should be able to avoid injury from the initial impact of the dredged material, although it is unlikely that all fish would escape unharmed. For example, in response to the descending material, demersal species such as flounder and tautog could seek refuge in or near the substrate, or simply may not move quickly or far enough to avoid being buried. Most finfish probably would not survive complete burial. The loss of these individuals during the disposal process should not cause sufficient mortality to adversely affect the populations of any species.

Immediately following a disposal event, increased turbidity might be a temporary problem for finfish in the disposal area, creating a direct impact for some species and life stages and an indirect impact for others. The impacts of increased turbidity to finfish would depend primarily on the life stage present during disposal. Adult and juvenile finfish are capable of leaving a disposal area that has high turbidity levels, although suspended sediments may injure some individuals by lacerating the protective gill covering and irritating or clogging the gill system (O'Connor, 1991). Damage to the gills of finfish can inhibit the effective respiration, thereby increasing the chances of mortality (LaSalle *et al*., 1991). The planktonic egg and larval stages of finfish, unlike adults and juveniles, have limited control over their mobility and may not be able to move away from the suspended sediment. As a result, younger life stages present at a disposal site may experience higher rates of turbidity-associated impacts.

Elevated turbidity levels may indirectly impact finfish by altering behaviors such as migration, spawning, foraging, schooling, and predator avoidance (O'Connor, 1991). Fish species that migrate through Rhode Island Sound during early spring may avoid disposal areas temporarily during periods of high turbidity. Following these turbid periods, finfish may be drawn back to the disposal site by irregularities in the substrate and the presence of new material containing infaunal organisms and other forage.

Perhaps the most significant impact to the fish community associated with the disposal of dredged material would be the potential alteration of the community as the result of changes to habitat and food resources. It is likely that most finfish would leave the area during the disposal event to escape the associated turbidity. This departure from the area would be temporary and, once disposal activities had ceased and the turbidity diminished, the finfish would likely return to the region to forage. However, as described in Section 4.3.5, it would take time for the benthic community to reestablish following a disposal event, reducing the foraging opportunities in the area until the recolonization process was under way.

The changes in bottom topography associated with dredged material disposal would not be expected to cause measurable impacts to marine life at either alternative site. The disposal mounds would likely slope gradually from the highest point to the level of the surrounding seafloor, which probably would not prevent pelagic species from reentering the area after the end of disposal operations. Most demersal organisms would return to an area despite new and distinct contouring. The larvae of some demersal fish, such as windowpane flounder, winter flounder, or summer flounder, might use an undisturbed silt or mud habitat for refuge and actively avoid freshly deposited dredged material that did not have a loose sediment layer and the varied seafloor relief that would facilitate concealment. There are few field or experimental data to indicate the refuge qualities necessary for the various demersal species. The potential displacement or loss of refuge probably would be limited to a period of a few years. After that period, the surface characteristics of the disposal mounds would be increasingly similar in surface texture and small-scale relief to predisposal conditions. Rocky substrates could become re-exposed as the disposed material weathered.

While some finfish species would delay returning to the site because of the change in benthic community, others could be attracted to the high density of colonizing species and disturbed sediments (Clark and Kasal, 1994). Clarke *et al*. (1988) suggested that demersal fish species are likely to return to an area in which the topographic features have been modified. The minor changes in currents resulting from the new contouring might attract prey species such as polychaetes and mysid shrimp, thus attracting larger predators such as finfish (Clark and Kasal, 1994).

Discussions of potential impacts on finfish at each alternative site are presented below. Impacts were assessed by examining the abundance relative to other parts of Rhode Island Sound and other species, and by considering the life history characteristics of each species (life stage, migration, foraging requirements, refuge).

Site E

The information available about fish populations in and near Site E indicates that the potential for adverse impacts associated with dredged material disposal at the site is minimal. National Marine Fisheries Service (NMFS) sampling conducted within about 4 nautical miles (nmi) of the site yielded lower Catch-per-Unit-Effort (CPUE) values (270 to 651 fish/tow) than found in much of the remainder of the ZSF (Section 3.10.2). Recent (July 2003) similar tows conducted in and near Site E showed that the fish population there was very similar in abundance and numbers of species as that in and near Site W. The sampling conducted at the alternative sites focused on capturing demersal fish because of their importance to the EIS evaluation. Most of the fish caught in the 2003 survey were demersal species, which are most likely to be impacted by burial and the disruption of forage habitat. The primary pelagic species at Site E, Atlantic butterfish and squid, would be most affected by water-column impacts that interrupted feeding on pelagic prey. These species would most likely be able to avoid the descending dredged material plume.

Site E is within a part of Rhode Island Sound that has Essential Fish Habitat (EFH) designated for 29 species (Section 3.10.2, Appendix A-4). However, only seven of these species (excluding the two skate species recently added to the EFH listing for the site) were caught in the tows conducted in 2003. Four species (winter flounder, Atlantic butterfish, spiny dogfish, and summer flounder) were relatively common. Skates were the most abundant fish caught in the trawls at Site E, but they were not identified to species, so it is not known whether the little skate or winter skate were among the catch. Site E is within EFH that has been designated for winter flounder eggs, larvae, juveniles, and adults. However, winter flounder spawn throughout the region, so Site E is not a unique spawning or nursery area. Therefore, dredged material disposal at Site E would not likely have a significant adverse impact on any of the winter flounder life stages.

The overall impacts to fish populations by dredged material disposal at Site E are expected to be minor and short-term and to consist primarily of localized, limited habitat disruption. Use of the site would likely resume after disposal ceased, although the time-frame for complete repopulation of the area might depend on the length of time the benthos required to recolonize the impacted seafloor. In addition to sediment, the habitat diversity available to fish in Site E includes rocky substrates in the northeastern portion of the site. Disposal of dredged material could reduce overall habitat diversity here unless site management activities restricted the disposal locations to areas that do not have rocky substrates.

Site W

The information available about fish populations in and near Site W indicates that the potential for adverse impacts associated with dredged material disposal at the site would be minimal. NMFS sampling conducted within about 4 nmi of the site yielded lower CPUE values (217 to 725 fish/tow) than found in much of the remainder of the ZSF (Section 3.10.3). Tows conducted in 2002 also yielded a relatively low average CPUE (680 fish/tow). Recent (July 2003) similar tows conducted in and near Site W showed that the fish population there was very similar in abundance and numbers of species to that in and near Site E. As was the case for Site E, most of the fish caught at Site W in the 2003 survey were demersal species that are most likely to be impacted by burial and the disruption of forage habitat. The primary pelagic species at Site W, Atlantic butterfish and squid, would be most affected by water-column impacts that interrupted feeding on pelagic prey. These species would most likely be able to avoid the descending dredged material plume.

Site W is within a part of Rhode Island Sound that has EFH designated for 31 species (Section 3.10.3, Appendix A-4). However, only six of these species (excluding the two skate species recently added to the EFH listing for the site) were caught in the tows conducted in 2003. Three species (winter flounder, Atlantic butterfish, and spiny dogfish) were relatively common. Skates were the most abundant fish caught in the trawls at Site E, but they were not identified to species so it is not known whether the little skate or winter skate were among the catch. Site W is within EFH that has been designated for winter flounder eggs, larvae, juveniles, and adults. However, as discussed for Site E, dredged material disposal at Site W would not adversely impact concentrations of winter flounder eggs, larvae, and juveniles because they are not uniquely found in the open water deep areas of this site.

The overall impacts to fish populations by dredged material disposal at Site W are expected to be minor and short-term and to consist primarily of localized, limited habitat disruption. Use of the site would likely resume after disposal ceased, although the time-frame for repopulation of the area might depend on the length of time the benthos required to recolonize the seafloor. Additionally, the habitat types available to fish within alternative Site W are not as diverse as those found at Site E. Therefore, from an overall management standpoint, there would be more operational latitude to allocate disposal locations at Site W than at Site E.

4.3.7 Shellfish

In general, the disposal of dredged material in the RIR ZSF may result in short- and long-term impacts to shellfish populations. The most significant impact is the burial of shellfish that are in the direct footprint of a disposal mound. This section describes the potential impacts to the ocean quahogs, surf clams, sea scallops, and whelks that are commercially harvested in the ZSF. Impacts to lobsters are discussed in Section 4.3.8.

The most important direct impact of disposal operations to shellfish in the ZSF is burial by a descending sediment mass. Depending on the thickness of the dredged material deposited, the frequency of subsequent disposal events, and the sediment type or composition, some species would be more likely to recover from burial than others. Sea scallops and surf clams live on the sediment surface or just below it and thus may have limited abilities to recover from burial by more than a few inches of dredged material. The ability of sea scallops to "swim" further reduces the likelihood of their demise as the result of a discharge of dredged material. Whelks live on the surface of the sediment and, because they are very mobile, may be able to eventually escape some degree of burial at a disposal mound. However, the effects of burial on any of these taxa have not been studied. Ocean quahogs may survive for a time in areas of little to no oxygen (Oeschger, 1990; Rosenberg *et al*., 1991) and can survive burial to a depth of 4 inches (Taylor, 1976).

Increased water column turbidity, decreased light penetration, and the release of nutrients or contaminants from sediments all may impact all life stages of shellfish. In particular, increased sediment material in the water column from a discharge of dredged material may interrupt feeding and respiration by filter-feeding bivalves. Most filter feeders stop feeding and reduce respiration while the sediment content in the water is high. Such interruptions are likely to be relatively short in duration. Egg and larval stages of shellfish present at the disposal site may experience higher rates of turbidity-associated impacts. These impacts could be larger during the summer months when spawning generally occurs and there is a larger plankton population.

Potential indirect impacts to shellfish from disposal activities include reductions in growth and altered or prematurely terminated reproduction activities that may translate into changes in population densities. Physical changes to the sediment characteristics (i.e., grain size or organic carbon content) may indirectly affect the types and quantities of shellfish inhabiting a particular area by affecting the survival of residents or the recruitment of new members.

Erosion is another possible indirect impact to shellfish. As sediments erode from a mound, any newly settled larvae or adults that have burrowed into or affixed themselves to the surface layer of the sediment might be swept away from the area or exposed to a greater predation risk.

The potential impacts on individual species at the alternative sites were assessed by determining the abundance of these species as compared to that within the general ZSF area and evaluating the life history characteristics of each species (life stage, migration, foraging requirements, refuge, etc.).

Site E

As described in Section 3.11, sampling at Site E did not reveal the presence of populations of surf clams, sea scallops, and whelks. Therefore, any impacts that did occur would be experienced by relatively few, if any, representatives of the species. Site E does support a population of ocean quahogs. However, historical accounts (Fogarty, 1981) and recent surveys (Corps, 2003c) indicate that the population is small relative to other locations in the ZSF. The habitat type in Site E ranges from coarse to medium sand in the southwest portion of the area to silty-fine sand along the southern portion of the area. Ocean quahogs occur primarily in sediments with high amounts of medium sand and shell fragments. Adverse impacts to ocean quahogs would be confined to that portion of the site.

The disposal of dredged material at Site E would bury the shellfish that are in the direct path of the sediment deposition, but these activities should not have an adverse impact to the shellfish populations found in the greater ZSF.

Site W

As described in Section 3.11, sampling in Site W did not reveal the presence of populations of surf clams, sea scallops, and whelks. Therefore, any impacts that did occur would be experienced by relatively few, if any, representatives of the species. Site W does support a population of ocean quahogs. However, historical accounts (Fogarty, 1981) and recent surveys (Corps, 1998b; Corps, 2003c; Corps, 2003d) indicate that the population is small relative to other locations in the ZSF. The habitat type in Site W consists of unconsolidated soft bottom with very fine sand mixed with silt-clay. Areas of fine rippled sand habitat are found in the northern, eastern, and southern sections of the site.

The disposal of dredged material at Site W would bury the shellfish that are in the direct path of the sediment discharge, but these activities should not pose an adverse impact to the shellfish populations found in the greater ZSF. The commercial shellfish resource appears to be greater around Site E than in Site W.

4.3.8 Lobster

In general, many of the potential impacts from dredged material disposal that affect shellfish may also impact the lobster population in the ZSF. There are possible short- and long-term impacts to lobsters that can be evaluated through direct and indirect effects.

The burial of lobsters or burial of a desirable lobster habitat are considered during the selection of a disposal area. As discussed in Section 3.12, lobsters occur in a variety of habitats such as rocks and crevices for hiding and protection, but they are also found in consolidated silty-fine sand areas where they can burrow into the seafloor material. If the descending dredged material discharge does not bury a lobster, the lobster's ability to burrow may enable it to escape from the mound.

The increased material suspended in the water column after the disposal of dredged material is too localized and infrequent to represent a serious threat to the planktonic larvae of the lobster (Harding, 1992). However, this increase in suspended particulate matter has the potential to interfere with the normal physiological processes of some organisms through mechanical damage to respiratory surfaces of fish and lobsters (Saila *et al.*, 1971). Experimental studies concluded, however, that lobsters did not appear to be affected by high suspended sediment concentrations for short time periods such as resulting from storm events.

The disposal of dredged material and the creation of a disposal mound can alter the habitat of juvenile and adult lobsters by disrupting and burying shelter and food resources. Varied bottom topography or substrate types have been identified as desirable locations to find lobsters. Fisherman from Long Island Sound reported that trawling and lobstering near active disposal sites was more productive than when disposal was not occurring (Corps, 2003a). This may be due to the changes in topography and bottom type from the disposal of sediments and other material.

The potential impacts to lobsters at each alternative site were assessed by determining the abundance of lobsters at each alternative site as compared to the general ZSF area and evaluating the life-history characteristics of lobsters (life stage, migration, foraging requirements, refuge, etc.).

Site E

The grain-size habitat in Site E is generally medium sand with silty/fine sand in the northeast corner of the area. As discussed in Section 3.12, Site E supports a relatively healthy lobster population with respect to the surrounding area. Small juvenile lobsters are usually found in habitats with rocks and crevices for shelter, which does not appear to occur within the sandy habitat in Site E. The nearby area to the east of Site E does have a more variable terrain, with rocks and cobbles, and also probably has a larger juvenile lobster population.

The data available for Site E are from a lobster pot survey conducted in August 2003. As discussed in Section 3.12, and evident in other areas of the ZSF, lobsters generally migrate from offshore to inshore locations in the summer to molt and mate. Thus, the lobster population at Site E probably decreases during the fall and winter when adult lobsters are offshore. Deposition of dredged material at Site E would impact the lobsters in the direct path of the disposed material but would not be expected to adversely impact the lobster population in the ZSF.

Site W

The habitat in Site W consists of unconsolidated soft bottom with very fine sand mixed with silt-clay. Lobsters in this type of habitat generally dig burrows for shelter and protection. Several recent lobster pot surveys have been conducted in Site W (Corps, 2003e; Corps, 2003f) during various times of the summer and fall. As predicted from the life history discussion in Section 3.12, the lobster population in Site W is largest during the summer months of July, August, and September, when lobsters are molting and mating before they begin their winter migration offshore. The lobster pot surveys conducted during the fall collected fewer lobsters than the other months sampled, indicating that lobsters were less abundant, less active, or less likely to be attracted to bait in the pots during this season.

Lobsters that are in the direct path of a disposal discharge would likely be buried, but the disposal of dredged material at Site W would not be expected to adversely impact the lobster population in the ZSF.

4.3.9 Marine and Coastal Birds

The occurrence of coastal, colonial, and marsh birds in the general ZSF area and at Sites E and W is likely to be minimal during dredging activities. Pelagic birds and waterfowl are more common in the open waters of the ZSF and would likely be the only species that could be impacted by disposal activities. Most of the species of birds identified in Section 3.13 and Appendix A-5 may be found in various areas of the ZSF, depending on the season and species-specific foraging habits. Many of these bird species have large foraging and migrating ranges; therefore, the chances of dredged material disposal events having an adverse effect on a particular species' population in the ZSF are small. Marsh birds and shorebirds are generally found along the coast or in inland bays and are not likely to travel to the alternative sites. Colonial water birds are common along the coastal areas, and raptors nest in inland areas; both may venture farther into the open waters of the ZSF in search of prey (e.g., fish, crustaceans), but probably remain relatively close to shore most of the time. The birds that would most likely be impacted by disposal activities are the pelagic birds and waterfowl, which spend most if not all of their time on the water or foraging in the water for fish, crustaceans, or invertebrates.

No bird species is likely to be impacted directly by dredged material disposal activities because birds are generally found below the water surface only when diving for prey, which is unlikely to occur during disposal operations. The water depth at the two potential sites is too great for birds to realistically be diving for benthic prey. Potential indirect effects on birds from dredged material disposal would include increased turbidity in the water column and reduced light penetration, which would make it difficult for birds to see prey, but these impacts would likely be minimal and would occur for only a very short time period until the disposal material settled. Any potential bioaccumulation of contaminants by the consumption of prey items would be expected to be minimal because of the relatively large foraging range of most birds and the low contaminant levels in dredged material expected to be disposal of within the site. Also, any dredged material disposed of in the ZSF must meet strict regulatory guidelines.

Birds in the area of a disposal site would most likely avoid the immediate vicinity during disposal operations. Birds resting on the water or foraging in the area would likely leave during disposal activities and would not be impacted. Some species, such as gulls, would be attracted to disposal operations, but they are not expected to be impacted by disposal activities.

4.3.10 Marine Mammals and Reptiles

As discussed in Section 3.14, the use of the ZSF or alternative sites by whales, dolphins, seals, and sea turtles is possible but is likely to be limited and would occur for very short periods of time while transiting the area during seasonal migrations. The literature search conducted for this project did not find any specific information on the occurrence of or use by harp seals, hooded seals, white-sided dolphins, harbor porpoise, or minke whales specifically in ZSF waters. The only species that has been identified and documented in the ZSF is the harbor seal. Harbor seals were observed hauled out at Block Island, at Horseneck Rock Piles near Narragansett Bay, and at Seal Rocks off Newport, Rhode Island, in late winter to early spring before migrating north to pupping grounds in Maine and Canada. Whales and sea turtles that are listed as threatened or endangered species are discussed in Section 4.3.11.

Whales, seals, dolphins, and sea turtles have been documented feeding and resting in, or migrating through, portions of the ZSF. In general, possible impacts to marine mammals and sea turtles include (1) bioaccumulation of chemical contaminants occurring in tissues of prey, (2) reduced foraging opportunities during disposal activities, and (3) physical injury from the disposal activities or potential collisions with tugboats and barges carrying dredged material. Significant adverse effects to these species at Sites E and W would be unlikely for several reasons, as discussed below.

No studies have directly evaluated the impact of a descending sediment plume on marine mammals and sea turtles, but any impact would be expected to be minimal because these organisms are relatively mobile (turtles) or are mobile enough to avoid the descending dredged material plume (marine mammals). The risk of the bioaccumulation of contaminants from feeding would be small because any dredged material disposed of in the ZSF must meet the current regulatory testing guidelines for toxicity and bioaccumulation to be classified as suitable for open water disposal. The marine mammals and sea turtles that have been sighted in this area are occasional visitors to this area, not residents, and it is unlikely that they would obtain a significant portion of their food from either of the alternative disposal sites.

Potential indirect effects on marine mammals and sea turtles from dredged material disposal would include increased turbidity in the water column and reduced light penetration, which would make prey detection more difficult. Possible impacts to prey such as plankton, squid, or jellyfish that are in the direct path of the dredge plume could indirectly affect mammals and turtles. These conditions would likely be temporary and would not be expected to have significant adverse effects on marine mammals and sea turtles.

4.3.11 Rare, Threatened, and Endangered Species

As discussed in Section 3.15, several species of whales, sea turtles, birds, and beetles that may use specific areas of the ZSF as part of their migration paths or as foraging habitats are listed as threatened, endangered, or species of concern. Consultation with the NMFS and U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act (ESA) is occurring (for more information, see Section 6.6). Fin whales are the species of whales with the greatest potential to be found in the ZSF. Fin whales feed in coastal waters along the 130- to 165-ft depth contour and therefore may be found in the southern areas of the ZSF. Other whale species are generally found off the continental shelf or in deeper waters and are not expected to occur in the ZSF except as occasional visitors. At Sites E and W, minimal impacts to whales from disposal operations would be expected. Whales would likely avoid any areas where disposal was occurring because of possible disruption to their ability to locate prey and navigate.

Several species of sea turtles have been identified in the ZSF and are discussed in Section 3.15. These sea turtles generally migrate north from the tropical waters of Florida and the Gulf of Mexico and feed on such items as crabs, plants, and jellyfish in coastal areas, including the ZSF, during the summer and fall. The loggerhead, leatherback, and green turtles are the most likely species to be found in the ZSF. Most sea turtles are generally found in the coastal waters in search of prey with average dives of about 200 ft, but many species are known to dive to considerable depths (e.g., leatherback turtles have been documented diving at depths of at least 3,280 ft in search of their preferred prey of jellyfish) (Battelle and the U.S. Coast Guard, 1995). The majority of the sea turtles that use the ZSF are juveniles that feed generally in waters less than 20 meters deep. Although sea turtles are slow swimmers, their ability to avoid vessels during disposal operations at Sites E and W would not be compromised because the disposal vessels are relatively slow-moving; the potential risk could be reduced further by requiring scows to perform avoidance maneuvers if protected species were observed in the operations area. In any case, due to their limited use of the RIR, potential impacts to turtles are expected to be minimal.

Three bird species (bald eagle, piping plover, and roseate tern) are listed on the threatened or endangered species list and five species (common loon, common tern, arctic tern, least tern, and Leach's storm-petrel) are listed as species of concern in Massachusetts or Rhode Island or both. Possible impacts of disposal activities to these bird species are as follows:

- Bald eagles nest in trees near the water's edge and commonly prey on fish and occasionally birds in the open water. Possible impacts to the bald eagle include consumption of contaminated fish or birds. Because these species generally forage in a wide habitat area, including coastal and terrestrial areas, and are known to prey on small mammals and birds, the potential impact of disposal activities at Sites E and W to bald eagles would be expected to be minimal.
- Piping plovers are common along coastal beaches. They nest in the narrow strip of land between high tide and the foot of the coastal dunes. They are commonly found along the coastlines of Rhode Island and on the beaches of Martha's Vineyard, Nantucket, and

Block Island. Their nesting and foraging habitats make it unlikely that piping plovers would occur in the open waters of Sites E and W or be impacted by disposal activities.

- Roseate terns arrive in northern nesting habitats, including coastal Rhode Island, in early May and breed in colonies situated in nesting areas having vegetative cover. They feed on fish such as sand lance, mackerel, and small herring, and rarely on other fish or invertebrates. Roseate terns feed in a variety of areas from up to 0.5 nmi offshore to sheltered bays or inlets and are commonly seen diving for prey. The coastal nesting and foraging areas of these birds make it unlikely that disposal activities in the open waters of Sites E and W would have any impacts on their population.
- The common loon, common tern, and least tern are common in coastal and nearshore areas, feeding on small fish, crustaceans, or insects. The arctic tern and Leach's storm-petrel are generally open ocean birds feeding far offshore on shrimp, squid, or small fish. All of these birds may be occasional visitors to Sites E and W, but their foraging areas are large enough that disposal operations in one specific location would cause minimal impact.

Two beetle species, the northeastern beach tiger beetle and the American burying beetle, are found in specific locations of coastal Rhode Island and Block Island, respectively. These beetles occur either in intertidal areas (northeastern beach tiger beetle) or among shrubs or grasses on Block Island (American burying beetle). Any disposal activities in the open waters of Sites E and W would not have adverse impacts on either of these species.

4.3.12 Contaminant Bioaccumulation Potential

An indirect impact to organisms at either disposal site would be exposure to any potential contaminants present in the dredged material placed on the site through ingestion of the sediment and exposure through contact of dissolved and particulate-bound components in the water column and in sediment pore-water. Although it is not possible to quantitatively predict future tissue concentrations in species at either of the alternative sites, tissue concentrations in organisms are primarily associated with sediment concentrations through bioaccumulation and trophic transfer. However, as part of the MPRSA requirements for dredged material testing conducted by the Corps and EPA (described in Section 1.4), sediments proposed for ocean disposal are subjected to a risk evaluation, and those identified as having possible risks to human health and the environment are managed accordingly. For example, sediments found to have elevated risks are either not accepted for ocean disposal or may be managed through procedures that ensure that the material is isolated from the marine environment and does not pose a potential for unacceptable adverse effects by bioaccumulation. These types of procedures have been a successful management tool for more than 30 years (Fredette, 1991; Fredette *et al*., 1992).

Through the use of these risk-based evaluations to select the appropriate management tools, it is anticipated that tissue concentrations (and subsequent risk to organisms and potential human consumers) would not be increased by placement of dredged material. Therefore, it is anticipated that the tissue concentrations of contaminants in organisms associated with sediments at either alternative disposal site would not increase or pose a risk to either organisms or potential human consumers; thus, bioaccumulation from long-term contact to the sediment would be minimal.

4.3.13 Socioeconomic Environment

As discussed in Section 3.17, Rhode Island and southeastern Massachusetts provide valuable socioeconomic resources to the region. This section analyzes the potential impacts to these resources that could result from the use of the alternative sites (Site E and Site W) for the disposal of dredged material. Because the two alternative sites share the same socioeconomic environment, impacts would be very similar between the two alternative sites; therefore, in some instances the discussion of impacts for Site E and Site W is combined.

Commercial Fishing

Commercial fishing activities occur at or near both alternative sites. Disposal activities could interfere with fishing methods or change the resource itself. For example, disposal activities could restrict the amount of time that either site was available for commercial fishing activities, because fishermen would not want to risk loss of gear when active disposal was under way. Disposal at either site would likely restrict the area available for placing lobster trawls (pots) during and immediately following disposal activities. Anecdotal information from fishermen in other coastal areas (Wright, 1978; Corps, 1979; Corps, 2003a) indicated that their catch often is better in or near active disposal sites. Thus, even though fishing activity could temporarily be displaced by disposal at a site, this anecdotal information suggests that fishermen could experience positive impacts such as improved catches of finfish or lobster as a result of disposal activities.

As discussed in Sections 4.3.6, 4.3.7, and 4.3.8, the primary impacts to finfish, shellfish, and lobsters would be short-term, affecting fish and shellfish immediately following a disposal event by either burial or displacement. In the long term, commercial fisheries would be expected to remain unaltered and not be adversely impacted. A change in substrate as a result of introducing the disposed material could affect the fisheries' productivity in the area. However, that impact is not possible to predict. Dredging windows, when instituted, place a restriction on when dredging can occur and are intended to avoid affecting most species during their early life stages. These seasonal restrictions limit the duration of disposal annually which, depending on the life

Worst-Case Scenario

To estimate fisheries losses that could result from designation of a long-term dredged material ocean disposal site, a number of scenarios were considered. As a conservative approach, only the results of the 'worst-case' scenario are presented in this EIS. This scenario assumes the following:

1. No seasonal restriction is imposed on dredging and subsequent disposal.
2. The site is divided into 10 sub-areas, and disposal occurs for 1 year at each sub-area before moving on to the next sub-area. At the end of 10 years, the process starts again in the first sub-area.
3. 100% mortality of all biota occurs in the sub-area being used for disposal.
4. Each sub-area recovers for 9 years before disposal returns to that sub-area.
5. Fishermen who would have fished at the location of a disposal site would not fish elsewhere.

cycle of the organisms located at a disposal site, can limit the impact to fish and shellfish inhabiting the site (see Section 4.3.6). For example, winter flounder's eggs are demersal and are therefore vulnerable to sedimentation from dredging activities. The winter flounder spawning period is generally January through April. By using dredging windows, spawning areas could be avoided during the winter flounder spawning period to reduce the potential for impacts to this species.

To ascertain the dollar value losses for each alternative site, fishery and economic losses were analyzed under various disposal conditions (Corps, 2004b) using a U.S. Department of the Interior model. The analysis was based on commercial and recreational fish species harvested in the Economic Study Area (see Section 3.17 and Figure 3-71) and assumed a worst-case scenario (see text box). Dollar value losses for commercially harvested species at Site E and Site W were calculated on both a species- and a harbor-specific basis (Corps, 2004d); results are discussed below. Additional economic impacts of disposal at Sites E and W as a result of the dollar losses to the commercial fishing industry are discussed later in this section under *Economic Impacts*.

As a first step, the current dollar value of catch was quantified for 40 species of fish caught within the ZSF (see Appendix A-7). Results show that the major impact of disposal at both Site E and Site W would focus on relatively few species, with lobster (27 percent for Site E and 40 percent for Site W) and quahog/hard clams (28 percent for Site E and 27 percent for Site W) accounting for most of the loss (Corps, 2004d). Model results of losses based on the assumptions of the worst-case scenario estimate that the total percentage lost in terms of dollar value to the Economic Study Area would be approximately 0.01 percent for both sites (Corps, 2004d) (Table 4-8).

Table 4-8. Projected Current Dollar Value of Commercial Catch Losses over the 20-Year Study Period.

Value	Site E ($)	Site W ($)
Current Dollar Value Losses of Catch over Study Period	612,925	966,475
Projected Total Value of Commercial Catch over Study Period	6.6 billion	6.6 billion
% Loss in Value of Catch over Study Period	< 0.01%	0.01%

Source: Corps, 2004d

The current dollar values were also summarized by harbor based on catch reported in the 2001 NMFS vessel trip report (VTR) data (Corps, 2004d) (see Appendix A-7). The largest catch within the Economic Study Area was seen at Point Judith, Rhode Island, from which the highest number of commercial fishing boats sail. While the associated dollar value losses to commercial fishing out of Point Judith were also the highest, these losses would represent a small portion of the total catch (0.06 percent for Site E and 0.1 percent for Site W) made by vessels operating out of that harbor (Corps, 2004d). The total current dollar loss for the entire Economic Study Area would be slightly higher (0.07 percent for Site E and 0.12 percent for Site W).

Approximately 25 percent of the catch from within the ZSF is attributed to ports outside of the Economic Study Area. Dollar value losses projected for these ports range from 1.0 to

1.66 percent, depending on the harbor, with slightly higher losses estimated if disposal occurred at Site W. Considering the large number of harbors beyond the Economic Study Area in comparison to the relatively small size of the Economic Study Area, and in comparison to the much larger area available to fishermen from outside the Economic Study Area, the impact from designation of either site would be insignificant (Corps, 2004d).

In addition, the dollar values reported by harbor only represent 2001 catch reported from a limited area representative of the ZSF. These estimates account for only a small portion of the overall commercial fishing catch from vessels based at those locations; therefore, any losses calculated are relative to that portion of the catch originating in the ZSF, not on the total catch brought into those harbors

Based on this evaluation, the majority of the economic impacts related to commercial fishing were found to be associated with a small number of species. As a result, the loss to commercial fishing boats would be very small. The use of either Site E or Site W for disposal of dredged material would not be expected to adversely impact the ports, marinas, and other land-based activities that support the commercial fishing industry. However, designation of a disposal site would facilitate the continued dredging of Federal channels, which in turn would allow marinas to continue operating at current levels and avoid relocation of commercial vessels due to possible reduction in slip availability.

Recreational Fishing

Recreational fishing is seasonal, occurring mostly from spring to fall when most people are vacationing. Recreational fishing occurs from private boats, commercial boats (charter and party boats), the shore, bridges and jetties, and docks along the coastlines of Rhode Island and southeastern Massachusetts.

The predominant recreational fishing areas are located along the coast of Rhode Island from Watch Hill to Point Judith and extending approximately 5 nmi offshore and around Block Island. Some man-made obstructions such as shipwrecks, jetties, and groins serve as reefs within the ZSF. These areas are likely popular recreational fishing locations, although there is no evidence that fish yields are higher from these areas. No data are available to determine what ports recreational fishermen originate from; therefore, the analysis assumed that recreational fishing boats would come from the entire region.

Impacts to recreational fishing would be spread across an even narrower range of species than those identified for commercial fishing, with bluefish accounting for most of the losses (Appendix A-8). An estimated annual recreational catch of approximately 86 million pounds (lbs) (~$200 million value) over the 20-year study period across the Economic Study Area was assumed based on a 5-year average of available catch data attributable to recreational fishermen (Corps, 2004d) (Appendix A). Table 4-9 illustrates the estimated total dollar value loss to recreational fisheries over the 20-year study period. Also shown is the percent dollar value loss to bluefish, one of the most abundant of the recreational species, over the 20-year study period. In both cases, the percent loss would be less than 0.5 percent of the total fishery, and the overall impact to recreational fishing would be insignificant. Due to the vast area available for recreational fishing outside the limits of any potential disposal site, it is unlikely that there would be any significant economic impact to recreational fishing or boating within the Economic Study Area to either offshore or onshore fishing (Corps, 2004b).

Table 4-9. Distribution of Current-Dollar Recreational Losses over the 20-Year Study Period.

Category	Total Value of Catch over 20-Year Study Period ($)	Value of Catch Lost over 20-Year Study Period – Site E ($)	(%) Loss	Value of Catch Lost over 20-Year Study Period - Site W ($)	(%) Loss
Total Recreational Catch	203,238,254	216,814	1.07%	212,036	1.04%
Bluefish	74,281,746	166,068	0.22%	166,068	0.22%

Source: Corps, 2004d

The recreational fishing industry includes tackle shops, marinas, boats, and charter boats, as well as tourist expenditures at restaurants, hotels, and shops in the area. Economic impacts to the Economic Study Area as a whole as a result of dollar losses from recreational fishing are discussed later in this section under *Economic Impacts*.

Site E: No significant economic impact to recreational fishing would result from designation of Site E as a long term ocean disposal site. Based on the economic analysis (Corps, 2004d), under the worst-case scenario for recreational fishing (including headboats and private or rental boats), a total of up to $216,814 in dollar value losses, representing approximately 1.0 percent of the total projected recreational catch in the Economic Study Area over the 20-year study period, could occur if Site E were designated (Corps, 2004d). A majority of the losses would be attributed to bluefish (77 percent) and tautog (13 percent). Table 4-9 illustrates that the loss to bluefish would account for only 0.22 percent of the total bluefish catch over the 20-year study period under the worst-case scenario.

Site W: No significant economic impact to recreational fishing would result from designation of Site W as a long term ocean disposal site. While designation of Site W could result in a dollar value loss to recreational fishing in the Study Area over the 20-year period of up to $212,036, this represents approximately 1 percent of the total value of recreational catch over the study period (Corps, 2004d). Under the worst-case scenario for recreational fishing (including headboats and private or rental boats), bluefish (78 percent) and tautog (13 percent) represented the majority of loss at Site W. Losses to bluefish would be the same at Site W as at Site E (Table 4-9).

Shipping

Many ships use shipping lanes within the ZSF to enter and leave the Rhode Island and southeastern Massachusetts ports from the Atlantic Ocean. The designation of an open-water dredged material disposal site would result in the continued availability of affordable disposal of dredged material in the region. Designation of a cost-effective, long-term disposal site for dredged material would facilitate the continued economic health of navigation-dependent industries in the Economic Study Area and would preserve the benefits of navigation-related economic activity in the region.

Neither Site E nor Site W is located within shipping or navigation lanes. Site E is far enough outside of the nearest shipping lanes that disposal would have no impact to shipping. Site W is located within the separation zone of the inbound and outbound Narragansett Bay traffic lanes and is actually located adjacent to the inbound lane. Ships are not expected to use the extreme outer boundaries of the lanes but would instead use the center. Therefore, while Site W is adjacent to the inbound lane, it is not expected to adversely affect the ingress or egress of ships in the area. There is a potential for impact at Site W during a disposal event, when shipping in the area may have to be restricted to accommodate disposal. This impact would be short-term only. Disposal of dredged material at either site would not be expected to adversely impact the shipping industry in the long term.

Designation of either Site E or Site W would preserve shipping, provide increased navigation safety and effectiveness, and ensure the continued use, economic viability, and safety of Federal navigational channels and private navigation-dependent facilities.

Military Usage

Rhode Island Sound is an area actively utilized by the U.S. Army, the U.S. Navy, the U.S. Air Force, the U.S. Coast Guard, and the Air Force National Guard, with 20 military facilities that may conduct military exercises in the Sound (see Section 3.17). The military exercises involve personnel and equipment transport and a variety of training exercises, search and rescue, and patrol.

Neither Site E nor Site W infringes on areas used by the military. Site W is the closest alternative site to unexploded ordnance (UXO) materials, with known UXO materials located approximately 1 nmi west of Site W. Disposal of dredged material at Site W would not affect this UXO location. Other military uses, including restricted areas, are at least 2 nmi from either Site E or Site W and would not be affected by disposal.

Mineral and Energy Development

Active telephone cables are present within the ZSF to the east of Block Island and west of Site W and are presumably buried under existing sediments. Active utilities present within the ZSF are not located within the site boundaries of either Site E or Site W. Therefore, none of these resources would be expected to be impacted by disposal activities. One inactive telephone cable transects Site W; however, because it is not active and is likely buried beneath sediment, it would not be affected by potential disposal activities at Site W.

Recreational Activities

Recreational beaches in the vicinity of the two alternative sites would be relatively unaffected by the use of either alternative site for the disposal of dredged material due to the distance of the proposed sites from the shore. Similarly, areas of special concern in Rhode Island and southeastern Massachusetts that occur inland or along the coastline would not likely be affected by the use of either Site E or Site W. Based on the results of the modeling presented in Section 4.3.3, transport of dredged material to beaches would not occur; therefore, no impacts on recreational beach activities such as sunbathing or swimming would be expected to occur.

Because dredging and disposal would be more likely to occur in the winter months, when use of the area by tourists is limited for the most part to inland activities, no impact would occur to other recreational activities such as recreational boating, surfing, diving, and boat races, regardless of which alternative site was selected.

Natural and Cultural Features of Historical Importance

No known natural or cultural features of historical importance were identified at either Site E or Site W. Extensive archaeological studies were performed within the boundaries of the currently proposed Site W in 2001 (Corps 2001a) during the selection process for Site 69b. Magnetometer studies were performed to detect any potential cultural relics, and all targets identified during that study were further investigated using a remotely operated vehicle with a camera. No archaeologically significant targets were identified. Additional side-scan sonar data were collected within Site E in 2003 (Corps 2003i). These data, along with research conducted by University of Massachusetts Archeological Services (Corps, 2004e), did not identify any culturally significant targets within Site E, and no specific reports of shipwrecks were found. The closest known shipwrecks are *U 853*, a German submarine of World War II vintage, resting approximately 1 mi west of Site W, and *Barbara G*, possibly 1 mi south-southeast of Site W.

Other Legitimate Uses

Based on the discussions above regarding recreational fishing, boating, beach use, and natural areas, the use of either Site E or Site W for disposal of dredged material would not adversely impact tourism in the area.

Areas of Special Concern

There are 12 barrier beaches that are Federally protected as units of the U.S. Department of the Interior's Coastal Barrier Resources System within the ZSF. Based on the results of the modeling presented in Section 4.3.3, transport of dredged material plumes to the areas would not occur; therefore, these protected areas would not be adversely affected.

Economic Impacts

Economic impacts to the Economic Study Area from disposal at either Site E or Site W were estimated in terms of income, employment, output, tax revenue, and GSP for the commercial and recreational fishing and recreational boating industries (Corps, 2004d). Estimated impacts were assessed using baseline economic data presented in Section 3.17 (Corps, 2004f). The economic impact analysis for these industries was designed to assess potential economic losses to the businesses, boat owners, and people who are employed in these businesses. The analysis was based on the worst-case scenario (defined earlier in this section) over a 20-year study period (2005-2025) and used very conservative assumptions, meaning that the potential losses are probably overstated rather than understated (Corps, 2004d).

Economic Losses (Income, Employment, Output, Tax Revenue, and GSP): The projected worst-case losses in terms of income, employment, output, tax revenue, and GSP to the Economic Study Area are shown in Table 4-10 for commercial and recreational fishing and recreational boating. Table 4-10 shows the *total* estimated losses for the 20-year study period (2005-2025).

As shown in Table 4-10, 34,462 jobs will depend on commercial and recreational fishing and recreational boating over the 20-year study period. A maximum of 21 jobs (or less than 0.1 percent of the total number of jobs) are projected to be lost over the study period, resulting in income losses ranging from $536,000 (Site E) to $782,000 (Site W). When income losses were compared to the economic contribution of income earned ($1,296,000,000) in the commercial and recreational fishing and recreational boating industries for the total Economic Study Area, lost income resulted in less than 0.1 percent of the total economic contribution, regardless of which alternative site was chosen. For other scenarios (not shown in Table 4-10) such as seasonal disposal, economic impacts would be less severe than the worst-case scenario presented in Table 4-10.

Site E: Under the worst-case scenario for the 20-year study period (2005 – 2025), an estimated one job per year (14 jobs over the 20-year study period) would be lost out of a total of 34,462 navigation-dependent jobs, accounting for 0.04 percent of the total economic contribution from jobs within the Economic Study Area for commercial and recreational fishing and recreational boating.

Table 4-10 shows that for Site E, losses to income ($536,000), output ($985,000), tax revenue ($204,000), and GSP ($821,000) together accounted for approximately 0.04 percent of the total economic contribution ($6,158,000,000) of the Economic Study Area for the 20-year study period. Based on the economic analysis performed (Corps, 2004d), economic impacts resulting from disposal at Site E would not significantly affect the economic stability of the region under the Site E alternative.

Table 4-10. Comparison of Total Economic Impacts (Worst-Case Losses) over the 20-Year Study Period (2005 – 2025).

Classification of Impact	Total Impact of Disposal	Commercial and Recreational Fishing and Recreational Boating	
		Economic Contribution (a)	Disposal Impact (% of Economic Contribution)
Site E			
Employment (Jobs)	14	34,462	0.04
Labor Income ($)	536,000	1,296,000,000	0.04
Outputs ($)	985,000	2,383,000,000	0.04
Tax Revenue ($)	204,000	492,000,000	0.04
Value Added (GSP) ($)	821,000	1,987,000,000	0.04
Site W			
Employment (Jobs)	21	34,462	0.06
Labor Income ($)	782,000	1,296,000,000	0.06
Outputs ($)	1,439,000	2,383,000,000	0.06
Tax Revenue ($)	297,000	492,000,000	0.06
Value Added (GSP) ($)	1,200,000	1,987,000,000	0.06

Source: Corps, 2004d
(a) Total contribution over 20-year study period.

Site W: If disposal were to occur at Site W, slightly more than one job per year (21 jobs over 20 years) would be lost out of a total of 34,462 navigation-dependent jobs, representing $782,000 in lost labor income. Those impacts would be spread across 26 harbors within the Economic Study Area, making it less likely that any discernible impact would be felt.

For Site W, losses to income ($782,000), output ($1,439,000), tax revenue ($297,000), and GSP ($1,200,000) accounted for 0.06 percent of the total economic contribution ($6,158,000,000) of the Economic Study Area for the 20-year study period. Based on the conclusions of the economic analysis (Corps, 2004d), economic impacts to the commercial and recreational fishing industry and to recreational boating would not significantly affect the region's economy under the Site W alternative.

Environmental Justice

It is not likely that impacts to minority or low-income populations would result from dredged material disposal at either of the two alternative sites. These impacts would be unlikely because of the higher income requirements for boat ownership, whether operating a commercial fishing business or owning a recreational boat safe enough to take into water in the vicinity of the alternative sites. Even if such populations were identified as minority and low income populations, the scale of projected employment losses (less than one job per year) and other impacts across the Economic Study Area would be so small as to be insignificant. Losses to fisheries on the scale of less than 0.01 percent would not be expected to impact even subsistence fishermen living in the Economic Study Area.

Dredging, Disposal, and Transport Costs

A cost analysis was performed as part of this Final EIS to compare the proposed disposal site alternatives (Site E and Site W). This cost analysis was performed based on dredging and disposal cost data developed by the Corps cost engineers. The cost estimates are based on past Corps experience with different disposal methods; an engineering analysis of the costs of material transport, mobilization and demobilization of equipment, and labor; and best professional judgment.

As part of this analysis, the distance from each harbor to the two alternative disposal sites was determined, since the cost of disposal is related to the distance from the harbor to the disposal site. The cost per cubic yard is also strongly related to the volume of material dredged, since disposal costs per cubic yard generally decrease with larger dredging jobs due to economies of scale and fixed mobilization and demobilization costs. For this reason, a range of likely disposal amounts at each harbor location was analyzed. The likely range of dredging amounts was determined based on the results of the survey of private facilities and the projections of Federal dredging amounts (Corps, 2002b). For each harbor location, and for each dredging amount, a cost per cubic yard for each disposal alternative was then developed. Unit costs (cost/CY) should only be compared for similarly-sized projects.

The cost analysis shows only a very minor difference in average cost per cubic yard between Site E and Site W, with Site W being, in general, from 1 to 4 percent more expensive per cubic yard than Site E. The overall average dredging and disposal cost for all project sizes in all locations analyzed would be $40.53/CY for Site E and $40.97/CY for Site W. In many cases, the difference in average cost per cubic yard between the two sites would be less than $1. The average cost differentials are shown in Table 4-11. The detailed, harbor-by-harbor results of the cost analysis are contained in Appendix A-9. Appendix A-9 shows the estimated dredging and disposal cost for each location and dredge volume analyzed, for each of the two disposal alternatives. The distance from each harbor to each alternative disposal site is also shown.

Table 4-11. Summary of Dredging, Disposal, and Transport Cost Analysis.

Hypothetical Dredging Project Grouping		Average Cost per CY	
		Site E	Site W
All project sizes; All locations		$40.53	$40.97
All project sizes; Rhode Island locations only		$40.06	$39.63
All project sizes; Massachusetts locations only		$41.09	$42.57
250,000 CY typical project			
	All locations	$13.70	$13.87
	Rhode Island locations only	$13.60	$13.23
	Massachusetts locations only	$13.83	$14.72
100,000 CY project			
	All locations	$17.13	$17.74
	Rhode Island locations only	$16.98	$17.29
	Massachusetts locations only	$17.28	$18.18
26,000 CY project			
	All locations	$26.67	$27.05
	Rhode Island locations only	$26.26	$25.71
	Massachusetts locations only	$27.15	$28.64
15,000 CY project			
	All locations	$28.25	$28.84
	Rhode Island locations only	$28.01	$27.68
	Massachusetts locations only	$28.54	$30.22
5,000 CY project			
	All locations	$50.91	$51.53
	Rhode Island locations only	$50.57	$50.20
	Massachusetts locations only	$51.30	$53.09
1,500 CY project			
	All locations	$76.87	$77.16
	Rhode Island locations only	$76.65	$76.30
	Massachusetts locations only	$77.14	$78.17

As would be expected, specific dredging and disposal costs would depend on the location of the harbor relative to each alternative disposal site, with the closer site having the lower cost. When only harbors in Rhode Island are analyzed, Site W has the lower average cost. When only harbors in Massachusetts are analyzed Site E has the lower average cost. The cost analysis concludes that, given the very small difference in average cost between Site E and Site W, site selection should be made on grounds other than cost considerations.

It should be noted that for Massachusetts, only harbors along the southwestern coast of Massachusetts, stretching from Fall River to Bourne to Gosnold and the western coast of Martha's Vineyard, were included in the cost analysis. Facilities and projects located in those harbors would likely use a disposal site located in Rhode Island Sound. Harbors located along the remainder of Cape Cod and the islands in southeastern Massachusetts were not included in this cost analysis. Those harbors have not been included in the analysis in other parts of this Final EIS, because dredged material from those harbors has historically been used for beach nourishment purposes.

4.3.14 Air Quality/Noise

The designation of a disposal site in the RIR would not be expected to have significant impacts on air quality. Any dredging or disposal operations would comply with Rhode Island Air Pollution Control Regulations (RIDEM, 2003). The primary pollutants of concern associated with dredging-related operations are nitrogen oxides (NOx) and carbon monoxide (CO). Transport vessels would contribute to air emissions during the transfer of the dredged material to the designated disposal site, although the increased emissions would be minor and temporary. Some volatile organic compounds could be released from exposed sediments on barges. The general effects of offshore disposal on air quality are described below.

During the transport of material from a dredging site to Site E or Site W, vessel transportation would generate minor amounts of air pollutants, as would disposal operations at the designated site. These impacts to air quality would be temporary, occurring for only as long as disposal operations continued. Airborne dust would not likely be an issue at either site because the dredged material would be wet and would be placed underwater. There would be no long-term effects on air quality if either of these sites were designated.

It is unlikely that the general public would notice odors associated with the dredged material during transport and disposal. This, however, would depend on the air temperature, the direction of the wind, and the proximity of the transport vessel to populated areas. It is expected that disposal at Site E or Site W would occur far enough away from populated areas to avoid objectionable odors on land. Odors from the dredged material would not be noticeable at the sites after disposal because the material would be underwater.

Noise would be generated during transport and disposal operations. Transportation-related noise would be expected to originate from vessels, but this would not be expected to have impacts on land-based activities, particularly as the vessel moved farther away from the coast. While disposal-related noise would emanate from various equipment, the impact to populated areas would be expected to be minimal due to the disposal site's distance from shore. Although the noise would be greater at the disposal site than at onshore locations, these impacts would be expected to be minimal. Any marine life sensitive to the noise would likely avoid the region during the temporary disposal activities.

4.4 COMPARISON OF ALTERNATIVES, DISCUSSION OF CUMULATIVE IMPACTS, AND SELECTION OF PREFERRED ALTERNATIVE

This section integrates information presented in this section and in Section 3.0 with the 5 general (40 CFR Section 228.5) and 11 specific (40 CFR Section 228.6(a)) MPRSA site selection criteria outlined in Table 2-1 to allow a comparison among the No Action Alternative and the two alternative sites evaluated. Table 4-12 summarizes the key information for each alternative and concludes whether there is likely to be an impact, a minor impact, or no impact. For purposes of this evaluation, a minor impact is defined as an impact that is either short-term or mitigable (or both).

The following evaluation and discussion consider potential short- and long-term impacts, the ability to mitigate adverse impacts, and the potential for cumulative impacts. Based on this comparison, the preferred alternative, defined as the alternative that provides the greatest practicable net benefit with the least environmental and socioeconomic impact, is determined.

The site screening process described in Section 2.0 eliminated areas outside of the ZSF as potential candidate locations and much of the area within the ZSF that would conflict with site designation under the MPRSA site selection criteria. Moreover, several of the MPRSA site selection criteria could not discriminate (i.e., were considered equal) between the two alternative sites. Those criteria that could not discriminate between the alternative sites (i.e., non-discriminating) are discussed in Section 4.4.1. Section 4.4.2 discusses the discriminating site selection criteria. The No Action Alternative is compared to the two alternative sites in Section 4.4.3. Section 4.4.4 considers potential cumulative impacts of the three alternatives evaluated. The rationale for recommending the preferred alternative is summarized in Section 4.5.

4.4.1 Non-Discriminating Criteria and Use Conflicts

Four of the MPRSA general site selection criteria (40 CFR Section 228.5) and eight specific site selection criteria (40 CFR Section 228.6(a)) addressed during the process of identifying the alternative sites carried forward in this Final EIS did not function as discriminating factors in the evaluation of the three alternatives. These criteria are discussed below. Several of the criteria address more than one issue, some of which were discriminating and some of which were not. Those criteria that were non-discriminating are summarized in this section; those criteria that were discriminating are discussed in Section 4.4.2.

Table 4-12. Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	**Site W**	**No Action**
Depth (ft) **(*§ 228.6(a)(1)*)**	**No Impact** Depth 125–133 ft Site Capacity 27.5 MCY	**No Impact** Depth: 116-132 ft Site Capacity 20 MCY (~15 MCY will be available after the completion of Providence River)	**No Impact** No changes from present conditions
Sedimentation and Erosion **(*§ 228.6(a)(7)*)** LTFATE model: erosion by waves and currents of standard mound configuration for five storm conditions; fine-grained, cohesive sediments	**Minor Impact** LTFATE storms occurring 3–5 times/yr (7.0-ft wave height; maximum current = 8 cm/s; peak wave period = 5.6 sec) maximum total erosion = 0.25 ft; LTFATE 5–10 yr storm (14.7-ft wave height; maximum current = 8 cm/s; peak wave period = 8.4 sec) maximum erosion = 0.49 ft LTFATE major hurricane condition (15-yr storm return period; 16.0-ft wave height; maximum current = 25 cm/s; peak wave period = 9.5 sec) maximum total erosion = 0.76 ft	**Minor Impact** LTFATE storms occurring 3–5 times/yr (7.1-ft wave height; maximum current = 8 cm/s; peak wave period = 5.3 sec) maximum total erosion = 0.21 ft; LTFATE 5–10 yr storm (13.7-ft wave height; maximum current = 8 cm/s; peak wave period = 8 sec) maximum total erosion = 0.43 ft LTFATE major hurricane condition (15-yr storm return period; 14.9-ft wave height; maximum current = 25 cm/s; peak wave period = 9 sec) maximum total erosion = 0.69 ft	**No Impact** No changes from present conditions
Water Column (Transport) **(*§ 228.6(a)(6)*) and Water Quality** **(*§ 228.5(b)*)** STFATE model: disposal operations modeling, including dredged material deposition and residual plume transport, used to evaluate potential for water quality violations; characteristic dredged material; recent elutriate test data for projects from the RIR; specific site current conditions.	**Impact** Tidal currents 10-20 cm/s Depth averaged currents 25 cm/s toward the northeast (10% > 25 cm/s frequency of occurrence) Intermittent, short-term changes within residual plumes following disposal TSS concentrations return to predisposal levels within 4 hr Substantial potential for water quality impacts outside of site under typical and worst-case conditions (8 of 16 model runs) Neither use of smaller barges nor implementation of other site management practices would reduce potential for water quality violations outside of site	**Minor Impact** Tidal currents 12-13 cm/s Depth averaged currents 20 cm/s toward the northwest (10% > 20 cm/s frequency of occurrence) Intermittent, short-term changes within residual plumes following disposal TSS concentrations return to predisposal levels within 4 hr Limited potential for water quality impacts outside of site under worst-case conditions (2 of 16 model runs)[1] Use of smaller barges and other site management practices could reduce potential for (mitigate) water quality violations outside of site	**No Impact** No changes from present conditions

[1]Site management practices will mitigate the potential for water quality impacts outside the site.

Table 4-12 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	**Site W**	**No Action**
Sediment Quality (*§ 228.6(a)(4)*)	**Minor Impact**[2]	**Minor Impact**[2]	**No Impact**
	Medium to fine sand Contaminants are (1) low in concentration and similar to areas outside the site, and (2) consistently below concentrations considered adverse to organisms. No toxicity data are available. Assumed low due to low contaminant levels. Required testing and site management would minimize exposure of organisms to unacceptable contaminant levels.	Fine to very fine sand Contaminants are (1) low in concentration and similar to areas outside the site, and (2) consistently below concentrations considered adverse to organisms. Sediments are not toxic to benthic organisms, based on 10-day amphipod bioassays. Required testing and site management would minimize exposure of organisms to unacceptable contaminant levels.	No changes from present conditions
Plankton and Larval Forms (*§ 228.6(a)(2)*) (*§ 228.6(a)(9)*) (*§ 228.6(a)(10)*)	**No Impact**	**No Impact**	**No Impact**
	Short-term entrainment losses; losses would be small with respect to entire populations in the RIR	Short-term entrainment losses; losses would be small with respect to entire populations in the RIR	No changes from present conditions
Benthos (*§ 228.6(a)(2)*) (*§ 228.6(a)(9)*)	**Minor Impact**[3]	**Minor Impact**[3]	**No Impact**
	Benthic community consisting primarily of Mollusca, Crustacea, and Annelida, of which most species have limited ability to burrow through deposited sediment. Abundance = 34,800/square meter Species = 60/grab Diversity (*H′*) = 3.9 Habitat Quality RPD = >2.2 – >5.9 Stage: = I-II, III OSI = 7.0–10.0 Short-term reductions in abundance and diversity within the site. Recovery to levels similar to predisposal within a few years after disposal	Benthic community consisting primarily of Mollusca, Crustacea, and Annelida, of which most species have limited ability to burrow through deposited sediment. Abundance = 32,400/square meter Species = 53/grab Diversity (*H′*) = 3.4 Habitat Quality RPD = 0.9–2.6 Stage: = I-II, III OSI = 4.0–9.0 Short-term reductions in abundance and diversity within the site. Recovery to levels similar to predisposal within a few years after disposal	No changes from present conditions

[2]Disposal will potentially change the sediment type from what is there now; however monitoring has documented that recolonization and habitation at disposal sites occurs within a few years.
[3]Monitoring has documented that benthic disturbances at dredged material disposal sites are short-term and that sites recover within a few years.

Table 4-12 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	**Site W**	**No Action**
Fish, Lobster, and Other Invertebrates (*§ 228.6(a)(2)*) (*§ 228.6(a)(9)*)	**Minor Impact**	**Minor Impact**	**No Impact**
	Not in an area of distinctive lobster, shellfish, or finfish resources Relatively homogeneous bottom habitat; nearby high-relief habitat **Lobster**–small lobster population exists at site August 2003 CPUE; 6.4 lobsters/trap **Ocean quahog** only commercial shellfish species at site–small quahog population exists at site (1.32 quahog/square meter) and would be reduced by disposal; immediate recovery outlook poor because of sediment changes and slow clam growth rates. [4] Site is not significant ocean quahog resource **Finfish**–July 2003 CPUE 64.6 fish/tow 15 species Demersal species predominant Short-term local disruption and potential loss of non-migratory finfish species during disposal. Finfish recovery to levels similar to predisposal probable.	Not in an area of distinctive lobster, shellfish, or finfish resources Relatively heterogeneous bottom habitat; nearby high-relief habitat **Lobster**–small lobster population exists at site July 2002 CPUE; 4.6 lobsters/trap; August 2003 CPUE western boundary 6.6 lobsters/trap **Ocean quahog** only commercial shellfish species at site–small quahog population exists at site (0.93 quahog/square meter) and would be reduced by disposal; immediate recovery outlook poor because of sediment changes and slow clam growth rates.[4] Site is not significant ocean quahog resource **Finfish**–July 2003 CPUE western boundary 70.8 fish/tow 13 species Demersal species predominant Short-term local disruption and potential loss of non-migratory finfish species during disposal. Finfish recovery to levels similar to predisposal probable.	No change from present conditions
Birds, Mammals, Reptiles (*§ 228.6(a)(2)*)	**No Impact**	**No Impact**	**No Impact**
	Species occasionally visit the site but do not rely on it for critical habitat	Species occasionally visit the site but do not rely on it for critical habitat	No changes from present conditions
Endangered Species (Section 7 ESA consultation by NMFS and FWS is currently in progress)	**No Impact**	**No Impact**	**No Impact**
	Species occasionally visit the site but do not rely on it for critical habitat. Action will not impact species that might transit the area.	Species occasionally visit the site but do not rely on it for critical habitat. Action will not impact species that might transit the area.	No changes from present conditions

[4]Quahog and shellfish population densities are low. Disposal would cover any existing shellfish.

Table 4-12 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	**Site W**	**No Action**
Bioaccumulation Potential (*§ 228.6(a)(9)*)	**No Impact** Contaminant levels in water and sediment are low at the site; bioaccumulation potential would therefore be low. Material acceptable for ocean disposal would not be expected to have significant bioaccumulation potential	**No Impact** Contaminant levels in water and sediment are low at the site; bioaccumulation potential would therefore be low. Material acceptable for ocean disposal would not be expected to have significant bioaccumulation potential	**No Impact** No changes from present conditions
Fishing Activities (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact** Not in unique fishing area	**No Impact** Not in unique fishing area	**No Impact** No changes from present conditions
Shipping, Navigation (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact** Not located in navigation or shipping lanes	**No Impact** Located adjacent to shipping approach lane to Providence Harbor	**Impact** Greater potential for delays, groundings, casualties
Beaches and Swimming (*§ 228.5(b) and §228.6(a)(3)*)	**No Impact** Closest beach is 11.4 nmi to the north Transport to beaches not likely	**No Impact** Closest beach is 8.3 nmi to the west Transport to beaches not likely	**No Impact** No changes from present conditions
Parks / Natural Areas / Sanctuaries and Research Preserves (*§ 228.5(b) and §228.6(a)(8)*)	**No Impact** No resources identified in the site	**No Impact** No resources identified in the site	**No Impact** No changes from present conditions
Historic / Archaeological Resources (*§ 228.6(a)(11)*)	**No Impact** No resources identified in the site	**No Impact** No resources identified in the site	**No Impact** No changes from present conditions
Other Human Uses (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact** No resources identified in the site	**No Impact** No resources identified in the site	**No Impact** No changes from present conditions
Use of previous disposal sites (*§ 228.6(a)(7)*)	**Impact**[5] No previous use as a disposal site	**No Impact**[6] Actively used as a disposal site	**No Impact**[4] No changes from present conditions
Air Quality/Noise (*NEPA Requirement*)	**No Impact** No expected adverse impacts to air quality or noise Reduced onshore impacts, depending on disposal alternatives used on a project-specific basis.	**No Impact** No expected adverse impacts to air quality or noise Reduced onshore impacts, depending on disposal alternatives used on a project-specific basis.	**Minor Impact** Potential impact if upland disposal usage increases; increase in noise and reduction in air quality from truck traffic transporting large volumes of material to upland locations. Potential impacts onshore, depending on disposal alternatives used on a project-specific basis.

[5]This impact is defined as increasing the total area of seafloor subject to disruption if this alternative were selected.
[6]This impact characterization is defined as restricting the area of potential disruption due to previous, recent use of the site for disposal of dredged material found acceptable for ocean disposal.

Table 4-12 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	**Alternatives**		
	Site E	**Site W**	**No Action**
Economic Impacts (*§ 228.5(a) and §228.6(a)(8)*)	**No Impact**	**No Impact**	**Minor Impact**
	Annual cost of delivering goods and services would not increase.	Annual cost of delivering goods and services would not increase.	Annual cost of delivering goods and services would increase by $4.3M by 2021.
	Boater spending would be maintained through 2021.	Boater spending would be maintained through 2021.	Boater spending would decrease by $4.5M per year by 2021.
	No increase in casualty loss	Minimal increase in casualty loss	Increased Casualty Losses (up to 2.7 M by 2021)
	No increased employment loss	No increased employment loss	Increased loss of employment (up to 93 jobs lost annually by 2021)
	Negligible (< 0.07%) offshore economic loss in current dollar value.	Negligible (< 0.12%) offshore economic loss in current dollar value.	No economic loss to fisheries.
	Negligible loss to onshore economy from fisheries losses (0.04%).	Negligible loss to onshore economy from fisheries losses (0.06%).	No economic loss to onshore economy from fisheries losses.
	No environmental justice impact.	No environmental justice impact.	No environmental justice impact.
	Transportation cost for dredged material disposal at ocean site = $6 to $22/CY.	Transportation cost for dredged material disposal at ocean site = $6 to $22/CY.	Transportation cost for dredged material disposal at upland site = $50 to $104/CY.

Table 4-12 (continued). Summary of Impacts of Alternatives.

Evaluative Criteria (*Reference to MPRSA Criteria, 40 CFR*)	**Alternatives**		
	Site E	**Site W**	**No Action**
Cumulative Impacts (*§ 228.6(a)(7)*)	**Impact**	**No Impact**	**Impact**
	Site has not been used for dredged material disposal; site represents natural conditions in Rhode Island Sound; sediment quality is good and contaminant concentrations are low; benthic community is well-developed and diverse; no significant fish, shellfish, or lobster resources.	Site is presently disturbed by disposal of dredged material found acceptable for ocean disposal through the MPRSA dredged material testing requirements.	Additional areas selected for disposal after 69B selection expires would be disturbed during disposal, with recovery following.
	Designation would increase area in Rhode Island Sound disturbed by dredged material disposal.[5]	Designation would not increase areas disturbed by dredged material disposal.[6]	No change from present condition.
	No long-term cumulative impacts expected.	No long-term cumulative impacts expected.	No long-term cumulative environmental impacts expected.
	Not expected to have additive impacts relative to identifiable future impacts to the region.	Not expected to have additive impacts relative to identifiable future impacts to the region.	Not expected to have additive impacts relative to identifiable future impacts to the region.
	Casualty impacts reduced.	Casualty impacts reduced.	Potential casualty and associated environmental impacts.
	Onshore economic impact alleviated.	Onshore economic impact alleviated.	Compounded onshore economic impact.

1. **228.5(c) If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in Section 228.5 through 228.6, the use of such sites will be terminated as soon as suitable alternate disposal sites can be designated.**

The general criteria of Section 228.5(c) are relevant only to existing and historical sites and are related to site terminations if a site is not meeting the Section 228.5 and 228.5(a) criteria. Only Site W is relevant to this criterion, as it is an actively used ocean disposal site. Site monitoring to date has not identified any adverse impacts from the ongoing disposal activity (Corps, 2004d).

2. **228.5(d) The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any**

disposal site will be determined as a part of the disposal site evaluation or designation site study.

228.6(a)(5) Feasibility of surveillance and monitoring.

The requirements under the general criteria of Section 228.5(d) limit the size of disposal sites to enable identification and control of immediate impacts and to enable effective monitoring and surveillance programs. Specific criterion 228.6(a)(5) makes certain that any site chosen can be surveyed and monitored properly to ensure that no unanticipated impacts occur at a site.

The two alternative sites evaluated are approximately 1 nmi^2 and located in water depths that provide sufficient space to meet anticipated dredged material disposal needs in the RIR (see discussion under item 4 below). The alternative locations are also sufficient in size to control immediate impacts and to prevent long-range impacts. Site configurations were defined based on the resources in the area in which they are located and ability to meet the MPRSA site designation criteria.

The long history of dredged material site monitoring at active and historic ocean disposal sites in New England (i.e., the DAMOS program), including Site 16 (the former Brenton Reef Site) in Rhode Island Sound and actively used Site 69B (Site W), provides ample evidence that surveillance and monitoring programs are feasible for physical, chemical, and biological impacts, regardless of the alternative site location. Thus, the assessment required by Sections 228.5(d) and 228.6(a)(5) indicates that monitoring and surveillance are neither limiting nor discriminating with respect to the alternative sites evaluated. Moreover, both sites evaluated are located relatively close to shore and are approximately equal distances from nearby ports; therefore, there are no financial reasons that would favor one alternative site over the other from a surveillance/monitoring perspective.

3. **228.5(e) USEPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.**

The criterion of 228.5(e) states that EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf. However, as discussed in Section 2.2.1, sites beyond the edge of the continental shelf were eliminated from consideration during the development of the ZSF based on feasibility of other alternatives and a reasonable transport distance of ~17 nmi south of the southernmost dredging center (Block Island, Rhode Island). Transporting dredged material beyond the edge of the continental shelf presents a number of environmental, safety, and economic issues, including the greater risk of short dumps, greater casualty loss, greater use of fossil fuels (with a resulting increase in air emissions), and greater potential for endangered species encounters.

4. **228.6(a)(4) Types and quantities of wastes (*dredged material*) proposed to be disposed of, and proposed methods of release, including methods of packaging the waste (*dredged material*), if any.**

Section 228.6(a)(4) addresses the types and quantities of waste considered for disposal at a site. As discussed in Section 1.0, only dredged material found suitable for disposal in the ocean would be placed at either alternative site. In addition, the capacity of each site to receive and contain dredged material is sufficient to accept the approximately 8 MCY of dredged material projected over the next 20 years. Site W total capacity before any disposal activity is ~ 20 MCY; Site 69B is projected to receive ~ 5 MCY from the Providence River by 2005. Site E capacity is ~ 27.5 MCY[2]. Therefore, no available information allows a distinction to be made between the alternative sites on the basis of the types and quantities of material. Similarly, no information allows a distinction to be made between the sites on the basis of the disposal method, which would be predominantly via hopper dredge or barge.

5. **228.5(a) The dumping of dredged material into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.**

   228.6(a)(8) Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the ocean.

The site screening process described in Section 2.0 eliminated locations that would interfere with areas of heavy commercial and recreation navigation by placing the two sites evaluated outside of designated shipping lanes. Although recreational and commercial ship traffic may cross either of the alternative sites at unpredictable frequencies or for unpredictable duration, there was no identifiable difference between the alternative sites from a shipping perspective. Moreover, notice to mariners employed during disposal operations would enable mitigation of potential interference with vessel traffic or recreational uses, especially at Site W, which is located adjacent to an approach lane.

The alternative sites are located in waters that are at least 118 ft deep (before Providence River and Harbor Maintenance Dredging Project disposal). Given mound height restrictions defined for site screening of no more that 105 ft below the water surface, any potential for grounding and interference with navigation would not be expected. In addition, disposal operations would be conducted under permit and with full notification to mariners of the locations of disposal buoys and activities.

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[2] Mound capacity was calculated as the volume between the seafloor and 105-ft depth, assuming a rectangular mound and a shoulder slope of 1:20.

The site screening process identified areas that were heavily fished and eliminated these areas from consideration for alternative sites. Fishing activities occurring near the two alternative sites evaluated are similar relative to the evaluation factors in these criteria and therefore do not allow a distinction to be made between the two sites.

Based on the information evaluated in Section 3.0, neither alternative site evaluated in this Final EIS is located in or near desalination plants, in areas where minerals are extracted, in areas where aquaculture activities take place, or in areas where any other competing, legitimate use of the ocean occurs. There is a scientific testing area approximately 5 nmi east of Site E, used by Woods Hole Oceanographic Institute for testing surface and subsurface scientific instruments; however, it is estimated that the dredged material would travel no farther than 0.7 to 1 nmi from the disposal site, and it is unlikely that disposal operations would impact activities at the testing area. There is also a potential for blue mussel culturing at this site, but again, the distance from the disposal operations make impacts unlikely. Further conclusions regarding interference with fisheries and shellfisheries are drawn under item 10 below.

6. **228.5(b) Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations of effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery;**

   228.6(a)(3) Location in relation to beaches and other amenity areas.

As discussed in Section 3.17.5, the coasts of Rhode Island and southeastern Massachusetts have a number of beaches and other amenity areas. However, the alternative sites are located at least 8.3 nmi from the nearest beach or other amenity area. The eastern beaches of Block Island are located 8.3 nmi to the west of Site W; the beaches of southern coastal Rhode Island are located 9.3 nmi from Site W, while Site E is 11.4 nmi to the south of these beaches. The nearest beaches to Site E are Warren's Point Beach, Rhode Island, and Gay Head Beach, 11.4 nmi and 15.2 nmi, respectively, to the north and east. The movement of the water column due to currents is generally northwest-southeast at Site W and northeast-southwest at Site E. The typical tidal excursion is only about 1.0 to 1.5 nmi during such transport. Water quality modeling determined that any residual dredged material remaining in the water column after disposal would be dispersed to ambient conditions within 2 to 4 hrs, which could carry the residual plume no more than 0.7 to 1.0 nmi, well short of any beaches in the area. As a result, it is unlikely that significant amounts of dredged material would be transported to these beach and amenity areas. Similarly, there are no marine sanctuaries near either site and no known limited fisheries or shellfisheries at or near either site.

7. **228.6(a)(9) The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.**

Comparison of the two alternative sites did not identify existing water quality or ecology conditions that could differentiate between them.

8. 228.6(a)(10) Potentiality for development or recruitment of nuisance species in the disposal site.

The contribution of dredged material to primary production in Rhode Island Sound would be expected to be very small relative to other sources such as atmospheric inputs and would not be expected to contribute to conditions that could lead to the development of nuisance species. Thus, no potential impacts could be identified, and similarities between the alternative sites did not allow a distinction to be made under this criterion.

9. 228.6(a)(11) Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.

Natural or cultural features of known significance were not found at either alternative site. Therefore, no impacts were identified, and similarities between the alternative sites did not allow a distinction to be made under this criterion.

10. 228.6(a)(2) Location in relation to breeding, spawning, nursery, feeding or passage areas of living resources in adult or juvenile phases.

The data presented in this Final EIS show that fisheries resources are found in larger concentrations to the northeast, north, and southwest of the sites. The site screening process eliminated these more valuable areas from consideration as site locations. Other information did not identify either alternative site as being located in fish passage areas that are unique to the region. The sites are located outside of areas identified by offshore fishermen as major areas fished during the spring and fall migration of fish and shellfish species that inhabit the region. The two alternative sites are thus located in areas that are similar relative to the evaluation factors in this criterion.

Generally, the living resources at Sites E and W are similar in abundance and species composition of fish. Neither of the two sites is considered to be a significant nursery area for such key species as winter flounder; therefore, impacts to the eggs, larvae, and juveniles would not likely represent a threat to resource management programs from disposal operations at either site. Similar arguments can be made for the shellfisheries in and near the alternative sites, especially lobster.

Information presented in this Final EIS also shows that the benthic infaunal community at the two alternative sites is similar in terms of species composition, although abundances, species richness, and diversity were marginally higher at Site E. Impacts to this community from disposal at each alternative site would be related to the disruption and rates of recolonization following disposal activities; at both sites, such impacts would be similar. Thus, this potential impact did not allow a distinction to be made between the two sites under this criterion. Disposal of dredged material at the alternative sites would not be expected to have a direct or long-term adverse impact to the living resources in Rhode Island Sound, although short-term loss of benthic infauna species under the footprint of the dredged material mounds would occur at either alterative site. However, these communities would be expected to recover quickly, as demonstrated under the DAMOS program.

4.4.2 Discriminating Criteria and Use Conflicts

Five criteria involve impacts or conditions that are considered discriminating and were used to distinguish between the two alternative sites. The evaluation of two specific site selection criteria [Sections 228.6(a)(1) and 228.6(a)(6)] involves similar factors such as the water depth at the site, its bathymetry, and the physical characteristics of the site. Therefore, these two criteria are considered together this in section. The third criterion addresses water quality expectations in relation to the residual dredged material plume in the water column. The fourth and the fifth address impacts from ongoing disposal and use of historic dredged material disposal sites and are considered together in the discussion below.

1. **228.6(a)(1) Geographical position, depth of water, bottom topography and distance from coast;**

   228.6(a)(6) Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.

The geographic position of the alternative sites (approximately 10 nmi south of the southern shores of Rhode Island) places each within the outer portions of Rhode Island Sound, a water body that is exposed to wind and wave energy from the northwest Atlantic Ocean. The wind and wave climate is thus similar at each site. While little difference in the wind and wave climate was found between the sites, Site W is provided limited protection from some storms by Block Island to the west, and Site E is protected by Cape Cod and the Islands to the east. Both sites lie in the lee of wind and waves from the north because of their proximity to the shoreline to the north. Measured currents at Site W indicate that about half the current variance is caused by tides. The combined effects of wind and waves result in depth averaged currents directed to the northwest of Site W and velocities that exceed 20 cm/s about 10 percent of the time. Although current records are limited in the vicinity of Site E, the available data (see Section 4.3.3) suggest that average currents may be slightly higher than at Site W (velocities of 25 cm/s are exceeded about 10 percent of the time) and are directed to the northeast. Tidal currents are approximately 12 cm/s at Site W and 10 to 20 cm/s at Site E.

Analysis of waves potentially experienced at the sites during storms with a 2-year and 10-year return found differences between the sites. The 1-year storm return modeling indicated that wave height and period were larger at Site E (14.4 ft and 9.4 seconds [sec]) and smaller at Site W (13.4 ft and 9 sec). The water depths both within and between the alternative sites are slightly different, with Site W being slightly shallower. Water column depths ranged between 116 to 132 ft at Site W and 125 to 133 ft at Site E.

As a result of these small differences in physical characteristics, there are slight differences in the potential for resuspension, dispersion, and transport of deposited sediments between the two alternative sites. This interaction is best described by the strength of the induced currents at the seafloor by the waves (i.e., orbital velocity). These bottom orbital velocities were lower at Site W (7 and 38 cm/s for a typical winter storm and a 1- to 2-year storm return potential, respectively). The highest values from the modeling were estimated at Site E (13 and 49 cm/s, respectively). Sediment erosion and transport modeling using consistent input information showed a slightly greater potential for erosion during passage of major tropical storms. However, even under these rare conditions, erosion of mound height was less than 1 ft (0.76 ft at Site E and 0.69 ft at Site W) for freshly deposited dredged material typical of the region. Sediment consolidation processes (see Section 4.3.1 for an explanation) after disposal would be expected to reduce significant erosion at either site. Based on this information, Site W has a slightly lower likelihood of transport of material after disposal than Site E.

2. **228.5(b) Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations of effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery;**

The discriminating part of this criterion relates to short-term water quality impacts. The evaluation of short-term water quality impacts using consistent inputs to the STFATE model described in Section 4.3.3 indicates that disposal operations at either alternative site would likely meet the limiting permissible concentrations (LPCs) within 4 hrs of disposal. However, potential exceedance of the LPC at Site W boundaries could occasionally occur under higher current conditions (> 20 cm/s), especially if large barges (e.g., 5,000 CY) were used for disposal operations. In contrast, STFATE modeling results for Site E found that the LPC could frequently be exceeded outside of the site boundaries for both small and large barge volumes. Thus, Site E has the greater potential for violating water quality requirements outside of the site boundaries following disposal. Moreover, mitigation of these impacts at Site E through management activities such as restrictions on barge size or disposal times would likely not be successful. Thus, Site W would have less potential for water quality impacts than Site E.

3. **228.6(a)(7) Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).**

   228.5(e) USEPA will, wherever feasible, designate ocean dumping sites beyond the edge of the Continental shelf and other such sites that have been historically used.

Site E has not received dredged material or any other waste; thus, it is an area that has not been disturbed by ocean disposal practices. In contrast, Site W is an active dredged material disposal site. Monitoring of Site W since the initiation of disposal activities has shown expected changes in bathymetry within the site from ongoing disposal. However, short-term adverse impacts to the chemistry and biology at the site have not been found. Based on historic experience at other ocean dredged material disposal sites, significant long-term impacts on chemistry and biology at the site would not be expected.

The MPRSA ocean disposal site selection criteria emphasize the use of historical sites when designating dredged material disposal sites. The site selection process for the Providence River and Harbor Maintenance Dredging Project (Corps, 2001a) evaluated several ocean disposal site alternatives within the RIR ZSF and found that Site 69B (Site W in this Final EIS) was the location that would have the least potential environmental impact of the sites evaluated. Site screening conducted under this Final EIS also identified this site as a potential site and also eliminated the other sites considered under the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a). The only other site in the RIR ZSF found to be potentially acceptable as an alternative to Site W was Site E. Given that Site E has not received dredged material or any other waste, the criteria above point to Site W as the preferred alternative. Designation of Site W would reduce the potential for disruption of other areas within Rhode Island Sound from dredged material disposal, thus minimizing the potential for disturbance of additional areas in the ZSF. Based on this finding, designation of Site E would be more environmentally disruptive than designation of Site W.

4.4.3 Comparison of the No Action Alternative with the Alternative Sites E and W

Under the No Action Alternative, short- or long-term environmental impacts to offshore waters would be unlikely. Similarly, impacts to the fisheries or fish resources would not occur from dredged material disposal.

In contrast to disposal of dredged material at Site E or Site W, implementation of the No Action Alternative would likely have adverse impacts to the economies of Rhode Island and southeastern Massachusetts due to increased costs of delivering goods and services to the region, an increased threat of spills and pollution, lost boater spending, increased costs to the commercial fishing fleet, and increased costs for ferry services operating out of Point Judith, Rhode Island. In addition, there would be negative impacts on shipping because of an increased probability of groundings and related casualty losses, as well as increased costs of both commercial shipping and fishing because of restrictions of vessel operations at commercial ports.

Increased shoaling could also cause some businesses to either close or shift to land-based transport, which has the potential to have a greater impact on air quality through increased truck traffic.

Moreover, the No Action Alternative would increase the demand for upland disposal options, which are extremely limited in the region and, when used, can cause significant impacts to both water and air quality.

4.4.4 Cumulative Impacts

The CEQ regulations implementing the procedural provisions of NEPA require Federal agencies to consider the cumulative impacts of a proposal (40 CFR Section 1508.25(c)). A cumulative impact on the environment is the impact that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR Section 1508.7). This type of an assessment is important because significant cumulative impacts can result from several smaller actions that by themselves do not have significant impacts.

With respect to the disposal of dredged material at designated sites in the RIR, cumulative economic impacts could occur if a long-term ocean disposal site were not designated for the region, especially to activities such as shipping and boater recreation.

Other potential cumulative impacts that may affect the RIR include the introduction of contaminants from land-based sources, the atmosphere, and other activities that result in releases of contaminants (e.g., nonpoint source pollution or spills from vessels). However, the designation of a long-term ocean disposal site would not be expected to transfer unacceptable levels of contaminants to the ocean or increase contaminant availability because, as part of the permitting process (see Section 1.6), material proposed for ocean disposal must be thoroughly characterized and must not adversely affect human health, the marine environment, or other ocean uses per the MPRSA of 1972. Two guidance manuals are available to facilitate sediment characterization. The first is the "Green Book," or *Evaluation of Dredged Material Proposed for Ocean Disposal*, jointly published by the EPA and Corps. The second, the *Regional Implementation Manual*, is published by the EPA Region 1 and the New England District of the Corps and covers the RIR. Both documents present a testing and evaluation approach, including detailed methodologies, required to be used in characterizing and restricting the type of material that can go into the ocean. The most recent revision of the *Regional Implementation Manual* is currently under review.

Changes in the sediment type, and thus to habitat, at the sites would be expected to be small and may add structure to the seafloor that could provide additional habitat types in the region. Alteration of habitats from other uses of the ocean in this region could also occur.

Additional dredged material from dredging projects outside the RIR or unanticipated projects within the RIR that meet the criteria for suitable disposal at an ocean disposal site could increase the amount of material placed at the site. Such material could decrease the amount of space available for RIR projects and could result in the RIR having to readdress its long-term disposal options in the future. Such increases would not change the potential environmental impacts at either Site E or Site W, but could impact the navigation, safety, and economics of the RIR over the long term if needs were not addressed.

Overall, the impact of dredged material disposal relative to other possible perturbations is not expected to be long-term or significant; therefore, only minimal cumulative environmental impacts from designation of a long-term ocean dredged material disposal site are expected.

4.5 PREFERRED ALTERNATIVE

The site screening process led to the identification of two alternative sites for further evaluation with respect to MPRSA site selection criteria. Evaluation of the two sites and the No Action Alternative determined that there would be only minimal short-term, long-term, or cumulative adverse impacts to the marine environment from the designation of either Site E or Site W. Of these two alternative sites, Site W is preferred for the reasons discussed above and summarized below. Table 4-13 summarizes the impact assessment described in Section 4.4.

Environmental considerations, including a lower likelihood of post-deposition transport of dredged material and a greater likelihood of meeting water quality requirements outside the boundaries of the site following disposal events, give slight preference to Site W over Site E. Site W's location would be expected to have minimal adverse environmental effects from disposal operations, including cumulative impacts, when compared with designation of Site E. Monitoring conducted to date seems to support the success of those management practices. Similar practices would be used for the preferred alternative site.

In addition, Site W is preferred over Site E because there is slightly less potential for erosion of non-cohesive silt and sandy sediments, which could result in adverse impacts to surrounding areas following disposal activities and could make site management difficult. Furthermore, currents at Site W are slightly lower and directed toward the northwest-southeast, which would result in a lower potential for water quality violations outside of the site because of the site's orientation. Changes in the orientation of Site E to mitigate any potential violations were considered but determined to be unacceptable because it would encompass areas of higher bottom relief, thus higher-value habitat (lobster areas), and would encroach on areas removed from consideration during the site screening process. Trying to re-orient the site and reduce the site size was considered at Site E, but these actions would result in greater potential for water quality violations and would make navigation within the site during disposal activities more difficult and less safe. Reductions to the site boundaries to avoid the high relief areas would decrease the site capacity substantially but at unacceptable increased risk of water quality violations.

Table 4-13. Summary of the Preferred Alternative Decision.

Evaluation Criteria (*Reference to MPRSA Criteria, 40 CFR*)	Alternatives		
	Site E	Site W	No Action
Depth (ft) (*§ 228.6(a)(1)*)	No Impact	No Impact	No Impact
Sedimentation and Erosion (*§ 228.6(a)(7)*)	Minor Impact	Minor Impact	No Impact
Water Column (Transport) (*§ 228.6(a)(6)*) and **Water Quality** (*§ 228.5(b)*)	Impact	Minor Impact[1]	No Impact
Sediment Quality (*§ 228.6(a)(4)*)	Minor Impact[2]	Minor Impact[2]	No Impact
Plankton and Larval Forms (*§ 228.6(a)(2)*), (*§ 228.6(a)(9)*), (*§ 228.6(a)(10)*)	No Impact	No Impact	No Impact
Benthos (*§ 228.6(a)(2)*), (*§ 228.6(a)(9)*)	Minor Impact [3]	Minor Impact [3]	No Impact
Fish, Lobster, and Other Invertebrates (*§ 228.6(a)(2)*), (*§ 228.6(a)(9)*)	Minor Impact[4]	Minor Impact[4]	No Impact
Birds, Mammals, Reptiles (*§ 228.6(a)(2)*)	No Impact	No Impact	No Impact
Endangered Species	No Impact	No Impact	No Impact
Bioaccumulation Potential (*§ 228.6(a)(9)*)	No Impact	No Impact	No Impact
Fishing Activities (*§ 228.5(a) and §228.6(a)(8)*)	No Impact	No Impact	No Impact
Shipping, Navigation (*§ 228.5(a) and §228.6(a)(8)*)	No Impact	No Impact	Impact
Beaches and Swimming (*§ 228.5(b) and §228.6(a)(3)*)	No Impact	No Impact	No Impact
Parks / Natural Areas / Sanctuaries and Research Preserves (*§ 228.5(b) and §228.6(a)(8)*)	No Impact	No Impact	No Impact
Historic / Archaeological Resources (*§ 228.6(a)(11)*)	No Impact	No Impact	No Impact
Other Human Uses (*§ 228.5(a) and §228.6(a)(8)*)	No Impact	No Impact	No Impact
Use of previous disposal sites (*§ 228.6(a)(7)*)	Impact[5]	No Impact[6]	No Impact
Air Quality/Noise (*NEPA Requirement*)	No Impact	No Impact	Minor Impact
Economic Impacts (*§ 228.5(a) and §228.6(a)(8)*)	No Impact	No Impact	Minor Impact
Cumulative Impacts (*§ 228.6(a)(7)*)	Impact [5]	No Impact [6]	Impact

[1]Site management practices will mitigate the potential for water quality impacts outside the site.
[2]Disposal will potentially change the sediment type from what is there now; however monitoring has documented that recolonization and habitation at disposal sites occurs within a few years.
[3]Monitoring has documented that benthic disturbances at dredged material disposal sites are short-term and that sites recover within a few years.
[4]Quahog and shellfish population densities are low. Disposal would cover any existing shellfish.
[5]This impact is defined as increasing the total area of seafloor subject to disruption if this alternative were selected.
[6]This impact characterization is defined as restricting the area of potential disruption due to previous, recent use of the site for disposal of dredged material found acceptable for ocean disposal.

Finally, Site W is currently used as a dredged material disposal site selected under MPRSA Section 103. Management practices have been established at Site W that will minimize the potential for adverse impacts associated with disposal of dredged material from the Providence River and Harbor Maintenance Dredging Project. EPA regulations (40 CFR 228.5[e]) state that it is generally preferable to designate disposal sites in areas that have been used in the past, rather than to locate sites in new, undisturbed areas.

Site W is also the preferred alternative to the No Action Alternative. For dredging projects subject to MPRSA Section 106(f), project proponents under the No Action Alternative would need to find other suitable disposal alternatives if a long-term disposal site is not designated (see Sections 2.0 and 4.0). The analysis conducted for the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a) indicated upland disposal, beneficial use, and treatment technology were not found to be adequate or suitable alternatives for material found acceptable for ocean disposal (Section 2.1). While it is impossible to know how dredging needs resulting from channel and harbor shoaling in the RIR would be handled if a long-term disposal site is not designated, several hypothetical scenarios might reasonably be considered. These include:

1. Utilize an alternative open-water site, either inside or outside of the RIR, that has been "selected" by the Corps and concurred with by EPA under MPRSA. Such an alternative site could include, but would not be limited to, Site 69B, which can be used for no more than two 5-year periods. Once these periods expire, another site could be selected under MPRSA. The selection process requires the investment of considerable time and funding.
2. Use an already designated ocean disposal site outside of the RIR.
3. Develop and utilize appropriate land-based disposal/reuse alternatives.
4. Cancel the proposed dredging projects.

The first of these scenarios, selecting disposal sites on a short-term, project-specific basis, may have, at a minimum, greater impacts if it results in multiple sites being selected and placing dredged materials over a greater area (or number of areas) within the RIR. In contrast, designation of a long-term dredged material site for the RIR provides a predictable, long-term alternative for this region that eliminates project-specific uncertainty (project reviews and NEPA issues) of the site selection process. It also addresses the need to consider other, more distant designated ocean disposal sites (identified as scenario 2 above) and recognizes that these distant sites lack any appreciable benefit over the preferred alternative. The third scenario, land-based disposal or reuse, may result in adverse environmental impacts to upland areas and freshwater systems. In addition, these options have been determined to be more complicated, expensive methods of dredged material disposal and to potentially have higher environmental risk if chosen. Moreover, prior investigations have been unable to find adequate upland disposal capacity for the large volumes of material at issue from RIR projects. Designation of a long-term ocean dredged material disposal site does not nullify the requirement for upland and other disposal alternatives to be considered on a project-specific basis, as part of the assessment of the "need" for ocean disposal that is undertaken during the evaluation of each request for a disposal permit. Rhode Island and Massachusetts legislation requires the investigation of beneficial use and upland disposal prior to consideration of ocean disposal. The last scenario, curtailing dredging activities throughout the Rhode Island and southeastern Massachusetts Bay region, would compromise navigational safety and marine commerce and could result in increased casualty losses from vessels running aground and leaking oil and other hazardous materials. Therefore, the No Action Alternative would pose serious cumulative environmental risks compared to the preferred alternative. Moreover, adverse socioeconomic impacts of the No Action Alternative (Section 4.4.3) have been determined to be unacceptable.

In summary, Site W best meets the designation criteria and established objectives of a long-term dredged material disposal option in the RIR.

4.5.1 Description of Preferred Alternative Site

EPA has determined that designating Site W as a long-term ocean disposal site for the RIR is the preferred alternative. The Corps has played a crucial role in the collection and analysis of information used in the designation of a long-term ocean disposal site in this region and concurs with this EPA determination. This preferred site meets the objectives of MPRSA, satisfies the MPRSA criteria, and is an environmentally, operationally, and economically feasible site. This Final EIS concludes that, properly monitored and managed, the use of Site W would not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. Furthermore, dredged material disposal at this site, in a manner consistent with the criteria for open ocean disposal of dredged material imposed by this designation on disposal location and types of material to be disposed of, would mitigate adverse impacts to the environment to the greatest extent practicable.

Any dredged material to be disposed of at Site W would be required to be tested according to applicable regulations and national and regional guidance, and the material must satisfy the applicable legal requirements of the MPRSA.

Site W (to be known as the Rhode Island Sound Disposal Site) is 1-nmi square with its center located at 41˚ 13’51”N and 71˚ 22’49.16”W (NAD 83) (Figure 4-12). The site is located approximately 9 nmi south of Point Judith and roughly 6.5 nmi due east of Block Island. Site W is located over a topographic depression, where the maximum water depth is about 130 ft. Water depths of the surrounding area are between 113 and 118 ft to the north, east, and south of the surveyed area. The southeastern portion of the site shoals more rapidly than the northern area. Recent disposal of dredged material for the Providence River and Harbor Maintenance Dredging Project has decreased the bathymetry in the western portion of the site to approximately 112 ft as of May 2004 (Figure 4-12).

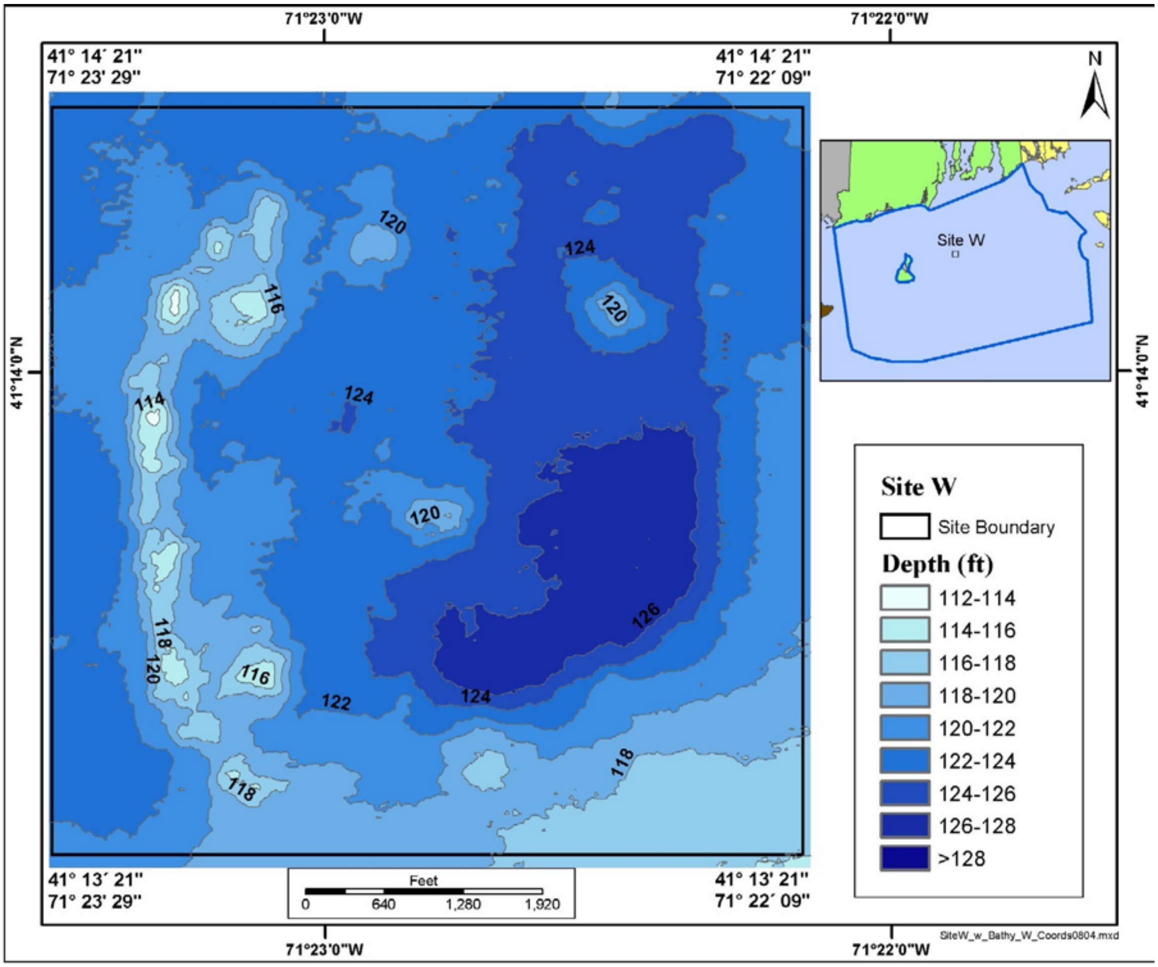

Figure 4-12. Location and Bathymetry of Site W (to be known as the Rhode Island Sound Disposal Site) as of May 2004.

5.0 FEASIBILITY OF SURVEILLANCE AND MONITORING

The U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (Corps) have determined that surveillance and monitoring of the preferred site are feasible. The proposed Final Site Management and Monitoring Plan (SMMP), included as Appendix C of this Final EIS, addresses the six requirements for ocean disposal site management plans included in the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Section 102(c)(3), as amended. These are:

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

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6.0 AGENCY COORDINATION AND COMPLIANCE

6.1 COOPERATING AGENCY REQUEST

The U.S. Environmental Protection Agency (EPA) is the lead agency for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. As the lead agency, the EPA has the primary responsibility of preparing the Draft and this Final Rhode Island Region (RIR) Environmental Impact Statement (EIS). The US Army Corps of Engineers (Corps), New England District (NAE) has worked closely with the EPA as a cooperating agency in preparation of this EIS. A cooperating agency is any Federal or state agency or Tribe not serving as a lead agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action.

The EPA has invited other Federal and state agencies and Tribes to participate in the review and decision-making process of the Draft and Final EIS. The following Federal and state agencies and tribes were invited and agreed to participate as cooperating agencies:

- Narragansett Indian Tribe
- National Marine Fisheries Service (NMFS)
- US Fish and Wildlife Service (FWS)
- Rhode Island Coastal Resource Management Council (RI CRMC)
- Massachusetts Office of Coastal Zone Management (MA CZM)

6.2 AGENCY COORDINATION

The EPA and the Corps have worked closely with the cooperating agencies in the preparation of the Draft EIS and continued to do so during the preparation of this Final EIS. To date, the Corps and EPA have held four agency coordination meetings with cooperating agencies. An additional meeting was held with the Narragansett Indian Tribe to update them on the status of the EIS process. Each meeting is summarized below.

November 14, 2001 - Intra-Agency Meeting

An intra-agency meeting was convened between the EPA, Corps, and NMFS on November 14, 2001. The purpose of this meeting was to exchange information about fishing practices and fishery resources relevant to the RIR EIS. This meeting focused on the “V-notch program” (see Section 3.12.1) that was being piloted by NMFS’s Narragansett Laboratory. Data collected from this program were identified as being potentially useful to this RIR EIS. It was determined that NMFS would provide V-notch program data, including number of legal lobsters and number of V-notches with eggs, for each square on the grid.

May 15, 2003 – Site Screening Presentation to Cooperating Agencies

The purpose of this meeting was to explain the initial screening process developed with the assistance of the Working Group (Corps, 2003a). The goal of the screening process was to identify potential areas within the ZSF that could be evaluated to determine if potential alternative sites could be delineated for analysis in the EIS. The RIR Geographic Information System (GIS) screening layers that were presented were developed based on a literature search of data collected from field investigations. This data illustrated the location and extent of the individual screening factors and cumulatively eliminated areas of the zone of siting feasibility (ZSF) from further analysis. Two areas were recommended by the inter-agency group for further analysis and consideration in this Final EIS: Area W and Area E.

After discussion, it was determined that additional, more site specific data needed to be collected to supplement the data already in hand. The cooperating agencies assisted in identifying data gaps and determining what additional data should be collected. This included detailed bathymetry, side-scan data, magnetometer, current meter data, sediment profile imaging (SPI), sediment chemistry, benthic fauna, finfish and lobster trawls, unvented lobster pots (< 5 days), and quahog trawls. It was decided that this data collection effort would be conducted in the summer of 2003. The data collected during these surveys would be used to characterize the alternative areas and to determine boundaries of the alternative sites within each area.

September 8, 2003 – Site Finalization Presentation to Cooperating Agencies

The purpose of the meeting and presentation was to explain the process and information used to identify the alternative disposal site(s) within the areas identified during the initial screening (Corps, 2003b). Data collected (bathymetry, side-scan data, SPI grain size, SPI mosaic, finfish Catch-per-Unit-Effort [CPUE], lobster pot data, and quahog density data) in the summer of 2003 for Areas E and W were presented in this meeting. Two proposed alternative site locations, one within Area E and one within Area W, were then presented, and the interagency group concurred with the locations of Site E and Site W (see Section 2.3.2 and Section 2.3.3). These sites were identified as the most appropriate for evaluation and analysis in this EIS, along with the No Action Alternative.

November 20, 2003 – Preferred Alternative Presentation to Cooperating Agencies

The purpose of the meeting was to present the preferred alternative for the RIR EIS and the rationale for its selection. An explanation of the evaluation process, the non-discriminating criteria, and use conflicts used to rule out an area was presented. An evaluation matrix listing the various potential impacts for Site E, Site W, and the No Action alternative were discussed. The interagency group agreed that Site W should be the preferred alternative for this Final EIS.

April 1, 2004 – Presentation of the Alternative Selection Process and Review of the Draft EIS – Narragansett Tribe

The purpose of this meeting was to present a review of the alternative selection process and an overview of the Draft EIS to the Narragansett Tribe. The Tribe had agreed to become a cooperating agency after the initial cooperating meetings were initiated. Due to a miscommunication, the project managers were not made aware of the Tribe's desire to participate as a cooperating agency. The Tribe was invited to the Working Group meetings that were initiated in September 2002 but did not participate in those sessions. This meeting was held to provide representatives of the Narragansett Tribe with the same briefings given to the other cooperating agencies. The briefing included a presentation that explained the initial screening process developed with the assistance of the Working Group, the process and information used to identify the alternative disposal site(s) within the areas identified during the initial screening and the preferred alternative for the RIR EIS and the rationale for its selection.

6.3 THREATENED AND ENDANGERED SPECIES CONSULTATION

On December 13, 2002, the Corps sent letters to NMFS and FWS requesting information on (1) the presence of Federally listed species considered to be endangered, threatened, or of special concern, and (2) designated critical habitat within the ZSF.

A response letter from NMFS, dated December 31, 2002, indicated that the following threatened and endangered species of concern are sometimes present in the ZSF: the loggerhead sea turtle (*Caretta caretta*), Kemp's ridley sea turtles (*Lepidochelys kempii*), the green sea turtle (*Chelonia mydas*), and the leatherback sea turtles (*Dermochelys coriacea*). These sea turtles are known to inhabit shallow harbors and embayments in New England waters during the summer months. Several species of whales may also be found seasonally in New England waters; these species include North Atlantic right whales (*Eubalaena glacialis*), humpback whales (*Megaptera novaeangliae*), and fin whales (*Balaenoptera physalus*). Transient whales may occur in the ZSF during seasonal migrations.

The FWS responded on January 10, 2003, with a table listing the Federally threatened and endangered species in Rhode Island. Based on the delineated ZSF map, which includes the entire coastal area of Rhode Island, several Federally threatened or endangered species are listed that inhabit only the shoreline areas and are not likely to be found in the open waters of the ZSF. These species include the Federally threatened piping plover (*Charadrius melodus*), two plant species (the small whorled pogonia [*Isotria medeoloides*] and sandplain gerardia [*Agalinus acuta*]), two beetles (the American burying beetle [*Nicrophorus americanus*] and Northeastern beach tiger beetle [*Cicindela dorsalis dorsalis*]), and the shortnose sturgeon (*Acipenser brevirostrum*). Although the shortnose sturgeon is listed by the FWS as an endangered species possibly inhabiting Rhode Island, it is more of a riverine species. NMFS has determined that shortnose sturgeons are not likely to be found in the ZSF; therefore, this species is not discussed in this Final EIS.

In addition to the sea turtles and whales that were identified as Federally threatened and endangered by NMFS, the FWS has also included the hawksbill turtle (*Eretmochelys imbricata*), blue whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter catodon*), bald eagle (*Haliaeetus leucocephalus*), and roseate tern (*Sterna dougallii dougallii*) on the list of species potentially inhabiting Rhode Island waters.

All of these species that are listed on the NMFS and FWS Federally threatened and endangered species lists, with the exception of the shortnose sturgeon and the two plant species, are discussed in Section 3.15.

A Biological Assessment (BA) was prepared for the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a) to determine if "maintenance dredging of the Providence River Federal Navigation Channel, associated projects, and subsequent dredged material disposal in Rhode Island Sound, could have adverse effects on the threatened and endangered species, marine ecosystem and biological resources of the area". The summary of the Providence River and Harbor Maintenance Dredging Project BA concluded that "it is unlikely that significant adverse effects to the listed whales and sea turtles will result from the disposal of dredged material in Rhode Island Sound" (Corps, 2001a). In a letter dated April 8, 2004, NMFS agreed that the BA prepared for the Providence River and Harbor Maintenance Dredging Project, which includes Site W (i.e., Site 69B), is adequate to address endangered species issues for this Final EIS.

6.4 ESSENTIAL FISH HABITAT (EFH) CONSULTATION

Many marine habitats are critical to the productivity and sustainability of marine fisheries. The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires that an EFH consultation be conducted for any activity that may adversely affect important habitats of Federally managed marine and anadromous fish species. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). "Waters" in the above definition refers to the physical, chemical, and biological properties of aquatic areas that are currently being used or have historically been used by fish. "Substrate" refers to sediment, hard bottom, or other underwater structures and their biological communities. The term "necessary" indicates that the habitat is required to sustain the fishery and support the fish species' contribution to a healthy ecosystem. EFH can be designated for four life stages—eggs, larvae, juveniles, and adults.

NMFS designates EFH for many species in association with a mapped grid of 10- by 10-minute squares covering all marine habitat along the U.S. coast. The ZSF lies within 22 of these 10- by 10-minute squares (Figure 6-1). The 10- by 10-minute square located to the northeast of Block Island was used to evaluate EFH at Site W, the preferred alternative. Information about EFH in the site was also gathered from the EFH evaluation prepared for the Providence River and Harbor Maintenance Dredging Project EIS, which focused on Site 69B, the earlier designation for Site W. In a letter dated April 8, 2004 NMFS agreed that the EFH prepared for the Providence River and Harbor Maintenance Dredging Project, which includes Site W (i.e., Site 69B), is adequate to address endangered species issues for this Final EIS.

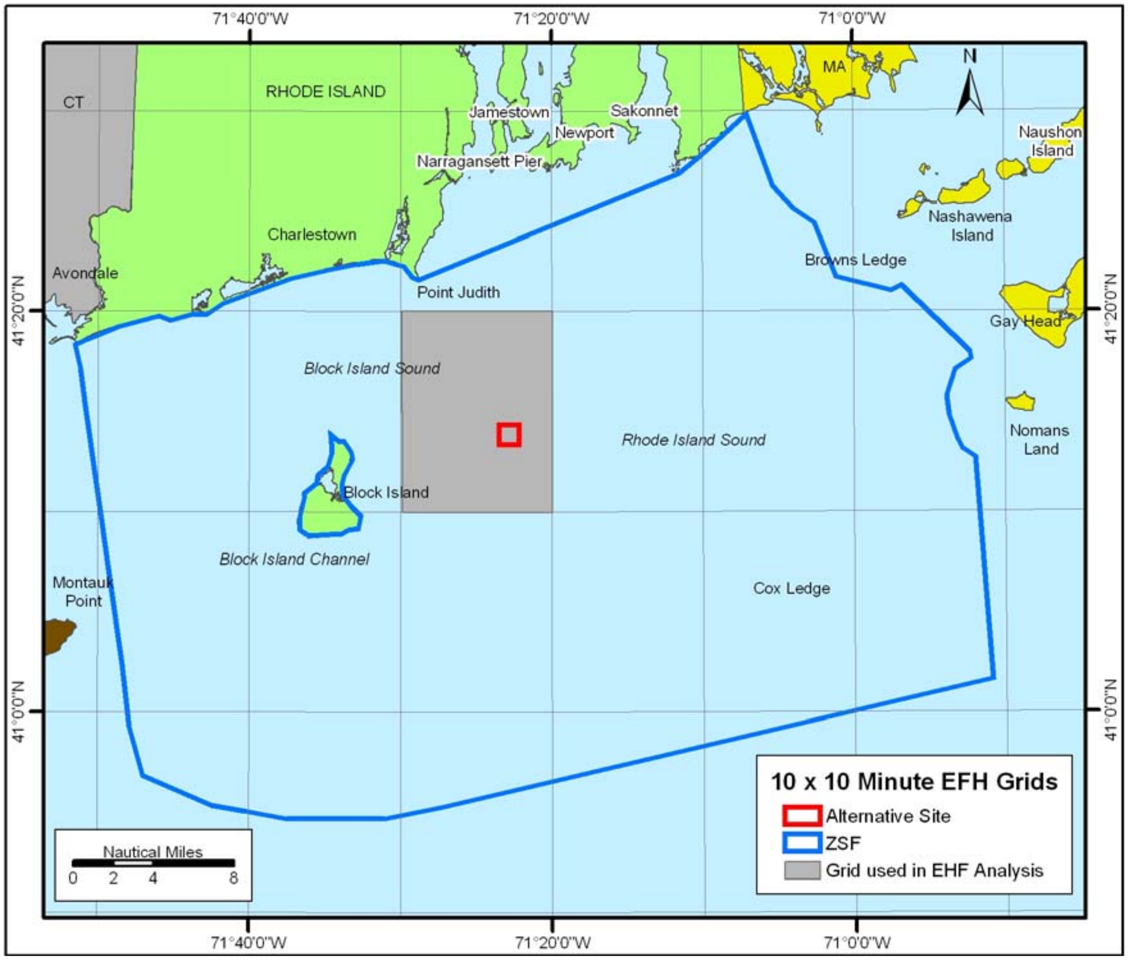

Figure 6-1. 10- by 10-Minute Grids Defining EFH Within the ZSF.

Twenty-nine finfish species (seven of which are sharks) and one invertebrate species (ocean quahog) have EFH designated within Site W (Table 6-1). Seven species—cobia, king mackerel, ocean pout, Spanish mackerel, whiting, windowpane flounder, and winter flounder—have EFH designated for all four life stages. The EFH for each life stage of these particular species is summarized in Appendix O of the Providence River and Harbor Maintenance Dredging Project EIS (Corps, 2001a).

Table 6-1. EFH Species/Life Stage Designations for Site W.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic butterfish *(Peprilus triacanthus)*			X	
Atlantic cod *(Gadus morhua)*	X	X		X
Atlantic mackerel *(Scomber scombrus)*	X			
Atlantic sea herring (*Clupea harengus*)			X	X
Black sea bass *(Centropristis striata)*			X	
Blue shark (*Prionace glauca)*		X	X	X
Bluefin tuna *(Thunnus thynnus)*				X
Bluefish *(Pomatomus saltatrix)*				X
Cobia *(Rachycentron canadum)*	X	X	X	X
Common thresher shark *(Alopias vulpinus)*		X	X	X
Dusky shark *(Carcharhinus obscurus)*			X	
Haddock *(Melanogrammus aeglefinus)*		X		
King mackerel *(Scomberomorus cavalla)*	X	X	X	X
Monkfish *(Lophius americanus)*	X	X		
Ocean pout (*Macrozoarces americanus*)	X	X	X	X
Ocean quahog (*Arctica islandica*)			X	X
Red hake *(Urophycis chuss)*	X	X	X	
Sand tiger shark *(Odontaspis taurus)*		X		
Sandbar shark *(Carcharhinus plumbeus)*			X	X
Scup *(Stenotomus chrysops)*			X	X
Shortfin mako shark *(Isurus oxyrhinchus)*			X	
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
Spiny dogfish (*Squalus acanthias*)			X	X
Summer flounder *(Paralichthys dentatus)*	X	X		X
Whiting *(Merluccius bilinearis)*	X	X	X	X
Windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
Winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
Witch flounder *(Glyptocephalus cynoglossus)*	X			
Yellowtail flounder *(Pleuronectes ferruginea)*	X	X	X	

Source: http://www.nero.noaa.gov/ro/STATES4/massri.htm

The potential impacts of disposal on EFH in Site W (as Site 69B) were evaluated for the Providence River and Harbor Maintenance Dredging Project EIS. That EIS concluded the following: (1) there would be temporary impacts to demersal species, or species having demersal eggs or larvae, during disposal activities that could persist until the benthic habitat recovered; (2) species that have pelagic eggs and larvae may also be adversely impacted by material released from the scow as it descends through the water column; and (3) some juveniles and adults may not be able to escape the descending plume and may be buried or otherwise damaged. The overall potential for adverse effects was also evaluated for the Providence River and Harbor Maintenance Dredging Project EIS by considering species abundance data and habitat information (Table 6-2). The potential for impacts to most species/life stages was low, with a few having medium potential for impacts. No species/life stages had a high potential for impacts.

Table 6-2. Summary of Fish Species with EFH in the Vicinity of Site W in Rhode Island Sound.

Life History Stage	Water Column Position	Species	Likelihood of Presence[1]	Habitat Requirement[2]	Potential for Adverse Effects[3]
Eggs	Demersal	Winter flounder	Medium	Low	Low
		Ocean pout	Medium-Low	Low	Low
	Planktonic	Summer flounder	Low	Medium	Low
		Windowpane flounder	Medium	Medium	Medium[4]
		Witch flounder	Low	Medium	Low
		Yellowtail flounder	Low	Medium	Low
		Cod	Low	Medium	Low
		Monkfish	Low	Medium	Low
		Red hake	Medium	Medium	Medium[4]
		Silver hake	High	Medium	Medium[4]
		Atlantic butterfish	Medium	Medium	Medium[4]
		Atlantic mackerel	Medium-Low	Low	Low
		Cobia	Low	Medium	Low
		King mackerel	Low	Medium	Low
		Spanish mackerel	Low	Medium	Low
Larvae	Demersal	Ocean pout	Medium-Low	Low	Low
	Planktonic - flounders	Winter flounder	Medium	Low	Low
		Summer flounder	Low	Medium	Low
		Windowpane flounder	Medium	Medium	Medium[4]
		Witch flounder	Low	Medium	Low
		Yellowtail flounder	Low	Medium	Low
	Planktonic - groundfish	Cod	Low	Low	Low
		Haddock	Low	Low	Low
		Monkfish	Low	Medium	Low
		Red hake	Medium	Medium	Medium[4]
		Silver hake	High	Medium	Medium[4]
	Planktonic - pelagic fish	Cobia	Low	Medium	Low
		King mackerel	Low	Medium	Low
		Spanish mackerel	Low	Medium	Low
Neonates	Planktonic sharks	Blue shark	Low	Medium	Low
		Common thresher shark	Low	Medium	Low
		Sand tiger shark	Low	Medium	Low
Juveniles	Demersal	Windowpane flounder	High	Medium	Low
		Winter flounder	High	Low	Low
		Yellowtail flounder	Low	Medium	Low
		Cod	Low	Low	Low
		Black sea bass	Low	Low	Low
		Ocean pout	Medium	Low	Low
		Red hake	Medium	High	Low
		Scup	Medium	Low	Low
		Silver hake	High	High	Low
		Ocean quahog	Medium	Medium	Medium[4]
	Pelagic	Atlantic butterfish	Medium	Medium	Low
		Atlantic sea herring	Medium	Medium	Low
		Bluefish	Low	Low	Low
		Cobia	Low	Medium	Low
		King mackerel	Low	Medium	Low
		Spanish mackerel	Low	Medium	Low
		Blue shark	Low	Medium	Low

Source: Corps, 2001b

Table 6-2 (continued). Summary of Fish Species with EFH in the Vicinity of Site W in Rhode Island Sound.

Life History Stage	Water Column Position	Species	Likelihood of Presence[1]	Habitat Requirement[2]	Potential for Adverse Effects[3]
Juveniles (cont.)	Pelagic	Common thresher shark	Low	Medium	Low
		Dusky shark	Low	Medium	Low
		Sandbar shark	Low	Medium	Low
		Shortfin mako	Low	Medium	Low
		Spiny dogfish	Low	Medium	Low
		Long-finned squid	Medium	Low	Low
Adults	Demersal	Summer flounder	Low	Medium	Low
		Windowpane flounder	High	Medium	Low
		Winter flounder	High	Low	Low
		Yellowtail flounder	Low	Medium	Low
		Cod	Low	Low	Low
		Ocean pout	Medium	Low	Low
		Scup	Medium	Low	Low
		Silver hake	High	High	Low
		Ocean quahog	Medium	Medium	Medium[5]
	Pelagic	Atlantic butterfish	Medium	Medium	Low
		Atlantic sea herring	Medium	Medium	Low
		Bluefin tuna	Low	Medium	Low
		Bluefish	Low	Low	Low
		Cobia	Low	Medium	Low
		King mackerel	Low	Medium	Low
		Spanish mackerel	Low	Medium	Low
		Blue shark	Low	Medium	Low
		Common thresher shark	Low	Medium	Low
		Sandbar shark	Low	Medium	Low
		Spiny dogfish	Low	Medium	Low

Source: Corps, 2001b

[1] Likelihood of presence information is based on surveys by Bourne and Govoni (1988), Keller *et al*. (1999), and MRI, Inc. (1996-2000). NMFS trawl surveys in Rhode Island Sound suggest presence of juvenile and adult fish species. Low - not present; Medium - present but not abundant; High - present and fairly abundant

[2] Habitat requirement information refers to the substrate type, water depth, salinity, and distance from shore at Site 69b. Low - not suitable habitat; Medium - moderately suitable; High - suitable

[3] Potential for adverse effects to juveniles and adults will be low because they will avoid the dredging area and TSS plume; however, the potential for adverse effects on newly metamorphosed juveniles may be greater. Low – no effects or effects highly unlikely; Medium – some adverse effects are likely (moderate mortality); High – adverse effects are likely – high mortality

[4] Adverse effects may include physical damage or death due to elevated TSS.

[5] Adverse effects may include burial and physical damage or death due to elevated TSS.

6.5 COASTAL ZONE MANAGEMENT (CZM) STATEMENT OF COMPLIANCE

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

The U.S. EPA has completed a federal consistency determination pursuant to Section 307 of the CZM and has determined that the proposed action is consistent with policies of the Rhode Island Coastal Resources Management Council (RI CRMC) as described in the State of Rhode Island Coastal Resources Management Program. Concurrence with this determination was requested in a letter to the RI CRMC, Executive Director on September 21, 2004 (Appendix B). Disposal at the preferred alternative is outside the State coastal zone.

6.6 ENVIRONMENTAL COMPLIANCE

This section describes the federal laws, regulations, and programs that are relevant to the designation of open-water dredged material disposal sites in Rhode Island Sound. Chapter 1, Section 1.3 also addresses the legal requirements of the MPRSA.

Federal Statutes

1. American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: Consultation with the Indian tribes that may be affected by the proposed action in order to ensure that the action does not interfere with their rights to traditional religious practices has taken place during the development and review of this EIS.

2. Clean Air Act, as amended, U.S.C. 7401 *et seq*.

Compliance: The "general conformity" requirements of Section 176(c)(1) of the Clean Air Act, 42 U.S.C. 7506(c)(1), may apply to the designation of a dredged material disposal site. Such a designation produces no emission, however, and therefore would clearly satisfy the general conformity requirement. It should also be noted that the future authorizations of specific dredging and dredged material disposal projects by the Corps would be evaluated under the general conformity requirements of Section 176(c)(1) of the Clean Air Act since these projects would actually produce air emissions. "Conformity" would be evaluated on a project-specific basis for these projects. At the same time, however, some such projects might satisfy the conformity requirements pursuant to one of the specific exemptions stated in EPA's regulations. *See* 40 CFR 51.853(c)(ix).

3. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1431 *et seq*.

Compliance: The U.S. EPA has completed a federal consistency determination pursuant to Section 307 of the CZM and has determined that the proposed action is consistent with policies of the RI CRMC as described in the State of Rhode Island Coastal Resources Management Program. Concurrence with this determination was requested in a letter to the RI CRMC, Executive Director on September 21, 2004 (Appendix B).

4. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq*.

Compliance: In 2001 EPA prepared a Biological Assessment (BA) consistency determination for the selection of site 69B, which occupies the same boundaries as Site W. USFWS and NMFS concurred with EPA's determination that species under their jurisdiction would not likely be adversely affected by the proposed action. The BA concludes that the proposed action is not likely to affect threatened and endangered species. In 2004 USFWS and NMFS reaffirmed their concurrence with EPA's determination (Appendix B). USFWS stated that no federally-listed or proposed, threatened or endanger species or critical habitat under their jurisdiction are know to occur within the project area. NMFS recommended that reassessment of the BA findings be scheduled at five year intervals, or whenever significant and extraordinary changes of the resource base are observed. If new information becomes available that affects the basis for the present consultation, additional consultation under Section 7 of the ESA may be required.

5. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 *et seq*.

Compliance: NMFS, USFWS, and the fish and wildlife agency of Rhode Island have been consulted and their recommendations have been included in this Final EIS. Also, when possible, their recommendations will be incorporated into the final action.

6. Magnuson-Stevens Fishery Conservation and Management Act, as amended, 16 U.S.C. 1801 *et seq*.

Compliance: In 2001 EPA prepared an EFH assessment for the selection of Site 69B, which occupies the same boundaries as Site W. The EFH assessment concludes that the proposed action is not likely to affect those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. In a letter dated April 8, 2004 (Appendix B), NMFS agreed that the EFH prepared for the Providence River and Harbor Maintenance Dredging Project, which includes Site W (i.e., Site 69B), is adequate to address endangered species issues for this Final EIS. NMFS also recommended that reassessments of the EFH findings be scheduled at five year intervals, or whenever significant and extraordinary changes of the resource base are observed. If new information becomes available that affects the basis for the present consultation, a distinct and further EFH consultation must be reinitiated pursuant to 50 CFR 600.920(1).

7. Marine Mammal Protection Act of 1972, 16 U.S.C. 1361.

Compliance: NMFS and USFWS have been consulted to determine whether any marine mammals under their respective jurisdictions may be affected by the project. Both agencies concurred that whales listed as threatened or endangered species under their jurisdiction would not likely be adversely affected by the proposed action (see "Endangered Species Act of 1973" above). Results of the literature search indicated that the project area is not a specific destination or concentration area for any of the marine mammals identified in this Final EIS, and the proposed action is not expected to have significant adverse effects on marine mammals.

8. Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 *et seq*.

Compliance: Pursuant to MPRSA 102, EPA promulgated criteria to guide the selection of open-water disposal sites. These criteria are set forth at 40 CFR Part 228. These criteria were followed in evaluating the potential designation of open-water disposal sites. The requirements of this Act are discussed more fully in Chapter 1 of this EIS.

9. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 *et seq*.

Compliance: NEPA does not apply to this action, as discussed in Chapter 1. However, EPA is preparing this EIS to be consistent with EPA's voluntary NEPA Policy. This is discussed more fully in Chapter 1 of this EIS.

10. National Historic Preservation Act of 1966, 16 U.S.C. 470.

Compliance: The project was coordinated with the State Historic Preservation Office in Rhode Island, and it was determined that no historic property would be affected by the proposed project. The basis for this determination was the archaeological assessment of Site 69B conducted as part of the Providence River and Harbor Maintenance Dredging Project (Corps, 2001a), and the side-scan sonar investigation (Corps, 2003c) and Historic Shipwreck Background Study (Corps, 2004) conducted as part of this Final EIS. In a letter dated February 6, 2003, the State Historic Preservation Office concurred that the disposal of dredged material at Site W would have no effect on any significant cultural resources (Appendix B). In addition, EPA consulted with Federal Historic Preservation Officers (July 16, 2004) and the Tribal Historic Preservation Officer (July 19, 2004) regarding possible effects on historic/archaeological resources.

11. Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3002.

Compliance: This statute should not be triggered by this action because (a) no human remains or objects will be found during this action, which involves designating open-water sites for potential future disposal of dredged material, (b) this action will not take place on either federal or Indian lands. Also, interested Indian tribes were consulted in the consideration of alternative courses of action for this EIS.

12. Preservation of Historic and Archaeological Data Act of 1974, 16 U.S.C. 469.

Compliance: The chance of this action leading to future damage to resources covered by this Act was considered and there is no expectation that this project will damage archeological, historic, scientific, or prehistoric data. If there is an unexpected discovery of data covered by this act, EPA will notify the National Park Service Departmental Consulting Archaeologist.

Executive Orders

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971.

Compliance: This Order has been incorporated into the National Historic Preservation Act of 1980. Coordination with the State Historic Preservation Offices in the state of Rhode Island signifies compliance with this Order.

(scroll down)

2. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Coordination and consultation with the Indian Tribal Governments with an interest in the study area signifies compliance.

3. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 11 February 1994.

Compliance: This Final EIS has evaluated the potential adverse risks to human health this project poses to minority and low income populations and found that there are no expected disproportionately high and adverse health or environmental effects to these populations.

4. Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, 21 April 1997.

Compliance: This Final EIS has evaluated the potential adverse risks to children's health and found that there are no expected disproportionately high, adverse health or safety threats to children from this action.

5. Executive Order 12962, Recreational Fisheries, 9 June 1995.

Compliance: This Final EIS has considered the goals of this Executive Order and the project is not expected to have disproportionately high or adverse effects on recreational fisheries.

6. Executive Order 13158, Marine Protected Areas.

Compliance: EPA has considered the location of any "marine protected areas" in considering alternative courses of action for this project. The action will avoid harm to the natural and cultural resources protected by any designated marine protected areas.

7. Executive Order 12088, Federal Compliance with Pollution Control Standards.

Compliance: EPA has considered the goals of the Executive Order and determined that the proposed action is in compliance with this Executive Order.

Executive Memorandum

1. White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: Consultation with the federally recognized Indian Tribes signifies compliance.

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7.0 PUBLIC INVOLVEMENT

As part of the environmental impact statement (EIS) process, the National Environmental Policy Act (NEPA) requires that there be an early and open process with the public regarding the proposed action for which an EIS will be prepared. The purpose of this public involvement process is to obtain input from private citizens, citizen groups, public interest groups, organizations, businesses, and Federal, state, and local agencies on issues to be discussed in the EIS.

This section summarizes the public involvement activities conducted during the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project to date. These activities involve public information meetings (i.e., public scoping and special interest group meetings), a series of working group meetings, public hearings conducted on the Draft EIS, and the creation and maintenance of project websites.

7.1 PUBLIC INFORMATION MEETINGS

The U.S. Army Corps of Engineers (Corps) and U.S. Environmental Protection Agency (EPA) held two public scoping meetings in the spring of 2001 regarding this Rhode Island Region (RIR) EIS. The format of the meetings was a formal presentation followed by a question-and-answer session. Following each meeting, participants were provided with questionnaires to write comments and questions to the Corps and EPA regarding the feasibility of designating a long-term dredged material disposal site. Responses to the questions were prepared by the Corps and EPA. Additionally, a project website (http://www.nae.usace.army.mil/projects/ri/riltds/ridredging.htm) was created that can be accessed by the public. A summary of each meeting is provided in Section 7.1.1.

The Corps and EPA also met with fishermen in the region to ensure that the decision-making process takes into account the special interests of the area's fishing and lobster industry. Three meetings were held in late 2001 and early 2002 to address these specific concerns; Section 7.1.2 describes those meetings.

7.1.1 Scoping Meetings

The first scoping meeting was conducted on May 17, 2001, at White's of Westport, in Westport, Massachusetts. The meeting was attended by representatives of the Corps, EPA, and Battelle and by 13 private stakeholders, including representatives from the marine trade organization, a marine operator, and the Harbor Master of Westport. A second meeting was held on May 22, 2001, at the Lighthouse Inn in Narragansett, Rhode Island. Representatives from the Corps, EPA, and Battelle and approximately 35 attendees were present at that meeting. Attendees included fishermen, lobstermen, members of environmental groups such as "Save the Bay," city council members, representatives for Rhode Island Senator Lincoln Chafee and for then-Rhode Island Governor Lincoln Almond, and members of the Rhode Island Coastal Resources Management Council (CRMC).

Each meeting began with a formal presentation explaining both the roles of the Corps and EPA, as well as the purpose and need for the proposed project. The NEPA process for preparing an EIS was also outlined.

Public comments received at both meetings reflected concerns regarding:

- Need for adequate data regarding fish and lobster habitats in Rhode Island Sound
- Potential economic impacts of the project
- Alternatives to disposal in Rhode Island Sound
- Purpose of the project

Several of the comments received related to the need for up-to-date, accurate data. Several fishermen were concerned that the EPA and Corps did not have sufficient information regarding important marine habitat areas in Rhode Island Sound. Some commented that they had never been surveyed to help identify areas of the Sound that may support abundant or diverse fish habitat.

Economic impacts were a main concern for local fishermen and lobstermen. The fishermen and lobstermen who were opposed to the designation of a long-term disposal site were concerned that such a site would seriously impact their livelihood. These individuals stated that fishery resources are this region's largest natural resource (seventh largest fishery in the United States and third largest in New England) and that the disposal site could lead to the collapse of some fisheries. Furthermore, they stated that the area is an important breeding and spawning habitat for marine organisms and has only recently recovered from a 1996 oil spill. There was also concern that the project would adversely affect recreational resources such as diving, sailing, and recreational boating; thus, consequently impacting businesses that support these activities.

Although several members of the marine trade association supported the designation of a long-term disposal site in Rhode Island Sound, other meeting participants were opposed to disposal of dredged material in the Sound. Those opposed asked the EPA and Corps to treat the dredged material as a resource and use it for beneficial uses such as fill for highway or other construction projects.

There was some confusion about whether the evaluation project involved one site or several long-term disposal sites, and who would use a long-term site. A question was raised as to whether a designation of such a site is even needed, and whether a long-term disposal site in Rhode Island Sound would be used only for large-scale dredging projects. There was also concern that the dredged material could be contaminated. The fishermen voiced concern that introducing contaminated dredged material to the Sound would cause a public perception that the seafood is "harmful" or "tainted," thus rendering it unmarketable. The EPA and Corps stated that all dredged material being considered for ocean disposal would require testing to ensure that no contaminants are present at levels above regulatory limits.

Based on the comments received at these two meetings, the EPA and Corps produced a list of potential additions to the scope of the project, including:

- Conduct a comprehensive review of available data pertaining to Rhode Island Sound
- Collect any existing data on biological resources (shellfish, lobsters, finfish, and habitat)
- Develop contacts with scientists at state agencies such as the Rhode Island Department of Environmental Management (RIDEM)
- Develop a survey or other mechanism to question fishermen about the fish/lobster areas
- Continue public outreach
- Determine what information from the Providence River and Harbor Maintenance Dredging project is relevant
- Compile relevant nautical charts to locate fisheries resources
- Forecast future dredged material disposal needs for the region
- Define methods to address economic issues
- After review of existing data gaps, develop a program to collect and analyze additional field data to fill in the gaps.

7.1.2 Special Interest Groups

Three meetings were held with fishermen from the region to specifically address concerns of the fishing and lobster industry. The meetings were held on August 28, 2001, November 14, 2001, and January 8, 2002. The August meeting was held at RIDEM in Wakefield, Rhode Island; the November and January meetings took place at the NMFS Laboratory in Narragansett, Rhode Island.

All meetings began with introductions from attendees, followed by a brief description of the project and the EIS process. EPA emphasized that the RIR EIS project is different from the Providence River Dredged Material Disposal EIS, recently completed by the Corps.

The August 2001 meeting was held to inform members of the Rhode Island commercial fishermen's association of the Corp's/EPA's intent to conduct sampling for fish in Rhode Island Sound. The Corps and EPA asked the fishermen to comment on a field sampling plan and on the methods that were proposed. The Corps and EPA also provided nautical charts for fishermen to delineate common fishing locations that are used by members of the Rhode Island Sound fishing community.

At this initial meeting, the fishermen stated their desire to be included in the planning process; therefore, additional meetings were scheduled. The Corps and EPA said they wanted to draw upon the knowledge the fishermen have of the area in terms of where key fish, shellfish, and lobster resources are located. This information is critical to improving the understanding of the area so that more informed decisions about potential locations for a dredged material disposal site(s) can be made.

At all meetings, the following main issues continued to surface:

- Relationship of (or confusion over) the Providence River project and the RIR project
- Public participation process for the RIR EIS
- Economic impact to fishing industry from the RIR project

- Data needs
- Alternatives to be examined in the RIR EIS

Comments at these meetings centered largely on concerns over data needs and the public participation process. Some fishermen expressed concern that, because Site 69B had already been selected as the proposed disposal site for maintenance dredging of the Providence River Project, it would also be chosen as the long-term disposal site without the input of local fishermen. The fishermen requested that alternatives, including not using Rhode Island Sound as a disposal site, be addressed in the EIS. Overall, the fishermen wanted to be certain that their concerns were being incorporated into the decision-making process and that the data they provided, concerning fish and lobster habitats, would be used as part of the analysis of alternatives. The EPA and Corps stated their desire to use these public meetings to better understand the needs of, and to avoid interference with, the fishing industry; and for fishermen to continue their participation in this process.

Another primary concern of the fishermen was the impact that a long-term disposal site could have on the fishing industry due to increased turbidity, disruption of migratory fish routes, and impacts on resident fish and lobster species. In addition, public concern over consuming fish caught in the vicinity of a disposal site, could harm the fish and lobster industry, as evidenced from the 1996 oil spill. The fishermen also raised concerns over the length of time that the evaluation project would take.

Local fishermen stressed that natural depressions on the seafloor are important areas for fish habitat and that the dumping of dredged material in these areas could have a potentially significant impact on fish populations in the area. Potential sources of information were also discussed, including NMFS's V-notch program, GSO Geoffrey Trawls, online access to NMFS logbooks, study of lobster tagging, data from zooplankton tows in Rhode Island Sound area, and data collected by RIDEM on the 1996 oil spill.

Overall, the fishermen showed a willingness to meet with the EPA and Corps and discuss and map fishing areas on charts; some volunteered the use of their boats for survey work. Several fishermen provided information to the EPA and Corps at the January 8, 2002, meeting, including nautical charts highlighting areas of productive fishing grounds and areas where lobster and dragging vessels were in operation year-round. Several fishermen suggested that they assist in the collection of fish population data for purposes of the EIS.

7.2 WORKING GROUP MEETINGS

Based on the issues and concerns identified at the public scoping meetings and on discussions with the fishermen and lobstermen at the special interest group meetings, EPA and the Corps determined that a series of special meetings with a representative Working Group of stakeholders needed to be conducted. The purpose of these meetings was to have the Corps, EPA, Federal and state agencies, and Working Group members work together to focus on resolving scoping issues and to work as a team to identify and prioritize the various concerns/criteria that should be evaluated in identifying and screening potential ocean disposal sites.

A series of six Working Group meetings were originally identified to be conducted at the University of Rhode Island (URI) Coastal Institute (CI) and facilitated by (CI) staff as part of the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. The CI served as a neutral forum for the Working Group. All meetings were open to the public, and active participation was encouraged. Complete meeting minutes were posted on a web site and Working Group members were emailed a notice to of the availability of the minutes. The Working Group minutes can be found on the project website (www.ci.uri.edu/projects/dd) (Coastal Institute, 2003a). Brief summaries of the Working Group meetings are provided below.

In addition, the CI prepared a final report titled *Coastal Institute Working Group Review of the Siting Criteria for an Offshore Long-Term Dredged Material Disposal Site(s) for the Rhode Island Region* (Coastal Institute, 2003b). The report summarized the first five Working Group meetings held from September 2002 to January 2003, providing a list of participants, project description, development of evaluation criteria, identification of data/information needed, site screening criteria, results of initial screening process, and other related topics. The report also summarized the major considerations discussed by the Working Group. The report is available online at http://www.ci.uri.edu/projects/dd/.

In addition to the Working Group meeting minutes, RIR EIS documents and Federal regulations and statutes were posted to the following project websites so that stakeholders could access this information as the project progressed:

- Designation of a Long-term Offshore Disposal of Dredged Material website (http://www.ci.uri.edu/projects/dd/) (a project listserv was also made available on the website, whereby Working Group members could openly communicate by e-mail)
- Corps website (http://www.nae.usace.army.mil/projects/ri/riltds/redredging.htm)

Additionally, EPA and Corps representatives provided telephone, fax numbers, and e-mail addresses for stakeholders to contact them directly to discuss the project.

September 26, 2002 – Overview of the RIR EIS Project, the Designation Process, and Roles of the Corps, EPA, and Working Group

This initial meeting provided a forum for the Working Group to (1) introduce themselves and the agencies and organizations they were representing, and (2) identify what goals, issues, and concerns should be addressed at the Working Group meetings. This meeting focused on providing an overview of the project, the area being evaluated in the dredging needs study, the site designation process, the EIS development process, and an understanding of site monitoring plans. Additionally, roles and responsibilities of the EPA, the Corps, and the stakeholders were presented. The EPA and Corps emphasized the need for active participation of the stakeholders throughout the series of Working Group sessions to assist in the decision-making process of project needs and site designation. Stakeholder concerns expressed at this meeting included the following:

- Limited scope of the evaluation project (addresses only offshore disposal)
- Consideration of beneficial use of dredged materials
- Prohibitive cost of ocean disposal
- Stakeholders concerns were not heard or addressed in the development of the Providence River EIS
- Demonstrated need for an offshore disposal site
- Local fishing and lobstermen organizations' concerns about impacts to fisheries, V-notch lobster program, bathymetric data, socioeconomic impacts
- Discussion of application approval for dredged material disposal
- Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) authority to designate Federal disposal sites
- Toxicity, suitability, or upland use of dredged materials, historical plume and sediment transport information associated with previous disposal sites
- Continued discussions on MPRSA-specific evaluation criteria

EPA and the Corps requested fishing locations and economic information from the fishing and lobster organizations, special interest groups, and the general public to assist in the site designation process.

October 8, 2002 - Overview of State Activities Regarding Dredged Materials, the Decision-Making Process of Offshore Sites, and Experiences of Boston Harbor Dredging and Disposal Activities and Monitoring Results

The purpose of this meeting was to review MPRSA site-specific criteria and to identify factors to evaluate potential offshore disposal sites, review candidate sites. Topic areas requested at the September 26 meeting were also discussed, including the permitting process, required toxicity tests, potential use of offshore disposal sites, discussion of plumes and sediment transport, and monitoring and the Disposal Area Monitoring System (DAMOS) program.

An overview of dredging in Rhode Island and in Massachusetts was presented by the Rhode Island CRMC and Massachusetts Coastal Zone Management (CZM), respectively. The overviews gave an historic perspective on dredging, discussed dredging needs in each state, and discussed other areas of dredged material management in Rhode Island and Massachusetts.

In addition, an overview of the MPRSA evaluation criteria (Sections 228.5 and 228.6), which specifies requirements for the evaluation of potential dredged material disposal sites, was addressed. Examples of areas that may be excluded from consideration were discussed (i.e., pipelines, cables, conservation areas, beaches, etc.).

The Corps provided an overview of DAMOS, a program that evaluates potential impacts of open water disposal of dredged materials. DAMOS establishes periodic site surveys and post-storm surveys to evaluate the movement of materials from a site. DAMOS generates data on the environmental health of sites, site stability, chemical isolation, sediment evaluation assessment, and the refinement of management techniques.

The Corps also presented a general outline of the process for identifying and approving dredging projects for aquatic disposal. Four tiers (Tier I through Tier IV) are used by the Corps to evaluate potential dredging projects based on the expected level of contaminants. That is, dredged material with minimal or no chemical contamination requires fewer tests to determine suitability for ocean disposal and does not proceed to the next tier of tests. Projects with higher levels of dredged material contamination would require more extensive tests (higher tiers) to determine if the material is suitable for ocean disposal. The tiered system allows the Corps to systematically evaluate projects in a standard protocol to save time and expense.

Tier I - Preliminary identification of potential contaminants using historical data for the area
Tier II - Marine water and sediment quality screening for biological impact. Project must meet water quality criteria.
Tier III - Expose marine organisms (toxicity test) to dredged materials to assess toxicity and bioaccumulation.
Tier IV - Specially designed evaluations (e.g., field pilot studies).

The Corps also discussed criteria to minimize potential adverse impacts, including how the MPRSA and the Clean Water Act govern the disposal of dredged material. In addition, EPA uses the Ocean Testing Manual *Evaluation of Dredged Material Proposed for Ocean Disposal* (EPA and the Corps, 1991) as the standard for evaluating contaminant risks to water quality and sediments from dredged materials using limiting permissible concentration (LPC) as the measurement criterion.

Concerns were expressed over the selection of Site 69B in the Providence River EIS regarding the potential loss of sediments outside of the site and potential impacts to marine life. Continued concerns about fisheries and shellfish impacts from dredged material disposal were also discussed. The need to use the most current fishery data was also emphasized, particularly for fish species that have been recovering in recent years in the area. Others stated that dredging was necessary for the continued viability of marinas. The need for a dredged material disposal site within Rhode Island Sound was also questioned.

Discussion of experiences with Boston Harbor dredging and disposal activities indicated that similar concerns regarding impact to marine life were heard in 1998-2001 for the project to deepen the Boston Harbor Navigation channels. Disposal plume tracking observations conducted by the Corps for dredging in the Boston Harbor channels indicated that there were no water quality violations and that areas returned to background levels within four to six hours.

November 19, 2002 – Overview of Dredging Needs Study and Revised Map of Zone of Siting Feasibility (ZSF) and Development of Evaluation Criteria

The results of the ZSF study (Corps 2002b) were reviewed. The ZSF report identified the area in which, based on a number of evaluation criteria, potential dredged material disposal sites should be investigated. The methodology used to determine the project's dredging needs along with the results of the dredging needs study were also reviewed at this meeting (Corps, 2002a). The dredging needs study was conducted to estimate the projected volume of dredged materials from Federal and non-Federal projects in Rhode Island and southeastern Massachusetts over a 20-year period. The overview also described impacts to facilities if a disposal site is not designated. The dredging needs report is available online at: http://www.ci.uri.edu/Projects/DD/Docs/Needs_Rpt.pdf; the ZSF report is available at: http://www.ci.uri.edu/Projects/DD/Docs/ZSF_Rpt.pdf.

A comment-and-response period was held after the presentations. Several of the comments concerned fisheries, including migratory routes and potential impacts to finfish and shellfish within the ZSF.

Members of the Working Group agreed that at the next meeting (December 10, 2002), they would continue to discuss concerns/issues in the ZSF. They would work to develop these concerns into specific evaluation criteria consistent with MPRSA that could be used in initial screening efforts.

December 10, 2002 – Review of Evaluation Criteria, Major Concerns, and Dredging Needs Study

A concern was voiced about the cost to perform toxicity testing of dredged material to determine suitability for ocean disposal. It was suggested that the cost to conduct toxicity testing, especially for smaller marinas, could exceed the cost of dredging and disposal. The need to address economic considerations was also discussed, including economic impacts of the No Action alternative. The Corps stated that an economic analysis would be performed.

The major concerns of the working group, as they pertained to the five general and 11 specific MPRSA criteria were also reviewed. Major concerns by category and data needs/sources included the following:

- Impacts to fisheries
- Recreational interests
- Commerce
- Biodiversity
- Remedial use
- Military activities
- Economics of use
- Hydrodynamics (containment vs. dispersal sites for disposal of dredged material)

The hydrodynamics of areas within the ZSF and the conditions required for a suitable disposal site based on wave action, storm events, and currents were of particular concern.

At this meeting, the dredging needs study and the revised ZSF boundaries were presented and discussed with the Working Group. The documents were subsequently posted online at www.ci.uri.edu/projects/dd.

Comments on the dredging needs study focused on the volume of material that the study estimated would be dredged in the next 20 years. An attendee mentioned that the State of Rhode Island should define and evaluate the real dredging disposal needs and options for Rhode Island, not a Federal agency. Staff from the State of Rhode Island agreed to review the results of the dredging needs study and provide feedback on the volume of material estimated from dredged material disposal for the State. There was also a discussion about using upland disposal locations; however, no known location is available in the RIR.

January 14, 2003 – Costs Associated with Tier Testing, an Overview of Draft Interim Report, Federal Site-Specific (11) Criteria, and Next Steps

The Corps discussed the tier testing used to determine acceptability for ocean disposal. It was noted, however, that the exact costs for testing dredged materials is not easy to determine because such costs depend on site-specific conditions. Three testing sequences (I, II, and III) were discussed which relate to the type of testing that can be performed on dredged material. Testing Sequence I analyzes all existing and readily available, assembled, and interpreted information, including physical, chemical, and biological data. Testing Sequence II consists of sediment and water chemistry analysis. Testing Sequence III provides data that will allow an impact assessment of contaminants of concern through the use of toxicity and bioaccumulation tests with appropriate sensitive organisms. If a sediment sample fails toxicity tests (kills too many organisms), offshore disposal of that dredged material is not allowed. The EPA and Corps can advise applicants as to the testing procedures required for specific areas.

The CI provided an overview of its draft interim report. Institute staff stated that the intent of the report was to summarize discussions of the Working Group to date, not to serve as an EIS or a complete guidance document for preparing the EIS. A copy of the draft report is available on the project website: www.ci.uri.edu/projects/dd.

At this meeting the Corps also presented a spreadsheet which identified the qualitative criteria that would be used in the initial site screening effort. The next step was to develop a screening process to determine the areas within the ZSF that were or were not appropriate to be considered further. The Working Group deferred further meetings while the Corps, the EPA, and their contractor assembled data sets to allow quantitative evaluation of the criteria. The Corps and EPA proposed three levels of consideration. These three levels would be used to quantitatively categorize areas that should be excluded from consideration (Level 1), areas that could be excluded or included (Level 2), and areas that could be included (Level 3).

The Corps and EPA planned to distribute the quantitative screening information to the Working Group via the web site to allow Working Group members an opportunity to review it prior to the initial screening effort

June 12, 2003 – Initial Screening Work Completed and Reports Available on the Coastal Institute's Website

The Corps and its consultant (Battelle) discussed the data gathered since the last Working Group meeting to address issues identified by the Working Group. The data presented were used to create Geographic Information System (GIS) data layers that were transposed onto a map of the ZSF, providing the first public viewing of the initial screening results. The data, together with input from the fisherman, were the initial steps in evaluating the screening criteria that would identify potential site ocean disposal locations. The following was presented:

- Objectives of the screening criteria
- Approach to screening
- Data gathering for screening effort
- References used for preparing Section 3.0, Affected Environment, of this Final EIS
- Data layers developed for the screening process
- Road map for the presentation of data

A question-and-comment period followed the presentation. Questions focused on clarifying issues relating to (1) erosion potential, (2) NMFS fish, shellfish, and lobster data, and (3) data collection needs for Areas W and E. As additional data are collected for the screening process, potential site locations would be further refined, identified, and delineated.

The objectives of the Working Group were met with the presentation of the initial screening results. The Working Group had identified its concerns/issues, provided stakeholder information, assisted in identifying and developing priorities for criteria that should be used in the initial screening, and viewed the results of those criteria applied in the initial screening.

November 19, 2003 – Information on Initial Screening of Alternative Disposal Sites

Although the Working Group objectives were met after presenting the results of the initial screening, the Corps and EPA wanted to continue the process of providing the Working Group information on the evaluation project. The results of the initial screening identified two areas in the ZSF where alternatives sites could be delineated. The Corps and EPA felt that additional field investigations were required to provide additional data to assist in the alternative site delineation. After completion of the additional field data collection and analysis effort, alternative sites to be evaluated in detail in this Final EIS were identified. An additional Working Group meeting was held on November 19, 2003, to present to the Working Group the process and information collected as part of the evaluation project used in delineating the project specific alternative disposal sites.

7.3 PUBLIC HEARINGS

As part of the public comment period for the Draft EIS, which was conducted from May 7 thru June 21, 2004, the Corps and EPA held two hearings to solicit and record comments from the public. The public hearings were held on June 15, 2004 at the Lighthouse Inn of Galilee in Narragansett, RI. Hearing proceedings were recorded by Justice Hill Reporting of Sterling, Massachusetts and are included in Appendix D of this Final EIS.

In addition to the comments received at the public hearings, three comment letters were received during the public comment period. Responses to all comments received on the Draft EIS are presented in the Response to Comments document (Appendix D).

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8.0 LIST OF PREPARERS

BATTELLE

Joel Banslaben: Researcher, Battelle
Education: M.P.A. in Environmental Policy from Columbia University; B.A. in Biology from Colorado College
Experience: As a Policy Analyst for Battelle, Mr. Banslaben is responsible for developing environmental planning and outreach documents. This includes conducting and integrating stakeholder participation as a means for environmental management. Mr. Banslaben's recent efforts have included developing a socioeconomic resource assessment for the *Long Island Sound Dredged Material Disposal Site Environmental Impact Statement* and formulating an *Environmental Feasibility Study for the Beneficial Use of Dredged Bedrock in the New York/New Jersey Harbor*.
Role in Preparing this EIS: Mr. Banslaben assisted with the evaluation of socioeconomic resources, including commercial and recreational fishing; shipping and navigation; recreational uses; energy resources; archaeological and cultural resources; and parks and areas of special concern.

Nancy Bonnevie: Associate Manager, Battelle
Education: B.S. in Biology from Bates College
Experience: Ms. Bonnevie has more than 12 years of experience in conducting environmental assessments (EAs). An environmental scientist specializing in aquatic ecology and sediment quality evaluations, she has effectively managed teams on tasks ranging from preliminary site characterizations to multi-tasked field sampling programs, ecological risk evaluations, and environmental impact statements (EISs).
Role in Preparing this EIS: Ms. Bonnevie provided technical and editorial review of the document.

Rosanna Buhl: Program Quality Assurance, Battelle
Education: Coursework at Bridgewater State College; Quality Assurance education through the Center for Professional Development and American Society of Quality
Experience: As Quality Systems Manager for Battelle's Applied Coastal & Environmental Services, Ms. Buhl is responsible for overseeing all site quality assurance activities, verifying that technical activities are conducted in compliance with the site Quality Management Plan, and managing the technical activities of the Quality Assurance Office.
Role in Preparing this EIS: Ms. Buhl oversaw the audit of EIS tables, figures, and text to verify that the data presented in the EIS accurately and completely represent the source data.

Deirdre Dahlen: Principal Research Scientist, Battelle
Education: B.S. in Chemistry from Bates College
Experience: Ms. Dahlen is a chemist with more than 15 years of experience related to the evaluation of chemical contaminants in the marine environment. Ms. Dahlen currently provides technical oversight of a variety of projects, involving analytical testing and characterization of

environmental samples (sediment, biota, and water) in support of harbor dredging, monitoring, and risk assessment studies.
Role in Preparing this EIS: Ms. Dahlen was responsible for chemical analyses of water, sediment, and biota samples for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. She reviewed data quality and prepared final reports containing the results of all analyses. Ms. Dahlen also prepared the subsections of Section 3.0, Affected Environment, involving contaminants in sediment in the Rhode Island Region (RIR).

Paul Dragos: Senior Research Scientist, Battelle
Education: M.C.E. in Coastal Engineering from the University of Delaware; B.S. in Civil Engineering from the University of Delaware
Experience: Mr. Dragos is a physical oceanographer/coastal engineer with 22 years of experience in estuarine and coastal ocean hydrodynamic measurement, data analysis, and interpretation in problems associated with water quality issues and coastal engineering works. He has led research projects in the sediment transport, circulation, mixing, dilution, and transport of contaminants in various bays, harbors, and estuaries throughout the United States and particularly in the Northeast, including the New York Bight, New York Harbor, Massachusetts Bay, and Long Island Sound. His experience includes field and modeling studies of ocean outfall monitoring; transport and fate of contaminants associated with dredged material, oil production, and sewage sludge; hydrodynamic measurement; and coastal engineering. These studies have contributed to numerous EA projects and provide Mr. Dragos with an extensive knowledge of transport and fate in marine water quality issues.
Role in Preparing this EIS: Mr. Dragos prepared the sections of the EIS pertaining to physical oceanography. Mr. Dragos reviewed articles and historical data and prepared Section 3.4, Physical Oceanography, and Section 3.6, Sediment Transport. He also prepared portions of Section 3.2, Geological Setting, and Section 3.3, Meteorology. In addition, he prepared Section 4.3.1, Sedimentation and Erosion, and Section 4.3.3, Water Quality. This included the analysis of available wind, wave, and current data and the running of the STFATE numerical model of disposal plume behavior and the LTFATE model of sediment resuspension and transport.

Jennifer Field: Principal Research Scientist/Marine Ecologist, Battelle
Education: M.S. in Biological Science from Old Dominion University; B.S. in Biological Science from Florida State University
Experience: More than 9 years of experience working on the biology and ecology of marine organisms, including fish, crustaceans, and marine mammals, and 5 years of experience working on anthropogenic impact studies in the marine environment.
Role in Preparing this EIS: Ms. Field was the lead author/reviewer of biological subsections for Section 3.0, Affected Environment, and Section 4.0, Environmental Consequences. She conducted all data analysis for finfish, lobster, and shellfish data used throughout the EIS.

Carlton Hunt: Research Leader, Battelle
Education: Ph.D. in Chemical/Geochemical Oceanography from the University of Connecticut; M.S. in Chemical Oceanography from the University of Connecticut; B.A. in Chemistry from Doane College

Experience: Dr. Hunt is a chemical oceanographer with broad experience in estuarine and coastal marine ecosystems. During the past 30 years, he has conducted and supervised projects involving the transport, fate, effects, and bioaccumulation of contaminants and water quality impacts of nutrients in diverse coastal systems, including Long Island Sound, Narragansett Bay, Massachusetts Bay, New York Harbor, and New York Bight, and the Northwest Atlantic Ocean. His experience includes studies of the transport and fate of contaminants associated with soils, sediments, urban runoff, sewage sludge, sewage effluents, and industrial wastes in the marine environment. He has contributed to numerous EAs, contributed to a programmatic EIS on mandatory ballast water regulations, and assisted in the preparation of EISs in support of dredged material site designations in the New York Bight Apex and Long Island Sound.
Role in Preparing this EIS: Dr. Hunt developed information in the EIS related to the general impacts of dredged material disposal in the coastal environment; led the alternatives screening efforts; facilitated discussions among agencies and provided public briefing support to the workgroup discussions; and provided technical review and comments on drafts of the EIS. He also was a lead author for the Site Management and Monitoring Plan (SMMP).

David Inglin: Principal Research Scientist, Battelle
Education: M.S. in Marine Science from University of South Florida; B.S. in Marine Science from Stockton State College
Experience: Mr. Inglin has been active in the design, development, and management of environmental information systems and geographic information systems (GIS) for the past 10 years. His experience ranges from field data collection to project management of multi-user geographic data management systems. His skills include spatial database design using Environmental Systems Research Institute's (ESRI's) Spatial Database Engine (SDE), database administration, Visual Basic programming, and GIS analysis. Since joining Battelle in April 2002, he has worked on a variety of data management and application development projects.
Role in Preparing this EIS: Mr. Inglin served as the task manager for GIS, providing oversight of map and figure production for the EIS. He also provided support for the modeling efforts included in this EIS.

Roy Kropp: Senior Research Scientist, Battelle
Education: Ph.D. in Zoology from the University of Maryland; M.S. in Biology from the University of Guam; B.S. in Zoology from San Diego State University
Experience: Dr. Kropp is a specialist in benthic marine ecology, toxicology, and the systematics of crustaceans and mollusks with 21 years of experience. He has served as the principal investigator for or participated in marine environmental surveys in the tropical and boreal Pacific, off the coast of California, in the Gulf of Mexico, along the Atlantic Coast of the United States, and in the Mediterranean. Currently, Dr. Kropp is a Senior Scientist for Benthic Biology for the Massachusetts Water Resources Authority Monitoring Program. Dr. Kropp has analyzed Rhode Island Sound infaunal data and described infaunal communities in a series of reports for the U.S. Army Corps of Engineers (Corps). Since matriculating to the Marine Sciences Laboratory from Battelle's Duxbury facility, Dr. Kropp has directed several toxicological studies involving the testing of marine and freshwater species. He was the technical project manager for the preparation of the Final EIS prepared for the Providence River dredging project by the Corps.

Role in Preparing this EIS: Dr. Kropp prepared the subsections for plankton, fish, and benthos in Section 3.0, Affected Environment, and Section 4.0, Environmental Impacts. He also analyzed the infaunal data collected in support of the EIS.

Lisa Lefkovitz: Project Manager, Battelle
Education: M.S. in Water Chemistry from the University of Wisconsin; B.S. in Chemistry from Case Western Reserve University
Experience: Ms. Lefkovitz has over 15 years of project management and environmental science experience working with public- and private-sector clients. Her project management experience has included all aspects of dredged material management as well as a variety of multidisciplinary environmental and engineering projects.
Role in Preparing this EIS: Ms. Lefkovitz served as the Battelle Project Manager, as well as one of the authors and technical reviewers. As Project Manager, Ms. Lefkovitz led Battelle's contributions to this Final EIS Project and coordinated with Corps and U.S. Environmental Protection Agency (EPA) leads. Ms Lefkovitz also prepared the sections of the Final EIS summarizing contaminants in tissues in the RIR.

Melissa Manley: Senior Project Assistant, Battelle
Education: B.A. in Environmental Studies, Digital Imaging minor from New England College
Experience: Ms. Manley has experience in EIS preparation. During degree development, Ms. Manley co-wrote a Draft EIS for the town of Henniker, New Hampshire, as part of a course final project. That EIS supplied the New Hampshire Department of Environmental Services with information for the Azalea Park Floodplain Mitigation Project. Ms. Manley joined Battelle in the summer of 2002 as a Senior Office Assistant/Project Assistant for the New England Operation Sector.
Role in Preparing this EIS: Ms. Manley contributed to the literature search for key references and completed a database of over 1,000 references associated with dredging and the Rhode Island Sound area. Ms. Manley also coordinated the administrative record task and assisted with the preparation of the EIS reference list.

Derek Michelin: Research Scientist, Battelle
Education: M.S. in Ocean Engineering from the University of New Hampshire; B.S. in Mechanical Engineering from the University of New Hampshire
Experience: Mr. Michelin has 5 years of experience in engineering and at-sea deployment of moorings and mechanical systems for operation in the ocean environment, software development, signal processing, database development, and GIS mapping. Mr. Michelin has participated in the development of rapid current oil containment devices and offshore aquaculture equipment. His engineering experience also includes the development of *in situ* sampling devices and sample processing systems. His programming experience includes the development of software that non-invasively measures the motion of objects and more specialized software for assessing oil boom failure.
Role in Preparing this EIS: Mr. Michelin prepared and presented GIS data at one of the interagency meetings and at a Working Group meeting.

Grace Neff: Quality Auditor, Battelle
Education: Ph.D. in Organic Chemistry from the University of Illinois; B.S. from the University of Illinois College of Pharmacy
Experience: Dr. Neff has approximately 18 years of experience in the field of environmental chemistry. Her background includes the synthesis of organic compounds, the analysis of marine samples for pollutants, and the management of environmental research projects. She was involved in developing detection and quantification methods for several phthalate pollutants. Dr. Neff joined the Quality Assurance Unit at Battelle in 1993 and participates in the auditing of environmental data. Her responsibilities include conducting statistical random data audits to determine the accuracy and completeness of raw vs. reported data and for reporting the results of audits in written reports to management.
Role in Preparing this EIS: Dr. Neff aided in the verification of data tables used in the Final EIS as well as the concurrence of tabular data and text. She also assisted in the literature search for the Final EIS.

Stacy Pala: Research Scientist, Battelle
Education: B.A. in Biology, with Chemistry and Russian Minors, Wheaton College, 1994
Coursework in Environmental Risk Analysis and Environmental Toxicology, University of Massachusetts Boston
Relevant Experience: Ms. Pala has over 9 years of experience in environmental science, including work in biological assessments (BAs) and EAs, environmental microbiology, chemical analyses, and task management.
Role in Preparing EIS: Ms. Pala acted as Battelle's Assistant Project Manager and EIS Coordinator. She prepared the water quality section of Section 3.0, Affected Environment.

Rachel Spangenberg: Environmental Specialist, Battelle
Education: B.S. in Biology from the Catholic University of America
Experience: Ms. Spangenberg has more than 13 years of experience in preparing EAs. She also has considerable experience in preparing other National Environmental Policy Act (NEPA) documents, including EISs and Findings of No Significant Impact (FONSIs). Her NEPA experience includes preparing public involvement documents and public meetings. Her experience as an environmental specialist also includes performing ecological and health-based risk assessments, facility compliance audits, and Phase I site assessments.
Role in Preparing this EIS: Ms. Spangenberg prepared the socioeconomic portions of the EIS, which included commercial and recreation fishing; shipping and navigation; recreational uses; military uses; energy resources; archaeological and cultural resources; areas of special concern, other legitimate uses, and economic baseline. She also assisted in the preparation of Section 6.0, Agency Coordination and Compliance, and Section 7.0, Public Involvement.

Desiree Thalley: Senior Technical Writer, Battelle
Education: B.A. *cum laude* in Journalism from the University of New Mexico, 1983
Experience: Ms. Thalley has 18 years of experience as a technical editor and writer in the environmental and military fields. For the last 11 years, her work has focused on the preparation, management, and production of U.S. Department of Energy documents, many of which were EAs and EISs prepared under NEPA.

Role in Preparing this EIS: Ms. Thalley edited the Final EIS.

Heather Thurston: Research Scientist, Battelle
Education: B.S. in Marine Biology/Biological Sciences from Florida Institute of Technology
Experience: Ms. Thurston has more than 12 years of experience in conducting dredged disposal evaluations and EAs. She has effectively managed teams on tasks ranging from multi-tasked field sampling programs, sediment characterization and toxicology programs, dredged material evaluations, and ecological and human health risk assessment projects. In addition, she has research experience with multiple species food web projects and bioaccumulation studies.
Role in Preparing this EIS: Ms. Thurston wrote the shellfish, lobster, birds, marine mammals and reptiles, and threatened and endangered species sections of Section 3.0, Affected Environment, and Section 4.0, Environmental Consequences.

Debra Walker: Technical Advisor, Battelle
Education: B.S. Biology, University of Tampa, 1974; Graduate Studies: Marine Biology, University of South Florida, 1976; Graduate Studies: Environmental Law, U.S. Department of Agriculture, 1992
Experience: Ms. Walker has more than 27 years of project management and administrative experience in the environmental field. Her expertise focuses on NEPA compliance, agency coordination, public involvement, and mitigation for involving civil works, military, and facilities planning. Ms. Walker has managed and contributed to numerous EISs, EAs, FONSIs, Categorical Exclusions, Memoranda of Agreement, and Records of Decision for Federal, state, and local clients.
Role in Preparing this EIS: Ms. Walker contributed to the socioeconomics, public involvement, environmental compliance, and NEPA review efforts.

Patty White: Senior Research Scientist, Battelle
Education: M.S. in Geology from the University of Washington, Seattle; B.S. in Geology from Kent State University
Experience: Ms. White has 18 years of experience as a geologist and has focused for the past 10 years on sediment quality assessment. Ms. White has served as a project geologist for dredged material disposal studies and has participated in multidisciplinary sediment studies that include site characterization, ecological and human health risk assessments, and feasibility studies.
Role in Preparing this EIS: Ms. White contributed to the sections of the Final EIS that addressed geological setting and sediment type.

Corey Wisneski: Research Associate, Battelle
Education: M.E.M. in Coastal and Watershed Systems from Yale School of Forestry and Environmental Studies; B.A. in Anthropology from Boston University
Experience: Ms. Wisneski has experience with researching and writing EISs. She is also familiar with developing information for the public on a variety of environmental issues. Ms. Wisneski has worked in the field of protection of threatened species to address habitat and predator issues. She has also participated in the creation of reports for ballast water testing methods, combined sewer overflows, and estuarine environmental indicators.

Role in Preparing this EIS: Ms. Wisneski contributed to Section 3.0, Affected Environment, and Section 4.0, Environmental Consequences.

Greeley-Polhemus Group, Inc.

Ronald G. Henry: Associate, The Greeley-Polhemus Group
Education: J.D., Georgetown University Law Center; A.B. (American Government), Georgetown University.
Experience: Mr. Henry has over 30 years of experience in matters relating to local, state, and Federal government issues, with particular concentration on public sector finance and management. He has served as an attorney and senior official for government agencies and as a public finance investment banker. He has also dealt with economic development, financial management, and other public policy issues.
Role in Preparing this EIS: Mr. Henry reviewed and edited sections of the EIS relevant to economic impacts.

Joe Mantey: Economist, The Greeley-Polhemus Group
Education: M.S. in Agricultural Economics, University of California at Davis; B.G.S. (general studies), University of Michigan at Ann Arbor
Experience: Mr. Mantey is a natural resource economist with over 25 years of experience evaluating civil works projects associated with navigation, flood damage reduction, and environmental restoration.
Role in Preparing this EIS: Mr. Mantey reviewed and edited sections of the EIS relevant to economic impacts.

U.S. Army Corps of Engineers

Thomas J. Fredette: DAMOS Program Manager, New England District, U.S. Army Corps of Engineers
Education: Ph.D. The College of William & Mary, Virginia Institute of Marine Science; M.A. The College of William & Mary, Virginia Institute of Marine Science; B.S. University of Massachusetts, North Dartmouth.
Experience: Dr. Fredette has more than 20 years experience in marine science, focusing on benthic ecology, marine environmental monitoring, dredged material management, and contaminated sediment management.
Role in Preparing the EIS: Mr. Fredette acted as a technical and regulatory reviewer for the Draft EIS and Final EIS.

Michael F. Keegan: Project Manager, New England District, U.S. Army Corps of Engineers
Education: B.S. in Civil Engineering, Lowell Technological Institute
Experience: Mr. Keegan is a registered professional engineer and a licensed construction supervisor with over 25 years experience in project management directing the evaluation, design, and construction of civil works projects focusing on navigation, flood damage reduction and environmental restoration.

Role in Preparing this EIS: Mr. Keegan was the project manager for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. He was responsible for overall project management, development, and implementation of the public outreach program and was a technical reviewer of all sections of the Final EIS. Mr. Keegan was also responsible for all coordination efforts with the EPA.

Edmund O'Leary: Senior Economist, New England District, U.S. Army Corps of Engineers
Education: M.A. in Economics from the University of New Hampshire; B.A. in History from the University of New Hampshire
Experience: Mr. O'Leary has described the socioeconomic environment and analyzed the socioeconomic impacts for EISs for the realignment of Fort Devens and Fort Huachuca, the realignment of the Watertown Arsenal, the closure of Fort Devens, and the closure of the Watertown Arsenal. Mr. O'Leary has also prepared the socioeconomic sections of EAs for the realignment of the Defense Mapping Agency and the proposed construction of border patrol stations for the Department of Homeland Security.
Role in Preparing this EIS: Mr. O'Leary was responsible for technical review of sections of the EIS dealing with the economic significance of navigation-dependent industries, the social and economic impacts of the No Action Alternative, and the economic impacts of disposal.

Marcos A. Paiva: Archaeologist, New England District, US Army Corps of Engineers
Education: Ph.D. Candidate in Anthropology at Brandeis University, Waltham, MA; M.A. in History/Historical Archaeology from the University of Massachusetts at Boston; B.A. in History (minor in Anthropology) from University of Massachusetts at Dartmouth.
Experience: Mr. Paiva has over 12 years of experience in addressing cultural resource impact assessments and compliance as a result of Federal projects including civil works, military, Superfund, project operations, and work for others. Underwater archaeology has been addressed as part of the Hyannis Harbor Improvement Project, Providence River and Harbor Maintenance Dredging Project, and Boston Harbor Deep Draft Navigation Dredging Project. Mr. Paiva was a technical reviewer and contract manager for cultural resources for the Providence River and Harbor EIS as well as for the current Long Island Sound EIS.
Role in Preparing the EIS: Mr. Paiva was responsible for the technical review of sections of the EIS dealing with Cultural Resources including both the Affected Environment and Environmental Impact sections. Additionally, as the New England District Tribal Coordinator, Mr. Paiva reviewed consultation letters prepared for respective Tribal governments.

Richard Ring: Senior Regional Economist and Team Leader of the Economics and Cultural Resources Section, New England District, US Army Corps of Engineers
Education: MA in Economics from Northeastern University; BA in Economics from Merrimack College
Experience: Mr. Ring has worked for the New England District for 26 years during which time he has performed and supervised numerous economic analyses for various navigation, flood control, and shoreline protection studies and environmental impact studies. He has also written reports for existing Corps projects under the Major Rehabilitation and Dam Safety Assurance Programs. He is currently involved with the economic components of the EIS for the Long Island Sound Dredged Material Disposal Site Designation.

Role in Preparing the EIS: Mr. Ring was responsible for the supervision and technical review of EIS sections dealing with dredging needs, economic significance of navigation dependent industries, social and economic impacts of the no action alternative, and the economic impacts of disposal.

Catherine J. Rogers: Ecologist, New England District, U.S. Army Corps of Engineers
Education: B.S. from the University of Massachusetts, Amherst; M.S. from the University of West Florida, Pensacola
Experience: Ms. Rogers serves as a technical leader in the preparation of NEPA documents; Marine Protection, Research, and Sanctuaries Act (MPRSA) and Clean Water Act Section 404 compliance; and other applicable environmental compliance for civil work actions. She has prepared numerous EAs and EISs for Corps water resources development, dredging, flood control, and environmental restoration projects since 1986. Major relevant projects include the Boston Harbor deep-draft EIS, harbor maintenance dredging EAs throughout New England, the Western Long Island Sound dredged material disposal site supplemental EIS, and the Boston Harbor navigation improvement EIS.
Role in Preparing this EIS: Ms. Rogers provided technical and policy review for this EIS. In addition, her previous experience administering NEPA documents has assisted in the development of an effective public participation process throughout its preparation.

Karen Umbrell: Regional Economist, New England District, U.S. Army Corps of Engineers
Education: B.A. in Economics from the University of Massachusetts at Amherst
Experience: Ms. Umbrell has been responsible for numerous economic benefit analyses for improving small boat harbors along the New England coast and is currently working on the benefit analysis for the potential deepening of Boston Harbor. In addition, Ms. Umbrell has conducted numerous economic analyses for various flood damage protection projects, shoreline protection projects, and dam safety assurance projects.
Role in Preparing this EIS: Ms. Umbrell prepared the economic cost comparison section of the EIS. She also was a technical reviewer of the dredging needs section of the EIS and related studies (survey of navigation-dependent facilities, projected Federal dredging volumes).

U.S. Environmental Protection Agency

Rona H. Gregory: Senior Assistant Regional Counsel, EPA Region 1
Education: J.D. from Boston College Law School; M.R.P. in City and Regional Planning from Cornell University; B.A. in Political Science from Mount Holyoke College
Experience: Ms. Gregory is an environmental attorney with 13 years of experience at EPA New England advising a broad range of programs on both policy and enforcement matters.
Role in Preparing this EIS: Ms. Gregory reviewed the document to ensure that it met the legal requirements of NEPA.

Olga Guza: Project Manager, EPA Region 1
Education: M.S. in Epidemiology from the State University of New York at Buffalo; B.S. in Medical Anthropology

Experience: Ms. Guza has over 12 years of experience in environmental science and dredged material management issues. She has held positions as Regional Ocean Dumping Coordinator, Coordinator for Dredging Task Force Committees, and Project Coordinator for Regional and State Dredge Management Plans for several New England states. She is also responsible for the management and coordination of field monitoring at several ocean disposal sites (Portland Disposal Site, Rockland Disposal Site, Massachusetts Bay Disposal Site) in the Northeast. In addition, she has served on the Risk Task Force Committee for EPA Region 1 and served as the Regional Coordinator for Invasive Species.
Role in Preparing this EIS: Ms. Guza was the EPA project manager for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. She was responsible for coordinating all EPA activities and was a technical reviewer for all sections of the Final EIS. Ms. Guza was also responsible for all coordination efforts with the Corps.

Matthew Liebman: Environmental Biologist, US EPA Region 1
Education: Ph.D. in Ecology and Evolution from the State University of New York at Stony Brook; B.A. in Biology from Carleton College, Northfield, Minnesota.
Experience: Mr. Liebman has over 5 years of experience in the evaluation of dredged material for open-water disposal in New England. He has prepared the Massachusetts Bay Disposal Site Management Plan and played a key role in the preparation of the Regional Implementation Manual for disposal of dredged material (Draft Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters). As of January 2004, he is the dredging team leader for EPA New England.
Role in Preparing this EIS: Mr. Liebman reviewed the document for technical content.

9.0 REFERENCES

SECTION 1: PURPOSE AND NEED

Corps. 1972. Fall River Harbor, Massachusetts and Rhode Island, Improvement Dredging Design Memorandum. U.S. Army Corps of Engineers, New England Division. Waltham, MA.

Corps. 1982. Draft Environmental Impact Statement, Improvement Dredging, Fall River Harbor, Massachusetts and Rhode Island. U.S. Army Corps of Engineers, New England Division. Waltham, MA.

Corps. 2001. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers, New England Division. Concord, MA.

Corps. 2002. Task 12F Dredging Needs Study. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle and the Maguire Group Inc. for the U.S. Army Corps of Engineers. November 2002.

EPA and Corps. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual. EPA Report No. EPA-503-8-91/001. Available http://www.epa.gov/OWOW/oceans/gbook/index.html. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection and Department of the Army, U.S. Army Corps of Engineers. Washington, DC.

EPA and Corps. 2002. Draft Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters. Prepared by USEPA Region 1, New England, Boston, MA and the U.S. Army Corps of Engineers, New England District, Concord, MA. September 2002.

Pratt, S.D., S.B. Saila and M.P. Sissenwine. 1973. Study and Report on Environmental Effects of Dredged Material Rhode Island Sound – Phase III. SR-3. University of Rhode Island. Kingston, RI.

Saila, S.B., T.T. Polgar, and B.A. Rogers. 1969. Results of Studies Related to Dredged Sediment Dumping in Rhode Island Sound: Phase I. Report No. SR-1. 36 pp.

Saila, S.B., S.D. Pratt, and T.T. Polgar. 1971. Providence Harbor - Improvement Spoil Disposal Site Evaluation Study: Phase II. SR-2. Marine Experiment Station, University of Rhode Island. Kingston, RI.

West, N., B. Almeida, and K.J. Scott. 1985. Rhode Island and Southeastern Massachusetts Dredging Needs Survey: 1985-1995. Contribution 45. Disposal Area Monitoring System (DAMOS) Report. SAIC Report No. SAIC-84/7520&C45. Prepared by SAIC for the U.S. Army Corps of Engineers. 110 pp.

SECTION 2: ALTERNATIVES

Cobb, J. Stanley and Bruce F. Phillips. 1980. The Biology and Management of Lobsters, Volume II: Ecology and Management. Academic Press.

Corps. 1995. Boston Harbor Navigation Improvement Project and Berth Dredging Project Final EIS/EIR. Prepared by Normandeau Associates under contract to the US Army Corp of Engineers, New England Division.

Corps. 1998. Shellfish Sampling and Site Characterization, Narragansett Bay and Rhode Island Sound Proposed Disposal Sites. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix C-6. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 14 by Battelle for the U.S. Army Corps of Engineers. January 1998.

Corps. 2001. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers, New England Division. Concord, MA.

Corps. 2002a. Task 12F Dredging Needs Study. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle and the Maguire Group Inc. for the U.S. Army Corps of Engineers. November 2002.

Corps. 2002b. Task 13 Zone of Siting Feasibility. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by the Maguire Group Inc. for the U.S. Army Corps of Engineers. September 2002.

Corps. 2002c. Fall 2001 REMOTS Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order 2 by SAIC for the U.S. Army Corps of Engineers. December 2002.

Corps. 2003a. Task 10.4 Alternative Site Screening Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order 2 by Battelle for the U.S. Army Corps of Engineers. June 2003.

Corps. 2003b. Fall 2002 Benthic Tissue Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003c. Summer 2003 SPI and Benthic Survey Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. November 2003.

Corps. 2003d. Summer 2003 Finfish Survey and Data Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003e. Summer 2003 Lobster Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2003.

Corps. 2003f. Summer 2003 Quahog Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2003.

Corps. 2003g. Survey Report for the Rhode Island Region Side-Scan Sonar and Bathymetric Survey. Prepared under Contract No. DACW33-01-D-0004 by SAIC and Battelle for the U.S. Army Corps of Engineers, New England District. SAIC Report No. 645. 24pp. November 2003.

EPA and Corps. 1986. Ocean Dumping Site Designation Delegation Handbook for Dredged Material. Office of Marine and Estuarine Protection, Washington, DC. 199 pp.

EPA and Corps. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual. EPA Report No. EPA-503-8-91/001. Available http://www.epa.gov/OWOW/oceans/gbook/index.html. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection and Department of the Army, U.S. Army Corps of Engineers. Washington, DC.

EPA and Corps. 2004. Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters. Prepared by USEPA Region 1 – New England Boston, Massachusetts, and the U.S. Army Corps of Engineers, New England District, USACE, Concord, MA. May, 2004.

EPA. 2004. Environmental Impact Statement for the Designation of Dredged Material Disposal Sites in Central and Western Long Island Sound Connecticut and New York. U.S. Environmental Protection Agency.

Fogarty, M.J. 1979. Assessment of the ocean quahog, *Arctica islandica*, resource in Rhode Island Sound and south of Martha's Vineyard, Massachusetts. RIDEM, Division of Fisheries and Wildlife.

Fogarty, M.J. 1981. Distribution and relative abundance of the ocean quahog *Arctica islandica* in Rhode Island Sound and off Martha's Vineyard, Massachusetts. *Journal of Shellfish Research*. 1(1):33-39.

Petruny-Parker, M., Boyd, J., Rubinstein, N., Carey, D., and P. August. 2003. Designation of an Offshore Long-Term Dredged Material Disposal Site(s) for the Rhode Island Region: Evaluation Process. Final Report on Working Group Meetings. Coastal Institute, University of Rhode Island. January 2003. 21 pp. + Appendices.

SECTION 3: AFFECTED ENVIRONMENT

Abbott, R.T. 1974. American Seashells. Van Nostrand Reinhold Company, New York, New York. 663 p.

ACS (American Cetacean Society). 2003a. Sperm Whale Fact Sheet [Online]. Available http://www.acsonline.org/factpack/spermwhl.htm

ACS (American Cetacean Society). 2003b. Blue Whale Fact Sheet [Online]. Available http://www.acsonline.org/factpack/bluewhl.htm

Aguilar, A. 1987. Using organochlorine pollutants to discriminate marine mammal populations: a review and critique of the methods. *Marine Mammal Science.* 3:242-262.

Allen, G.M. 1916. The whalebone whales of New England. *Memoirs of the Boston Society of Natural History.* 8(2):107-322.

Anderson, D.M., D.M. Kulis, J.A. Orphanos, and A.R. Ceurvels. 1982. Distribution of the toxic dinoflagellate *Gonyaulax tamarensis* in the southern New England region. *Estuarine, Coastal and Shelf Science*. 14:447-458.

Anderson, V. and P. Nival. 1987. Modeling of a planktonic ecosystem in an enclosed water column. *Journal of the Marine Biological Association of the United Kingdom Research*. 67:407-430.

Angell, Tom. 2002. RIDEM. Personal communication.

Angell, T.E. and S.D. Olszewski. 2002. Rhode Island Lobster Research and Management Project; 2001 Annual Report; Segment 2 Completion Report. RIDEM, Division of Fish and Wildlife.

Anonymous. 1992. Interactions between Sea Turtles and the Summer Flounder Trawl Fishery, November 1991 - February 1992. NOAA Technical Memorandum NMFS-SEFSC-307. U.S. Dept. of Commerce, NOAA/NMFS, Southeast Fisheries Center. 58 pp.

Armstrong, R.S. 1998. Water Temperatures and Climatological Conditions South of New England, 1974-83. NOAA Technical Report NMFS 134. 43 pp.

Arntz, W.E. 1974. A contribution to the feeding ecology of juvenile cod (*Gadus morhua* L.) in the western Baltic. Rapports et Procès-Verbaux des Réunions Conseil International pour L'exploration de la Mer 166:13-19.

Arntz, W.E. 1978. The food of adult cod (*Gadus morhua* L.) in the western Baltic. Meersforschung 26:60-69.

AT&T and International Cable Protection Committee. 2001. NOAA Chart 12300, Approaches to New York, Nantucket Shoals to Five Fathom Bank, 42nd edition, February 17, 2001 provided by AT&T and International Cable Protection Committee (21st edition, September 15, 2001).

Auster, P.J., R.J. Malatesta, and S.C. LaRosa. 1995. Patterns of microhabitat utilization by mobile megafauna on the southern New England (USA) continental shelf and slope. *Marine Ecology Progress Series*. 127(1-3):77-85.

Barlas, M.E. 1999. The Distribution and Abundance of Harbor Seals (*Phoca vitulina concolor*) and Gray Seals (*Halochoerus grypus*) in Southern New England, Winter 1998 - Summer 1999. Boston University, Graduate School of Arts and Sciences. Boston, MA: 52 pp.

Battelle. 2003. Sediment Chemistry Data Report, Sediment Chemistry Study HC021 for Water Quality Monitoring Task 19.2: MWRA Harbor and Outfall Monitoring Program: 2002-2005.

Beardsley, R.C. and W.C. Boicourt. 1981. On Estuarine and Continental-shelf Circulation in the Middle Atlantic Bight in: Evolution of Physical Oceanography. B.A. Warren and C. Wunsch, (Eds.) MIT Press.

Bearse, D.T. 1976. Density and Distribution of the Ocean Quahog (*Arctica islandica*) in Rhode Island Waters Relative to Various Environmental Factors. M.S. Thesis. University of Rhode Island. Kingston, RI. 91 pp.

Best, P.B. 1993. Increase rates in severely depleted stocks of baleen whales. *ICES Journal of Marine Science*. 50:169-186.

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. *U.S. Fish and Wildlife Fishery Bulletin*. 77:1-576.

Block Island Power Company. 2003. Personal Communication with Public Affairs Office.

Boehm, P.D. and J.G. Quinn. 1978. Benthic Hydrocarbons of Rhode Island Sound. *Estuarine and Coastal Marine Science*. 6:471-494.

Bohlen, W.F., M.M. Howard-Strobel, D.R. Cohen, E.T. Morton. 1996. An investigation of the dispersion of sediments resuspended by dredging operations in New Haven Harbor. DAMOS Contribution #112. Submitted to New England Division, U.S. Army Corps of Engineers, Waltham, MA.

Boulon, R.H. Jr., D.L. McDonald, and P.H. Dutton. 1994. Leatherback turtle (*Dermochelys coriacea*) nesting biology, Sandy Point, St. Croix, U.S. Virgin Islands: 1981-1993. Pages 190-193 in: K.A. Bjorndal, A.B. Bolten, D.A. Johnson, and J.J. Eliazar, (Eds.), Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-351. 323 pp.

Bourque, B. (Ed.). 1979. Summary and Analysis of Cultural Resource Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras. Peabody Museum at Harvard, Cambridge, Massachusetts

Bricker, S.B. 1990. The History of Metals Pollution in Narragansett Bay as Recorded by Salt Marsh Sediments. Dissertation. University of Rhode Island.

Brown, S.G. 1986. Twentieth-century records of right whales (*Eubalaena glacialis*) in the northeast Atlantic Ocean. Pages 121-128 in: R.L. Brownell, P.B. Best, and J.H. Prescott, (Eds.), Right Whales: Past and Present Status. Volume Reports of the International Whaling Commission, Special Issue No. 10. Cambridge, England.

Brown, B. and J. Neff. 1993. Bioavailability of Sediment-Bound Contaminants to Marine Organisms. Prepared for the National Ocean Pollution Program Office, National Oceanic and Atmospheric Administration under a Related Services Agreement with the U.S. Department of Energy. Contract DE-AC06-76RLO 1830. September 1993.

Burke, V.J., E.A. Standora, and S.J. Morreale. 1990. Comparisons of diet and growth of Kemp's ridley and loggerhead turtles from the northeastern U.S. Page 135 in: T.H. Richardson, J.I. Richardson, and M. Donnelly, (Eds.), Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-278. U.S. Dept. of Commerce, NOAA, NMFS.

Canadian Wildlife Service (CWS). 2002. Hinterland Who's Who website. Environment Canada, Canadian Wildlife Service [Online]. Available http://www.cws-scf.ec.gc.ca/.

Cargnelli, L.M., S.J. Griesbach, D.B. Packer, and E. Weissberger. 1999. Essential Fish Habitat Document: Atlantic Surfclam, *Spisula solidssma*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-142.

Carminati, C.E., E. Gerle, L.L. Kleihn, and R.P. Pisciotta. 1994. Blood chemistry comparison of healthy vs. hypothermic juvenile Kemp's Ridley sea turtles (*Lepidochelys kempi*) in the New York Bight. Pages 203-205 in: K.A. Bjorndal, A.B. Bolten, D.A. Johnson, and J.J. Eliazar, (Eds.) Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-351. U.S. Dept. of Commerce, NOAA, NMFS, Southeast Fisheries Science Center.

Carr, A. 1967. So Excellent a Fish. A Natural History of Sea Turtles. Natural History Press. Garden City, NY.

Carr, A.F. and J. Mortimer. 1980. Survey and Preliminary Census of Marine Turtle Populations in the Western Atlantic. Prepared under Contract No. 03-79-DO8-0025. U.S. Dept. of Commerce, NOAA, NMFS.

CETAP (Cetacean and Turtle Assessment Program). 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report #AA551-CT8-48 to the Bureau of Land Management, Washington DC, 538 pp.

Checkley, D.M., Jr. 1980. Food limitation of egg production by a marine, planktonic copepod in the sea off southern California. *Limnology and Oceanography*. 25:991-998.

Childress, L.M., P. Childress, and T. Martin. 1996. A Cruising Guide to Narragansett Bay and the South Coast of Massachusetts. International Marine/Ragged Mountain Press: Camden, ME.

Clancy, M. and J.S. Cobb. 1991. Abundance of cancer crab *Megalopae* and the potential ramifications to population regulation. *Journal of Shellfish Research*. 10(1):304-305.

Clapham, P.J. and I.E. Seipt. 1991. Resightings of independent fin whales, *Balaenoptera physalus*, on maternal summer ranges. *Journal of Mammalogy.* 72(4):788-790.

Cobb, J. Stanley and Bruce F. Phillips. 1980. The Biology and Management of Lobsters, Volume II: Ecology and Management. Academic Press.

Cobb, J.S., M. Clancy, and R.A. Wahle. 1999. Habitat-based assessment of lobster abundance: a case study of an oil spill. *American Fisheries Society Symposium*. 22:285-298.

Collins, B.P. 1976. Suspended material transport: Narragansett Bay area, Rhode Island. *Estuarine and Coastal Marine Science*. 4:33-46.

Conlan, K.E. 1994. Amphipod crustaceans and environmental disturbance: a review. *Journal of Natural History* 28:519-554.

Conover, R.J. 1956. Oceanography of Long Island Sound, 1952-1954. 6. Biology of *Arctica clausi* and *A. tonsa*. *Bulletin of the Bingham Oceanographic Collection*. 15:156-233.

Corps. 1979. Disposal Area Monitoring System (DAMOS) Annual Data Report - 1978 Supplement E Brenton Reef Disposal Site. U.S. Army Corps of Engineers, New England Division. Waltham, MA. 36 pp.

Corps. 1996. Sediment Survey at the Mud Dump Site and Environs - Final Report. EPA Contract No. 68-C2-0134, Work Assignment 3-133 by Battelle for the U.S. Environmental Protection Agency, Region 2, New York, NY.

Corps. 1997. Sediment Profile Sampling for the Providence River and Harbor Environmental Impact Statement. Appendix C-2. Prepared under Contract No. DACW33-96-D-0004, Delivery Order No. 0008, Mod. 1 and 2 by ENSR and SAIC for the U.S. Army Corps of Engineers. March 1997.

Corps. 1998a. A Predictive Model for Sediment Transport at the Portland Disposal Site, Maine. DAMOS Contribution No. 122. U.S. Army Corps of Engineers, New England District, Concord, MA, 23 pp.

Corps. 1998b. Shellfish Sampling and Site Characterization, Narragansett Bay and Rhode Island Sound Proposed Disposal Sites. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix C-6. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 14 by Battelle for the U.S. Army Corps of Engineers. January 1998.

Corps. 2000a. Providence River Hydrodynamic Measurement Study: Final Report. Prepared by ENSR and Battelle for the U.S. Army Corps of Engineers.

Corps. 2000b. Final Data Report for Providence River and Rhode Island Sound, RI. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers. 34 pp + Appendices.

Corps. 2000c. Waterborne Commerce of the United States, Part 1 – Waterways and Harbors Atlantic Coast. Compiled under the Supervision of the Institute for Water Resources.

Corps. 2001a. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers, New England Division. Concord, MA.

Corps. 2001b. Letter Report: Evaluation of Existing Physical Oceanographic Data. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2001c. Dredged Material Fate Modeling of Proposed Providence River Confined Aquatic Disposal (CAD) Cells and Ocean Dredged Material Disposal Site (ODMDS). In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix P. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 14 by Gailani, J.Z., S.J. Smith, N.W. Scheffner, and W. Vanadit-Ellis for the U.S. Army Engineer District, New England.

Corps. 2001d. Archaeological Assessment, Remote Sensing, and Underwater Archaeological Survey for the Providence River and Harbor Maintenance Dredging Project, Rhode Island, April 12, 2001. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix M. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 52 by Battelle for the U.S. Army Corps of Engineers. April 2001.

Corps. 2002a. Task 12F Dredging Needs Study. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle and the Maguire Group Inc. for the U.S. Army Corps of Engineers. November 2002.

Corps. 2002b. Task 13 Zone of Siting Feasibility. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by the Maguire Group Inc. for the U.S. Army Corps of Engineers. September 2002.

Corps. 2002c. Fall 2001 REMOTS Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order 2 by SAIC for the U.S. Army Corps of Engineers. December 2002.

Corps. 2002d. Fall 2001 Water Column Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. August 2002.

Corps. 2002e. Spring 2002 Water Column Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2002.

Corps. 2002f. Fall 2001 Infauna Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. September 2002.

Corps. 2002g. Fall 2001 Finfish Characterization Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2002h. Long Island Sound Finfish Fillet Data Report. Prepared under contract DACW33-01-D-0004, Delivery Order No. 13 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003a. Survey Report for the Rhode Island Region Side-Scan Sonar and Bathymetric Survey. Prepared under Contract No. DACW33-01-D-0004 by SAIC and Battelle for the U.S. Army Corps of Engineers, New England District. SAIC Report No. 645. 24pp. November 2003.

Corps. 2003b. Final Survey Report for Winter 2002 Physical Oceanography Data Collection Survey. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003c. Fall 2001 Sediment Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. April 2003.

Corps. 2003d. Fall 2002 Finfish Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. June 2003.

Corps, 2003e. Draft Long Island Sound Dredged Material Disposal Site Designation Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 13 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003f. Summer 2003 SPI and Benthic Survey Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. November 2003.

Corps. 2003g. Fall 2002 Benthic Tissue Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003h. Benthic Infauna Data for Area E and Area W, July 2003. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle for the U.S. Army Corps of Engineers. November 2003.

Corps. 2003i. Spring 2002 Finfish Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. January 2003.

Corps. 2003j. Summer 2003 Finfish Survey and Data Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003k. Summer 2003 Quahog Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2003.

Corps. 2003l. Summer 2002 Lobster Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003m. Fall 2002 Lobster Survey – Final Survey and Data Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003n. Summer 2003 Lobster Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2003.

Corps. 2003o. Task 15.2: Analysis of Economic Impacts of No Action Alternative. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. December 2003.

Corps. 2004a. Monitoring Surveys of the Rhode Island Sound Disposal Site Summer 2003. Contribution 155. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers. 81 pp. August 2004.

Corps. 2004b. Analysis of Dredged Material Transport Potential at Two Disposal Alternatives in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. April 2004.

Corps. 2004c. Fall 1999 and Spring 2002 Physical Oceanographic Data Report. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2004d. Task 15.1: The Economic Significance of Navigation-Dependent Industries Within the Zone of Siting Feasibility. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. April 2004.

Corps. 2004e. Historic Shipwreck Background Study. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by UMASS Archeological Services for the U.S. Army Corps of Engineers. April 2004.

Cross, J.N., C.A. Zetlin, P.B. Berrien, D.L. Johnson, and C. McBride. 1999. Essential Fish Habitat Document: Butterfish, *Peprilus triacanthus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-145.

Danbom, S.H. 1975. Sediment Classification by Seismic Reflectivity in Eastern Block Island Sound. Dissertation. University of Connecticut.

Davis, J.P. and R.T. Sisson. 1988. Aspects of the Biology Relating to the Fisheries Management of New England Populations of the Whelks, *Busycotypus canaliculatus* and *Busycon carica*. *Journal of Shellfish Research*. 7(3):453-460.

Day, C.G. 1960. Bottom Water Temperature on Browns Ledge off Southern Massachusetts. *J. Cons. Perm. Int. Explor. Mer.* 25(3):235-239.

Dayal, R., M.G. Heaton, M. Fuhrman, and I.W. Duedal. 1981. A Geochemical and Sedimentological Study of the Dredged Material Deposit in the New York Bight. NOAA Technical Memorandum OMPA-3. NOAA, Office of Marine Pollution Assessment. Boulder, CO. 174 pp.

Dayal, R., M.G. Heaton, M. Fuhrman, and I.W. Duedal. 1983. A Geochemical Study of the Dredged Material Deposit in the New York Bight. Pages 123-150 in: Kester, D.R., B.H. Ketchum, I. Duedall, and P.K. Park, Wastes in the Ocean. Volume 2. John Wiley & Sons, New York, NY.

Durbin, A.G. and E.G. Durbin. 1981. Standing stock and estimated production rates of phytoplankton and zooplankton in Narragansett Bay, Rhode Island. *Estuaries*. 4:24-41.

Durbin, A.G. and E.G. Durbin. 1988. Zooplankton and Ichthyoplankton in Narragansett Bay: Status and Trends Part 1: Zooplankton. Prepared for the New England Interstate Water Pollution Control Commission. The Narragansett Bay Project is sponsored by the U.S. EPA and the RI DEM.

Durbin, A.G., E.G. Durbin, T.J. Smayda, and P.G. Verity. 1983. Food limitation of production by adult Arctia tonsa in Narragansett Bay, Rhode Island. *Limnology and Oceanography*. 28:1199-1213.

Dyer. 1986. Coastal Estuarine Sediment Dynamics. Wiley.

EPA. 1988. Boston Harbor Wastewater Conveyance System. Volume 1: Draft Supplemental Environmental Impact Statement and Volume II: Appendices. Prepared for the U.S. Environmental Protection Agency, Region I. Boston, MA.

EPA. 1993. Assessment of potential impact of the MWRA outfall on endangered species. Biological assessment prepared pursuant to Section 7 of the Endangered Species Act. U.S. Environmental Protection Agency, Region I. Boston, MA.

EPA. 1997. Supplement to the Environmental Impact Statement on the New York Dredged Material Disposal Site Designation for the Designation of the Historic Area Remediation Site (HARS) in the New York Bight Apex. Prepared by the U.S. Environmental Protection Agency with the assistance of Battelle.

EPA, 2003. EPA's National Health Protection Survey of Beaches for the 2002 Swimming Season. [Online]. Available http://yosemite.epa.gov/water/beach2003.nsf.

Estrella, B.T. 1991. Shell disease in American lobster (*Homarus americanus*, H. Milne Edwards, 1837) from Massachusetts coastal waters with considerations for standardizing sampling. *Journal of Shellfish Research*. 10(2):483-488.

Estrella, B.T. and T.D. Morrissey. 1997. Seasonal movement of offshore American lobster, *Homarus americanus*, tagged along the eastern shore of Cape Cod, Massachusetts. *Fishery Bulletin*. 95:466-476.

Evans, P.G.H. 1987. The Natural History of Whales and Dolphins. Helms, C. (Ed.). New York, NY. 343 pp.

Falkowski, P.G., C.N. Flagg, G.T. Rowe, S.L. Smith, T.E. Whiteledge, and C.D. Wirick. 1988. The Fate of spring phytoplankton bloom: export or oxidation? *Continental Shelf Research*. 8:547-584.

Farmer, F.H., G.A. Vargo, C.A. Brown, and O. Jarrett. 1982. Spatial distribution of major phytoplankton community components in Narragansett Bay at the peak of the winter-spring bloom. *Journal of Marine Research*. 40(593-614).

FDA. 1989. Compliance Policy Guide-Section 575.100: Pesticide Residues in Food and Feed-Enforcement Criteria (CPG 7141.01) [Online]. Available http://www.fda.gov/ora/compliance_ref/cpg/cpgfod/cpg575-100.html.

Fogarty, M.J. 1979. Assessment of the ocean quahog, *Arctica islandica*, resource in Rhode Island Sound and south of Martha's Vineyard, MA. RIDEM, Division of Fisheries and Wildlife.

Fogarty, M.J. 1981. Distribution and relative abundance of the ocean quahog *Arctica islandica* in Rhode Island Sound and off Martha's Vineyard, Massachusetts. *Journal of Shellfish Research*. 1(1):33-39.

French, D.P. 1998. Estimate of injuries to Marine Communities Resulting from the North Cape Oil Spill Based on Modeling of Fates and Effects, Final Report. NOAA Document ID No. 373.

Frolander, H. 1955. The Biology of Zooplankton of the Narragansett Bay Area. Brown University. 94 pp.

Glenn, S.M. and W.D. Grant. 1987. A suspended sediment stratification correction for combined wave and current flows. *Journal of Geophysical Research*. 92(C8):8244-8264.

Goff, G. and J. Lien. 1988. Atlantic leatherback turtles (*Dermochelys coriaceae*) in cold water off Newfoundland and Labrador. *The Canadian Field-Naturalist*. 102(1):1-5.

Gray, C.L. 1991. Winter flounder (*Pseudopleuronectes americanus*) species profile. Pages 21-27 in: Narragansett Bay Project. RIDEM, Division of Fish and Wildlife, Marine Fisheries Section. Report No. NBP-91-56. Providence, RI.

Greer, A.E., J.D. Lazelle, and R.M. Wright. 1973. Anatomical evidence for a countercurrent heat exchange in the leatherback turtle (*Dermochelys coriacea*). *Nature*. 244:181.

Grimes, B.H., M.T. Huish, J.H. Kerby, and D. Moran. 1989. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic) Summer and Winter Flounder. U.S. Fish and Wildlife Service Biological Report No. 82 (11.112); U.S. Army Corps of Engineers Report No. TR EL-82-4. 18 pp.

Grosslein, M.D. and T.R. Azarovitz. 1982. Fish distribution. MESA New York Bight Atlas Monograph. No. 15, 182 pp.

Hain, J.H.W., M.A.M. Hyman, R.D. Kenney, and H.E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. *Mar. Fish. Rev. 47(1): 13-17*.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. *Report of the International Whaling Commission.* 42:653-669.

Harding, G.C. 1992. American Lobster (*Homarus americanus Milne Edwards*): A Discussion Paper on their Environmental Requirements and the Known Anthropogenic Effects on their Populations. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1887. 16 pp.

Hargraves, P.E. 1988. Phytoplankton of Narragansett Bay. Pages 136-142 in: Sheath, R.G. and M.M. Harlin, (Eds.), Freshwater and Marine Plants of Rhode Island. Kendall/Hunt Publishing Co., Dubuque, Iowa.

Hargraves, P. 2003. Personal Communication.

Hargraves, P.E. and L. Maranda. 2002. Potentially toxic or harmful microalgae from the northeast coast. *Northeastern Naturalist*. 9(1):81-120.

Hart, D. 2001. Status of Fisheries Resources off Northeastern United States: Sea Scallops [Online]. Available http://www.nefsc.noaa.gov/sos/spsyn/iv/scallop/.

Henwood, T.A. and W.E. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. *Fisheries Bulletin*. 85:813-817.

Hicks, S.D. 1959. The physical oceanography of Narragansett Bay. *Limnology and Oceanography*. 4:316-327.

Hulsizer, E. 1976. Zooplankton of Lower Narragansett Bay, 1972-1973. *Chesapeake Science*. 17:260-270.

Hunt, C.D. 1979. The Role of Phytoplankton and Particulate Organic Carbon in Trace Metal Deposition in Long Island Sound. Dissertation. The University of Connecticut. Storrs, CT. 282 pp.

Ingham, M.C. and J. Eberwine. 1984. Evidence of Nearshore Summer Upwelling off Atlantic City, New Jersey. NOAA Technical Memorandum NMFS-F/NEC-31. U.S. Department of Commerce. 10 pp.

Intergovernmental Policy Analysis Program. 1989. The Commercial Fishing Industry in Rhode Island: An Inventory, Analysis and Assessment Prepared for the Rhode Island Port Authority and Economic Development Corporation. Intergovernmental Policy Analysis Program, University of Rhode Island. Kingston, RI .

Jeffries, H.P., S. Hale, and A.A. Keller. 1988. Historical Data Assessment- Finfishes of the Narragansett Bay Area. Narragansett Bay Project. University of Rhode Island, Kingston, RI.

Karentz, D. and T. Smayda. 1984. T emperature and seasonal occurrence patterns of 30 dominant phytoplankton species in Narragansett Bay over a 22 year period (1959-1980). *Marine Ecology Progress Series*. 18:277-293.

Kaufman, K. 1996. Lives of North American Birds. Houghton Mifflin Company: Boston.

Keatts, H. 1988. New England's Legacy of Shipwrecks. American Merchant Marine Museum Press, Kings Point, New York.

King, J., J. Corbin, R. McMaster, J. Quinn, P. Gangemi, D. Cullen, J. Latimer, J. Peck , C. Gibson, J. Boucher, S. Pratt, L. LeBlanc, J. Ellis, and M. Pilson. 1995. A Study of the Sediments of Narragansett Bay: Volume I. The Surface Sediments of Narragansett Bay. Submitted to the Narragansett Bay Project. Graduate School of Oceanography, University of Rhode Island, Narragansett, RI. March 1995.

Klein-MacPhee, G. 2003. Personal Communication.

Knebel, H.J., S.W. Needell, and C.J. O'Hara. 1982. Modern sedimentary environments on the Rhode Island Inner Shelf, off the eastern United States. *Marine Geology*. 49:241-256.

Knowlton, A.R., J. Sigurjonsson, J.N. Ciano, and S.D. Kraus. 1992. Long distance movements of North Atlantic right whales (*Eubalaena glacialis*). *Marine Mammal Science.* 8:397-405.

Kraus, S.D., P.K. Hamilton, R.D. Kenney, A. Knowlton, and C.K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. *Journal Cetacean Research and Management.* Special Issue 2 (in press).

Kremer, J.N. and S.W. Nixon. 1978. A Coastal Marine Ecosystem, Simulation and Analysis. Spring-Verlag. New York. 217 pp.

Krom, M.D., K.K. Turekian, and N.H. Cutshall. 1985. Fate and Metals in the Sediments of the New York Bight Chapter 9. Pages 209-234 in: Ketchum, B.H., J.M. Capuzzo, W.V. Burt, I. Duedall, P.K. Park, and D.R. Kester, (Eds.) Wastes in the Ocean. Volume 6. John Wiley & Sons, New York, NY.

Lamoureux, J.E. 1967. Analysis of the Zooplankton of Block Island Sound. USL Technical Memorandum No. 2213-180-67. U.S. Navy Underwater Sound Laboratory. New London, CT.

Landry, M.R. 1975. The relationship between temperature and the development of life stages of the marine copepod, *Acartia clausi Giebr*. *Limnology and Oceanography*. 20:854-857.

Lazell, J.D., Jr. 1980. New England Waters: Critical Habitat for Marine Turtles. *Copei*. 2.

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, Dolphins and Porpoises of the Western North Atlantic: A Guide to Their Identification. NOAA Technical Memorandum NMFS/CIRC-396. U.S. Dept. of Commerce, NOAA, NMFS. 176 pp.

Lindsay, J. 2003. "Plummeting Lobster Stock Leaves Lobstermen Struggling". Boston Globe Website archives [Online]. Available http://www.boston.com.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects with ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19(1):81-97.

Maciolek, N.J., R.J. Diaz, D. Dahlen, B. Hecker, E.D. Gallagher, J.A. Blake, I.P. Williams, S. Emsbo-Mattingly, C. Hunt, and K.E. Keay. 2003. 2002 Outfall Benthic Monitoring Report. Prepared for the Massachusetts Water Resources Authority, Boston, MA.

MacKenzie, C. and J.R. Moring. 1985. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic) - American Lobster. U.S. Army Corps of Engineers Report No. TR EL-82-4; U.S. Fish and Wildlife Service, Biological Report 82(11.33). 19 pp.

Mager, A., Jr. 1985. Five-year status reviews of sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service. St. Petersburg, FL. 90 pp.

Malone, T.C. 1971. The relative importance of nanoplankton and net plankton as primary producers in the California current system. *Fishery Bulletin*. 69:799-820.

Mann, R. 1982. The seasonal cycle of gonadal development in *Arctica islandica* from the southern New England shelf. *Fishery Bulletin.* 80(2): 315-326.

Mann, R. 1990. Larval ecology of *Arctica islandica* on the inner continental shelf of the eastern United States. *Journal of Shellfish Research*. 8(2):464.

Manning, J.P., L.Y. Oey, D. Packer, J. Vitaliano, T.W. Finneran, K.W. You, and S. Fromm. 1994. Observations of bottom currents and estimates of resuspended sediment transport at the New York Bight 12-mile dumpsite. *Journal of Geophysical Research*. 99(C5):10211-10239.

Márquez, M.R. 1989. Kemp's ridley turtle (*Lepidochelys kempi*). Pages 159-165 in: L. Ogren, et al., (Eds.) Proceedings of the Second Western Atlantic Turtle Symposium. Panama City, FL.

Marshall, H.G. and M.S. Cohn. 1980. Phytoplankton Community Structure in Northeastern Waters of the United States. I: October 1978. NOAA Technical Memorandum No. NOAA-TM-NMFS-F/NEC-8. 65 pp.

Martin, J.H. 1965. Phytoplankton-zooplankton relationships in Narragansett Bay. *Limnology and Oceanography*. 10:157-171.

Massachusetts Audubon Society. 2003. Massachusetts Important Bird Areas [Online]. Available http://www.massaudubon.org/Birds_&_Beyond/IBA_new/iba_sites.php.

MassParks. 2003. [Online]. Available http://www.state.ma.us/dem/region1.htm.

Massachusetts Department of Conservation & Recreation, Division of State Parks and Recreation. 2003. [Online]. Available http://www.state.ma.us/dem/programs/acec/acec1.htm.

Massachusetts Division of Marine Fisheries. 2002. Saltwater Sport Fishing Guide (2002). [Online]. Available http://www.state.ma.us/dfwele/dmf/recreationalfishing/.

Massachusetts Division of Marine Fisheries. 2003. Diver Information (2003). [Online]. Available www.state.ma.us/dfwele/dmf/recreationalfishing/diverinfo.pdf.

Massachusetts Fish and Wildlife Service (MAFWS). 1985. Massachusetts Rare and Endangered Wildlife: Common Tern. Natural Heritage and Endangered Species Program (NHESP) [Online]. Westborough, MA. Available http://www.state.ma.us/dfwele/dfw/nhesp/nhfacts/Stehir.pdf.

MAFWS. 1988a. Massachusetts Rare and Endangered Wildlife: Arctic Tern. Natural Heritage and Endangered Species Program (NHESP) [Online]. Westborough, MA. Available http://www.state.ma.us/dfwele/dfw/nhesp/nhfacts/Stepar.pdf.

MAFWS. 1988b. Massachusetts Rare and Endangered Wildlife: Least Tern. Natural Heritage and Endangered Species Program (NHESP) [Online]. Westborough, MA. Available http://www.state.ma.us/dfwele/dfw/nhesp/nhfacts/Steant.pdf.

MAFWS. 2002. Massachusetts Natural Heritage Program [Online]. Available http://www.state.ma.us/dfwele/dfw/nhesp/nhrare.htm.

MAFWS. 2003a. Massachusetts Rare and Endangered Wildlife: Common Loon. Natural Heritage and Endangered Species Program (NHESP) [Online]. Westborough, MA. Available http://www.state.ma.us/dfwele/dfw/nhesp/nhfacts/Gavimm.pdf.

MAFWS. 2003b. Massachusetts Rare and Endangered Wildlife: Leach's Storm-Petrel. Natural Heritage and Endangered Species Program (NHESP) [Online]. Westborough, MA. Available http://www.state.ma.us/dfwele/dfw/nhesp/nhfacts/Oceleu.pdf.

Massachusetts Marine Trade Association [Online]. 2003. Available http://www.boatma.com/boating_in_ma.html.

Mayer, D.A., D.V. Hansen, and D.A. Ortmann. 1979. Long-term current and temperature observations on the Middle Atlantic Shelf. *Journal of Geophysical Research*. 84(C4):1776-1792.

McMaster, R.L. 1960. Sediments of Narragansett Bay System and Rhode Island Sound, Rhode Island. *Journal of Sedimentary Petrology*. 30(2):249-274.

MEDMR (Maine Department of Marine Resources). 2003. The Blue Mussel in Maine [Online]. Available http://www.me.state.us/dmr/rm/bluemussel.html.

Meylan, A., B. Schroeder, and A. Mosier. 1994. Marine turtle nesting activity in the state of Florida, 1979-1992. Page 83 in: K.A. Bjorndal, A.B. Bolten, D.A. Johnson, and J.J. Eliazar, (Eds.), Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-351. 323 pp.

Mitchell, E. 1974. Present status of northwest Atlantic fin and other whale stocks. Pages 108-169 *in* W.E. Schevill (ed), The whale problem: A status report. *Harvard University Press*, Cambridge, MA, 419 pp.

Mitchell, E. 1975. Preliminary report on Nova Scotia fishery for sei whales (*Balaenoptera borealis*). *Rep. int. Whal. Commn*. 25: 218-225.

Mitchell, E. and D.G. Chapman. 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (*Balaenoptera borealis*). *Rep. int. Whal. Commn*. Special Issue 1: 117-120.

Morreale, S.J. and E.A. Standora. 1992. Habitat use and feeding activity of juvenile kemp's ridleys in inshore waters of the northeastern U.S. Pages 75-77 in: Salmon and J. Wyneken. (Eds.), Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-302. 195 pp.

Morreale, S.J., A.B. Meylan, S.S. Sadove, and E.A. Standora. 1992. Annual occurrence and winter mortality of marine turtles in New York waters. *Journal of Herpetology.* 26:301-308.

Morreale, S.J. and E.A. Standora. 1993. Occurrence, movement, and behavior of Kemp's ridley and other sea turtles in New York waters. Prepared for the New York Dept. of Environmental Conservation, Return-a-Gift Wildlife Program. Okeanos Ocean Research Foundation. Hampton Bays, New York, NY.

Murawski, S.A. 1979. On the Question of Offshore Surf Clam, *Spisula solidissima*, Resources off New England. Laboratory Reference No. 79-22. National; Marine Fisheries Service.

Murawski, S.A., J.W. Ropes and F.M. Serchuk. 1982. Growth of the Ocean Quahog, *Arctica islandica*, in the Middle Atlantic Bight. *Fishery Bulletin.* 80(1): 21-34.

Murawski, S.A. and F.M. Serchuk. 1983. An assessment of the surf clam resources in FCZ waters off southern New England - Spring 1983. National Marine Fisheries Service.

Narragansett Bay Shallow Water Test Facility (NPT). 2002. *Ranges* [Online]. Available http://www.npt.nuwc.navy.mil/ranges/ranges.html.

National Audubon Society. 2002. *The Christmas Bird Count Historical Results* [Online]. Available http://www.audubon.org/bird/cbc.

National Park Service. 2003. [Online]. Available http://www.nature.nps.gov/nnl/Registry/USA_Map/States/Massachusetts/NNL/GHC/.

National Ocean Service. 2001. U.S. Coast Pilot 2, Atlantic Coast: Cape Cod to Sandy Hook, 2001 (31st) Edition. National Ocean Service. Maryland.

Naval Station Newport (NAVSTA). 2003. *The Navy in Narragansett Bay.* [Online]. Available http://www.nsnpt.navy.mil/history.htm.

Neff, J. M. 1979. Polycyclic Aromatic Hydrocarbons in the Aquatic Environment: Sources, Fates and Biological Effects. Applied Sciences Publishers, Barking Essex, England.

NEFMC (New England Fishery Management Council). 2001. Report from the Groundfish Social Impact Informational Meetings. New England Fisheries Management Council [Online]. Available http://www.nefmc.org/documents/social-impacts.htm.

Nelissen, P.H.M. and J. Stefels. 1988. Eutrophication in the North Sea. Nederlands Institute voor Onderzoek der Zee. N10Z rapport 1988-4.

NESurf. 2003. Listing of Rhode Island Surf Breaks [Online]. Available http://www.nesurf.com/.

Nielsen, L.A. and D.L. Johnson. 1983. Estimating CPUE. Pages 411-413 in Fisheries Techniques. American Fisheries Society. Bethesda, MD.

NMFS (National Marine Fishery Service). 1991. Recovery Plan for the Humpback Whale (*Megaptera novaeangliae*). Report prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service. Silver Spring, MD. 105 pp.

NMFS. 1992. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service. St. Petersburg, FL. 40 pp.

NMFS. 1998. Sei Whale. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Office of Protected Resources. Stock Assessment Reports [Online]. Available http://www.nmfs.noaa.gov/prot_res/species/cetaceans/sei_whale.html

NMFS, 2001. An Overview of the Social and Economic Survey Administered During Round II of the Northeast Multispecies Fishery Disaster Assistance Program. Prepared By Julia Olsen and Patricia M. Clay, NMFS, Northeast Region, Northeast Fisheries Science Center, Woods Hole MA. NOAA Technical Memorandum NMFS-NE-164. 80 pp.

NMFS. 2002a. Letter to U.S. Army Corps of Engineers. December 31, 2002.

NMFS. 2002b. Sperm Whale. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Office of Protected Resources. Stock Assessment Reports [Online]. Available http://www.nmfs.noaa.gov/prot_res/species/cetaceans/sperm_whale.html.

NMFS. 2002c. Blue Whale. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Office of Protected Resources. Stock Assessment Reports [Online]. Available http://www.nmfs.noaa.gov/prot_res/species/cetaceans/blue_whale.html

NMFS. 2003a. Hawksbill Turtle Fact Sheet. National Marine Fisheries Service, National Oceanic Atmospheric Administration, Office of Protected Resources [Online]. Available http://nmfs.noaa.gov/prot_res/species/turtles/hawksbill.html.

NMFS. 2003b. Commercial Weight Out Data, Commercial Vessel Trip Reports, and Recreational Vessel Trip Reports. Data obtained from NMFS by Jennifer Field, Battelle.

NMFS. 2003c. Marine Recreational Fisheries Statistical Survey: 1996 Fact Sheet. [Online] Available http://www.st.nmfs.gov/st/.

NOAA (National Oceanic and Atmospheric Administration). 2000. Nautical Chart. Massachusetts-Rhode Island, Martha's Vineyard to Block Island 37th Edition.

NOAA. 2001. Nautical Chart. Approaches to New York, Nantucket Shoals to Fife Fathom Bank 42nd Edition.

NOAA. 2003a. Guide to Essential Fish Habitat Designations in the Northeastern United States [Online]. Available http://www.nero.noaa.gov/ro/STATES4/massri.htm.

NOAA, 2003b. NOAA News Release 2002-103. *Dutch Harbor-Unalaska and New Bedford Land Titles of Nation's Top Fishing Ports for 2001.* [Online] Available www.publicaffairs.noaa.gov/releases2002/aug02/noaa02103.html/

NOAA. 2003c. Automated Wreck and Obstruction Information System [Online]. Available http://chartmaker.ncd.noaa.gov/hsd/hsd-3.html.

Northeast Fisheries Science Center. 2000. Report of the 31st Northeast Regional Stock Assessment Workshop (31st SAW), Public Review Workshop. Northeast Fisheries Science Center Reference Document No. 00-14.

NRC (National Research Council). 1990. Decline of the Sea Turtles. Causes and Prevention. National Academy Press. Washington, D.C. 259 pp.

NYSDEC (New York State Department of Environmental Conservation). 2003a. Sei Whale Fact Sheet [Online]. Available http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/sewhfs.html.

NYSDEC. 2003b. Northeastern Beach Tiger Beetle Fact Sheet [Online]. Available http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/nbtbfs.html.

NYSDEC. 2003c. American Burying Beetle Fact Sheet [Online]. Available http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/abbefs.html.

O'Hara, K.J. 1989. Plastic debris and its effects on marine wildlife. Pages 395-434 in: Chandler, W.J. (Ed.). Audubon Wildlife Report 1988/1989. Academic Press, San Diego, CA.

O'Reilly, J.E. and C. Zetlin. 1998. Seasonal, Horizontal and Vertical Distribution of Phytoplankton Chlorophyll A in the Northeast U.S. Continental Shelf Ecosystem. NOAA Technical Report No. NMFS 139. U.S. Department of Commerce, NOAA, NMFS. 119 pp.

Oviatt, C.A., P. Lane, F. French III, and P. Donaghay. 1989. Phytoplankton species and abundance in response to eutrophication in coastal marine mesocosms. *Journal of Plankton Research*. 11:1223-1244.

Paerl, H.W., J.L. Pinckney, J.M. Fear, and B.L. Peierls. 1998. Ecosystem responses to internal and watershed organic matter loading: consequences for hypoxia in the eutrophying Neuse River Estuary, North Carolina, USA. *Marine Ecology Progress Series*. 166:17-25.

Page, J. 2002. Sails of the Sea. The Georgia Coastal Management Program, The Georgia Sound.

Pala S, Lefkovitz L, Moore M, and Schaub E. 2003. 2002 Annual Fish and Shellfish Report. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2003-05. p. 175.

Paul, W. 2003. Personal Communication.

Payne, P.M., L.A. Selzer, and A.R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observation. Prepared under Contract No. NA-81-FA-C-00023. NMFS, Northeast Fishery Center. 246 pp.

Petruny-Parker, M., Boyd, J., Rubinstein, N., Carey, D., and P. August. 2003. Designation of an Offshore Long-Term Dredged Material Disposal Site(s) for the Rhode Island Region: Evaluation Process. Final Report on Working Group Meetings. Coastal Institute, University of Rhode Island. January 2003. 21 pp. + Appendices.

Pilson, M.E.Q. 1985. Annual cycles of nutrients and chlorophyll in Narragansett Bay, Rhode Island. *Journal of Marine Research*. 43:849-873.

Pilson, M.E.Q. and C.D. Hunt. 1989. Water Quality Survey of Narragansett Bay, A Summary of Results from SINBADD 1985-1986. Technical Report No. NBP-89-22. Prepared for RIDEM. Providence, RI.

Pogue, P. and V. Lee. 1993. Public Access to the Rhode Island Coast: A Selective Guide to Parks, Wildlife Refuges, Beaches, Fishing Sites, Boat Ramps, Pathways, and Views along Rhode Island's Coast. University of Rhode Island, Division of University Relations.

Pratt, S.D. 1971. The Effects of Spoil Dumping on the Benthic Invertebrates of Rhode Island Sound. Pages 77-108 in: Providence Harbor Improvement Spoil Disposal Site Evaluation Study: Phase II. 144pp.

Pratt, S.D. 1973. Benthic Fauna. Pages 5-1 – 5-70 in: Coastal and Offshore Environmental Inventory, Cape Hatteras to Nantucket Shoals. University of Rhode Island, Marine Publication Series No. 2. Environmental Experiment Station, Graduate School of Oceanography, University of Rhode Island.

Pratt, S.D., S.B. Saila and M.P. Sissenwine. 1973. Study and Report on Environmental Effects of Dredged Material Rhode Island Sound – Phase III. SR-3. University of Rhode Island. Kingston, RI.

Pratt, S.D., C.A. Griscom, and R.A. Heavers. 1975. Survey of Currents, Water Turbidity, and Benthic Biology in the Vicinity of Browns Ledge, Rhode Island Sound. Marine Experiment Station, University of Rhode Island. Kingston, RI.

Pratt, S.D. and R.M. Heavers. 1975. Background Turbidity Conditions of Rhode Island Sound and Buzzards Bay. Report No. SR-5 Marine Experiment Station, Graduate School of Oceanography, U.R.I.

Pratt, S.D., A.R. Ganz, and M.A. Rice. 1992. A Species Profile of the Quahog in Rhode Island. Prepared for Rhode Island Sea Grant Program. Rhode Island Sea Grant Program. Kingston, RI. 117 pp.

Prescott, R.L. 1988. Leatherbacks in Cape Cod Bay, Massachusetts, 1977-1987. Pages 83-84 in Schroeder, B. (Ed.). Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFC-214. 136 pp.

Pruell, R.J. and J.G. Quinn. 1985. Geochemistry of organic contaminants in Narragansett Bay sediments. *Estu. Coast. Shelf. Sci.* 21: 295-312.

Rhode Island Department of Administration. 1986. The Rhode Island Coastal Resources Management Program (CRMP): A Working Paper for Land Use: 2010. Rhode Island Department of Administration, Division of Planning. Providence, RI.

Rhode Island Economic Development Corporation (RIEDC). 2003a. Official Rhode Island Tourism [Online]. Available http://www.visitrhodeisland.com/.

Rhode Island Economic Development Corporation. 2003b. Rhode Island Economy. [Online]. Available http://www.riedc.com/aboutri/economy/.

Rhode Island Statewide Planning Program. 2002. Rhode Island Energy Plan 2002, Part 781-02: Rhode Island's Energy Use [Online]. Available http://www.planning.state.ri.us/ed/default.htm.

Rice, M.A., A. Valliere, and A. Caporelli. 2000. A review of shellfish restoration and management projects in Rhode Island. *Journal of Shellfish Research*. 19(1):401-408.

RIDEM (Rhode Island Department of Environmental Management). 1999. Narragansett Bay Quahog Management Plan. A Report to the Narragansett Bay Project and Rhode Island Marine Fisheries Management Council. RIDEM, Division of Fish and Wildlife.

RIDEM. 2000. State of Rhode Island and Providence Plantations Department of Environmental Management Water Quality Regulation: Regulation EVM 112-88.97-1, Amended June 23, 2000. 34 pp.

RIDEM. 2002a. Rare native animals of Rhode Island [Online]. Available http://www.state.ri.us/dem/programs/bpoladm/plandev/heritage/pdf/animals.pdf.

RIDEM. 2002b. Stock Status of Marine Resources and Summary of Fisheries Management in Rhode Island. A Report to the Rhode Island General Assembly. RIDEM, Division of Fish and Wildlife, Marine Fisheries.

RIDEM. 2003. Division of Parks and Recreation, Alphabetical Listing of State Parks and Beaches [Online]. Available http://www.riparks.com/.

RIHPHC. 2003. Letter from Edward F. Sanderson, Executive Director of the Rhode Island Historic Preservation and Heritage Commission (RIHPHC) to Michael F. Keegan, Programs and Civil Project Management Branch, U.S. Army Corps of Engineers. February 6, 2003.

Riley, G.A. 1948. The Hydrography of the Western Atlantic. Woods Hole Oceanographic Institution Technical Report No. 11.

Riley, G.A. 1952. Phytoplankton of Block Island Sound. *Bulletin of the Bingham Oceanographic Collection*. 13(40-64).

RIRPP. 2003. Rhode Island Resource Protection Project. [Online] Available www.edc.uri.edu/rirpp/.

Saila, S.B., T.T. Polgar, and B.A. Rogers. 1969. Results of Studies Related to Dredged Sediment Dumping in Rhode Island Sound: Phase I. Report No. SR-1. 36 pp.

Saila, S.B., S.D. Pratt, and T.T. Polgar. 1971. Providence Harbor - Improvement Spoil Disposal Site Evaluation Study: Phase II. SR-2. Marine Experiment Station, University of Rhode Island. Kingston, RI.

Savard, W.L. 1966. The Sediments of Block Island Sound. University of Rhode Island, RI.

Scott, T.M. and S.S. Sadove. 1997. Sperm whale, *Physeter macrocephalus*, sightings in the shallow shelf waters off Long Island, New York. *Mar. Mammal Sci.* 13:317-321.

Sea Turtle Stranding and Salvage Network (STSSN). 2002. Unpublished data.

Sedgwick, S., C. Collins, and S. Olsen. 1980. Commercial Fishing Facilities Needs in Rhode Island. University of Rhode Island Coastal Resources Center, Kingston, R.I..

Seipt, I.E., P.J. Clapham, C.A. Mayo, and M.P. Hawvermale. 1990. Population characteristics of individually identified fin whales, *Balaenoptera physalus*, in Massachusetts Bay, 1980-1987. *Fisheries Bulletin*. 88:271-278.

Shepard, A.N., R.B. Theroux, R.A. Cooper, and J.R. Uzmann. 1986. Ecology of Ceriantharia (*Coelenterata, Anthazoa*) of the Northwest Atlantic from Cape Hatteras to Nova Scotia. *Fishery Bulletin*. 84(3):625-646.

Shepherd, G.R. and M. Terceiro. 1994. The Summer Flounder, Scup, and Black Sea Bass Fishery of the Middle Atlantic Bight and Southern New England Waters. NOAA Technical Report No. NMFS 122. U.S. Department of Commerce, NOAA, NMFS. 13 pp.

Sherman, K., M., W. G. Smith, J. R. Green, E. B. Cohen, M. S. Berman, K. A. Marti and J. R. Goulet. 1987. Zooplankton production and the fisheries of the northeastern shelf. In: R. H. Backus and D.W. Bourne (eds.), Georges Bank, p. 269-282. MIT Press, Cambridge, Mass.

Sherman, K., M. Grosslein, D. Mountain, D. Busch, J. O'Reilly, and R. Theroux. 1988. The Continental Shelf Ecosystem off the Northeast Coast of the United States. Pages 279-337 in: Postma, H. and J.J. Zijlstra, (Eds.), Ecosystems of the World . Volume 27. Elsevier Press, Netherlands.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distribution and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetology Monograph.* 6:43-67.

Sieburth, J.M., P.W. Johnson, and P.E. Hargraves. 1988. Ultrastructure and ecology of *Aureococcus anophagefferens Gen. et sp. nov. (Chrysphyceae*); the dominant picoplankter during a bloom in Narragansett Bay, Rhode Island, summer 1985. *Journal of Phycology*. 24:416-424.

Simmons, T. 2003. Personal Communication. Massachusetts Division of Fish and Wildlife, September 2, 2003

Smayda, T. and P. Fofonoff. 1987. Personal communication, May 1987.

Snooks, J.H., J.P. Jacobson, and W.P. Kramer. 1977. Summary of Temperature and Salinity Observations in Block Island Sound during July 1975 through September 1976. Yankee Atomic Electric Company. Westborough, MA.

Spangenberg, R. 2003a. Personal Communication with Massachusetts Coastal Zone Management, September 30, 2003.

Spangenberg, R. 2003b. Personal Communication with Rhode Island Coastal Zone Management, September 29, 2003.

Spendelow, J.A. 2002. The Falkner Island Tern Project. USGS Patuxent Wildlife Research Center [Online]. Available http://www.pwrc.usgs.gov/resshow/spendlow/roseback.htm.

Stehlik, L.L., C.L. MacKenzie Jr., and W.W. Morse . 1991. Distribution and abundance of four brachyuran crabs on the Northwest Atlantic Shelf. *U.S. Fishery Bulletin*. 89:473-492.

Steimle, F. 1982. The benthic macroinvertebrates of Block Island Sound. *Estuarine, Coastal and Shelf Science*. 15:1-16.

Steimle, F. 1990a. Benthic Macrofauna and Habitat Monitoring on the Continental Shelf of the Northeastern United States I. Biomass. NOAA Technical Report NMFS 86.

Steimle, F.W. 1990b. Population dynamics, growth and production estimates for the sand dollar *Echinarachnius parma*. *U.S. Fishery Bulletin*. 88:179-189.

Steimle, F. and L. Ogden. 1982. Food of fish collected on artificial reefs in the New York Bight and off Charlestown, South Carolina. *Marine Fisheries Review*. 44(6-7):49-52.

Steimle, F. W., D. Jeffress, S.A. Fromm, R.N. Reid, J.J. Vitaliano, and A. Frame. 1994. Predator-prey relationships of winter flounder, *Pleuronectes americanus*, in the New York Bight apex. *Fishery Bulletin.* 92:608-619.

Steimle, F.W. and C. Zetlin. 2000. Reef habitats in the Middle Atlantic Bight: abundance, distribution, associated biological communities, and fishery resource use. *Marine Fisheries Review*. 62(2):24-42.

Steinback, S., J. O'Neil, E. Thunberg, A. Gautam and M. Osborn. 1999. Volume I: Summary Report of Methods and Descriptive Statistics for the 1994 Northeast Region Marine Recreational Economics Survey. Prepared for the U.S. Department of Commerce, NOAA, NMFS. NOAA Technical Memorandum NMFS-F/SPO-37. August 1999.

Stubblefield, W.L., R.W. Permenter, and D.J.P. Swift. 1977. Time and space variation in the surficial sediments of the New York Bight Apex. *Estuarine and Coastal Marine Science*. 5:597-607.

Sturm, T.A., A. Amirtharajah, and C. Santamarina. 2000. Providence River Sediment Erosion Analysis. Report prepared for USACE New England District.

Sullivan, B.A. 1993. How does water column structure influence copepod populations in Coastal marine systems? *Bulletin of Marine Science*. 53:240-246.

TEWG (Turtle Expert Working Group). 1998. An Assessment of the Kemp's Ridley (*Lepidochelys kempii*) and Loggerhead (*Caretta caretta*) Sea Turtle Populations in the Western North Atlantic. NOAA Technical Memorandum No. NMFS-SEFSC-409 U.S. Department of Commerce, NOAA, NMFS.

TEWG. 2000. Assessment Update for the Kemp's Ridley and Loggerhead Sea turtle Populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444. U.S. Department of Commerce, NOAA, NMFS. 115 pp.

Thomas, J.D. 1993. Biological monitoring and tropical biodiversity in marine environments: a critique with recommendations, and comments on the use of amphipods as bioindicators. Journal of Natural History 27:795-806.

Thompson, N.B. 1988. The status of loggerhead, *Caretta caretta* ; Kemp's ridley, *Leptochelys kempi;* and green, *Chelonia mydas*, sea turtles in U.S. waters. *Marine Fisheries Review.* 50(3):16-23.

Tracey, G.A. 1988. Feeding reduction, reproductive failure, and mortality in *Mytalis edulis* during the 1985 'Brown Tide' in Narragansett Bay, Rhode Island. *Marine Ecology Progress Series*. 50:73-81.

U.S. Department of the Navy. 1973. Revised Draft Environmental Impact Statement, Naval Submarine Base, New London, Connecticut, Dredge River Channel. May 1973.

U.S. Federal Government. 2002a. Rhode Island Sound, Atlantic Ocean, Approximate 4.0 nmi Due South of Lands End in Newport, RI, Restricted Area for Naval Practice Minefield, Code of Federal Regulations Title 33- Navigation and Navigable Waters, Chapter II-Corps of Engineers, Department of the Army, Part 334-Danger Zone and Restricted Area Regulations. Report No. 334.78.

U.S. Federal Government. 2002b. Safety Zone: Rhode Island Sound, Narragansett Bay, Providence River, Code of Federal Regulations Title 33- Navigation and Navigable Waters, Chapter II-Corps of Engineers, Department of the Army, Part 165-Regulated Navigation Areas and Limited Access Areas. Report No. 165.121.

USFWS. 1978. Development of Fishes of the Mid-Atlantic Bight. Volumes I through VI. Performed for the Power Plant Project, Office of Biological Services, Fish and Wildlife Service.

USFWS. 1986. Endangered and Threatened Wildlife and Plants. 50 CFR 17.11 AND 17.12 U.S. Dept. of the Interior, Fish and Wildlife Service. Washington, D.C. January 1, 1986.

USFWS. 1994. Northeastern Beach Tiger Beetle Recovery Plan. Hadley, MA [Online]. Available http://ecos.fws.gov/recovery_plan/pdf_files/1994/940929b.pdf.

USFWS. 2003a. Letter to U.S. Army Corps of Engineers. January 10, 2003 .

USFWS. 2003b. Northeastern Beach Tiger Beetle Species Profile [Online]. Available http://ecos.fws.gov/servlet/SpeciesProfile?spcode=I02C#status.

Uye, S. 1981. Fecundity studies of neritic calanoid copepods *Arctica clausi Giesbrecht* and *A. steueri Smirnov*: a simple empirical model of daily egg production. *Journal of Experimental Marine Biology and Ecology*. 50:255-271.

Vincent, C. E., Swift, D. J. P. and Hillard, B. 1981. Sediment transport in the New York Bight, North American Atlantic Shelf. Mar. Geol., 32: 369-398

Wallace, N. 1985. Debris entanglement in the marine environment: a review. Pages 259-277 in: S.A. Eckert, K.L. Eckert, and T.H. Richardson, (Eds.), Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum No. NOAA-TM-NMFS-SEFC-232. Jekyll Island, Georgia, NMFS, Southeast Fisheries Science Center. Miami, FL.

Wang, J.S., T.C. Lee, R.E. Wolke, and S.B. Saila. 1996. PCB and heavy metal residues in livers and muscles of winter flounder (*Pseudopleuronectes americanus*) from Rhode Island waters. *Toxicological and Environmental Chemistry*. 55(1-4):19-30.

Waring, G.T. Unpublished Data.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern USA shelf. *Fish. Oceanogr. 2:101-105.*

Waring, G.T., J.M. Quintal, C.P. Fairfield (Ed.). 2002. Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-2002. NOAA Technical Memorandum NMFS-NE-169. 318 pp.

Waring, G.T., J.M. Quintal, S.L. Swartz, P.J. Clapman, T.V.N. Cole, C.P. Fairfield, A. Hohn, D.L. Palka, M.C. Rossman, USFWS, and C. Yeung . 2001. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-2001. NOAA Technical Memorandum NMFS-NE-168. 318 pp.

Weinberg, J. 2001. Status of Fisheries Resources off Northeastern United States: Ocean Quahog [Online]. Available http://www.nefsc.noaa.gov/sos/spsyn/iv/quahog/. NOAA.

Whitman, A. A. and P. M. Payne. 1990. Age of harbour seals, *Phoca vitulina concolor*, wintering in southern New England. *Can. Field-Nat.* 104(4): 579-58 2.

Wilber, P. and R. Will. 1994. New York Bight Study. Report 5: NY Bight Biological Review Program. Technical Report CERC-94-4. 93 pp + Appendices.

Williams, A.B. 1984. Shrimps, Lobsters, and Crabs of the Atlantic Coast of the Eastern United States, Maine to Florida. Smithsonian Press. Washington, D.C.

Williams, A.B. and R.L. Wigley. 1977. Distribution of Decapod Crustacea off Northeastern United States Based on Specimens at the Northeast Fisheries Center, Woods Hole, Massachusetts. NOAA Technical Memorandum No. NOAA-TR-NMFS-CIRC407; NOAA-78030302 . National Marine Fisheries Service. Washington, D.C. 44 pp.

Williams, R.B. 1964. Division rates of salt marsh diatoms in relation to salinity and cell size. *Ecology*. 45:877-880.

Williams, R.G. 1969. Physical Oceanography of Block Island Sound. USL Report No.966. U.S. Navy Underwater Sound Laboratory. Fort Trumbull, New London, CT.

Winn, H.E.. 1982. A Characterization of Marine Mammals and Turtles in the Mid- and North-Atlantic Areas of the U.S. Outer Continental Shelf. Final Report of the Cetacean and Turtle Assessment Program, University of Rhode Island, Kingston, RI. Prepared under Contract No. AA551-CT-48. U.S. Department of the Interior, BLM, Washington, DC. 450 pp.

Wishner, K., E. Durbin, A. Durbin, M. Macaulay, Winn. H., and R. Kenney. 1988. Copepod patches and right whales in the Great South Channel off New England. *Bulletin of Marine Science*. 43(3):825-844.

Witzell, W.N. and W.G. Teas. 1994. The Impacts of Anthropogenic Debris on Marine Turtles in the Western North Atlantic Ocean. Report No. NMFS-SEFSC-355. NOAA, NMFS, Southeast Fisheries Science Center. Miami, FL. 21 pp.

SECTION 4: ENVIRONMENTAL CONSEQUENCES

Arimoto, R. and S.Y. Feng. 1983. Changes in the levels of PCBs in *Mytilus edulis* associated with dredged-material disposal. In: Wastes in the Ocean. Volume II. Dredged Material Disposal in the Ocean. D. R. Kester, B.H. Ketchem, I.W. Duedall, and P.K. Park, (Eds.), John Wiley & Sons, New York. 199-212.

Battelle and the U.S. Coast Guard. 1995. Endangered Species Act Biological Assessment for the U.S. Atlantic Coast. Prepared for The National Marine Fisheries Service. August 1, 1995.

Brandsma, M.G. and D.J. Divoky. 1976. Development of Models for Prediction of Short-Term Fate of Dredged Material Discharge in the Estuarine Environmental. Contract Report No. CRD765. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

Brungs, W.A. and D.I. Mount. 1978. Introduction to a discussion of the use of aquatic toxicity tests for evaluation of the effects of toxic substances. Pages 15-26 in: Estimating the Hazard of Chemical Substances to Aquatic Life. J. Cairns Jr., K.L. Dickson, and A.W. Maki, (Eds.), American Society for Testing and Materials, Philadelphia, PA. ASTM STP 657.

Carey, D.A.; Fredette, T.J.; Morris, J.T.; Murray, P.M. 1997. Subaqueous capping in New England: Wise Use of Dredged Materials. Beneficial Use of Dredged Materials Conference, Baltimore, MD.

Chapman, P., H. Allan, K. Godtfredsen, and M. Z'Graggen. 1996. Evaluation of bioaccumulation factors in regulating metals. *Environmental Science and Technology*. 30:448A-452A.

Clarke, D., T.J. Fredette, and D. Ismsand. 1988. Creation of offshore topographic features with dredged material. Environmental Effects of Dredging. Vol D-88-5. November 1988. U.S. Army Corps of Engineers, Waterways Experiment Station. 5 pp.

Clark, D. and R. Kasal. 1994. Habitat Value of Offshore Dredged Material Berms for Fisheries Resources. Pages 938-946 in: McNair, E.C., Jr. (Ed.). Dredging, '94. Proceedings of the Second International Conference on Dredging and Dredged Material Placement. American Society of Civil Engineers. New York, NY.

Clausner, J.E., N.W. Scheffner, J.Z. Gailini, and M.C. Allison. 1996. Frequency Prediction for Vertical Erosion of Dredged Material Mounds in the Mud Dump Site. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

Connell, D.W. 1989. Biomagnification by aquatic organisms a proposal. *Chemosphere*. 19:1573-1584.

Corps. 1979. Disposal Area Monitoring System (DAMOS) Annual Data Report - 1978 Supplement E Brenton Reef Disposal Site. U.S. Army Corps of Engineers, New England Division. Waltham, Massachusetts. 36 pp.

Corps. 1980. Final Programmatic Environmental Impact Statement for the Disposal of Dredged Material in the Long Island Sound Region, plus appendices. Prepared by US Army Corps of Engineers, New England Division, Waltham, MA.

Corps. 1982. Final Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound. Prepared by US Army Corps of Engineers, New England Division, Waltham, MA.

Corps. 1986. Fate of Dredged Material during Open-Water Disposal. US Army Corps of Engineers, Water Ways Experimental Station. EEPD-01-2, September 1986, http://www.wes.army.mil/el/dots/eedptn.html. 12 p.

Corps. 1998a. A Predictive Model for Sediment Transport at the Portland Disposal Site, Maine. Portland Harbor Maintenance. Disposal Area Monitoring System (DAMOS) Report 122. Waterways Experiment Station. Prepared for U.S. Army Corps of Engineers, New England District.

Corps. 1998b. Shellfish Sampling and Site Characterization, Narragansett Bay and Rhode Island Sound Proposed Disposal Sites. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix C-6. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 14 by Battelle for the U.S. Army Corps of Engineers. January 1998.

Corps. 2001a. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers, New England Division. Concord, MA.

Corps. 2001b. Dredged Material Fate Modeling of Proposed Providence River Confined Aquatic Disposal (CAD) Cells and Ocean Dredged Material Disposal Site (ODMDS). In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix P. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 14 by Gailani, J.Z., S.J. Smith, N.W. Scheffner, and W. Vanadit-Ellis for the U.S. Army Engineer District, New England.

Corps. 2001c. Final Data Report for Laboratory Testing in Support of Environmental Assessment, Environmental Sampling and Testing – New Haven, CT. Submitted to U.S. Army Corps of Engineers, New England Division. Contract DACW22-01-D-0004. Delivery Order 11.

Corps. 2001d. Final Data Report for Laboratory Testing in Support of Environmental Assessment, Environmental Sampling and Testing – Norwalk, CT. Submitted to U.S. Army Corps of Engineers, New England Division. Contract DACW22-01-D-0004. Delivery Order 8.

Corps. 2001e. Final Data Report for Laboratory Testing in Support of Environmental Assessment, Environmental Sampling and Testing – Guilford Harbor, CT. Submitted to U.S. Army Corps of Engineers, New England Division. Contract DACW22-01-D-0004. Delivery Order 11.

Corps. 2002a. Fall 2001 Infauna Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 for the U.S. Army Corps of Engineers. September 2002.

Corps. 2002b. Task 12F Dredging Needs Study. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2. Prepared by Battelle and the Maguire Group Inc. for the U.S. Army Corps of Engineers. November 2002.

Corps 2003a. Draft Long Island Sound Dredged Material Disposal Site Designation Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 13 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003b. Task 15.2: Analysis of Economic Impacts of No Action Alternative. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003c. Summer 2003 Quahog Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003d. Fall 2002 Benthic Tissue Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003e. Fall 2002 Lobster Survey – Final Survey and Data Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003f. Summer 2003 Lobster Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2004a. Analysis of Dredged Material Transport Potential at Two Disposal Alternatives in Rhode Island Sound. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. April 2004.

Corps. 2004b. Fall 1999 and Spring 2002 Physical Oceanographic Data Report. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2004c. Task 15.3: Assessment of Economic Significance of and Potential Impacts to Navigation Dependent Facilities of Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. April 2004.

Corps. 2004d. Historic Shipwreck Background Study. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by UMASS Archeological Services for the U.S. Army Corps of Engineers. April 2004.

Corps. 2004e. Task 15.1: The Economic Significance of Navigation-Dependent Industries Within the Zone of Siting Feasibility. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. April 2004.

Corps. 2004f. Monitoring Surveys of the Rhode Island Sound Disposal Site Summer 2003. Contribution 155. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers. 81 pp. August 2004.

Csanady, G.T. 1973. Turbulent Diffusion in the Environment. Reidel. New York, NY. 248 pp.

Dragos, P. and D. Lewis. 1993. Plume Tracking/Model Verification Project. Prepared under EPA Contract No. 68C80105. 62 pp + Appendix.

Dragos, P. and C. Peven. 1994. Plume Tracking of Dredged Material Containing Dioxin, Final Report. Contract No. 68-C2-0134. 49 pp + Appendix.

Ecker, R.M. and J.P. Downing. 1987. Review of State-of the-Art Modeling of Ocean-Dumped Wastes. Prepared under EPA Contract no. 68-03-3319, Work Assignment No. 9 by Battelle for the EPA. 90pp.

EPA and Corps. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual. EPA Report No. EPA-503-8-91/001. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection and Department of the Army, U.S. Army Corps of Engineers. Washington, DC.

EPA and Corps. 2004. Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters. Prepared by USEPA Region 1, New England, Boston, MA and the U.S. Army Corps of Engineers, New England District, Concord, MA. May 2004.

Fogarty, M.J. 1981. Distribution and relative abundance of the ocean quahog *Arctica islandica* in Rhode Island Sound and off Martha's Vineyard, Massachusetts. *Journal of Shellfish Research*. 1(1):33-39.

Fredette, T.J. 1991. A summary of recent capping investigations with dredged sediments in New England. In Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 15th US/Japan Experts Meeting . November 1991. Los Angeles.

Fredette, T.J. 2003. Personal communication, March 2003.

Fredette, T.J. and G.T. French. 2004. Understanding the physical and environmental consequences of dredged material disposal: history in New England and current perspectives. Marine Pollution Bulletin 49:93-102.

Fredette, T.J., J.D. Germano, P.G. Kullberg, D.A. Carey and P. Murray. 1992. Chemical stability of capped dredged material disposal mounds in Long Island Sound, USA. *Chemistry and Ecology* 7:173-194.

Fredette, T.J., P.G. Kulberg, D.A. Carey, R.W. Morton, and J.D. Germano. 1993. Twenty-five years of dredged material disposal site monitoring in Long Island Sound: A long-term perspective in Van Patten, M.S. (Ed.). Proceedings of the Long Island Sound Research Conference. Connecticut Sea Grant Program Publication No. CT-SG-93-03. New Haven, CT.

Gentile, J.H., K.J. Scott, S.M. Lussier, and M.S. Redmond. 1987. The Assessment of Black Rock Harbor Dredged Material Impacts on Laboratory Population Responses. Technical Report No. D-87-3. Prepared for the U.S. Environmental Protection Agency. 53 pp.

Gobas, F.A.P.C., J.R. McCorquodale, and G.D. Haffner. 1993. Intestinal absorption and biomagnification of organochlorines. *Environmental Toxicology and Chemistry*. 12:567-576.

Hall, S.J. 1994. Physical disturbance and marine benthic communities: life in unconsolidated sediments. Oceanography and Marine Biology: an Annual Review 32:179-239.

Harding, G.C. 1992. American Lobster (*Homarus americanus Milne Edwards*): A Discussion Paper on their Environmental Requirements and the Known Anthropogenic Effects on their Populations. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1887. 16 pp.

Kranz, P.M. 1974. The anastrophic burial of bivalves and its paleological significance. Journal of Geology 82:237-265.

Kraus, N. C. 1991. Mobile, Alabama, Field Data Collection Project, 18 August - 2 September 1989. Report 1: Dredged Material Plume Survey Data Report. U.S. Army Corps of Engineers, Dredging Research Program. USACE Tech. Report No. DRP-91-3. Washington, D.C.

Koh, R.C.Y. and Y.C. Chang. 1973. Mathematical model for barged ocean disposal of waste. Environmental Protection Series, EPA 660/2-73-029. U.S. Environmental Protection Agency, Washington, DC.

LaSalle, M.W. 1991. Physical and chemical alterations associated with dredging: An overview. Environmental Laboratory, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Effects of dredging on anadromous Pacific Coast fishes: workshop proceedings. Seattle. Sept 8-9, 1988.

LeBlanc, G.A. 1995. Trophic differences in the bioconcentration of chemicals: implications in assessing biomagnification. *Environmental Science and Technology*. 29:154-160.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects with ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19(1):81-97.

Maurer, D., Keck, R. T., Tinsman, J. C., and Leathem, W. A. 1981a. Vertical migration and mortality of benthos in dredged material: Part I--Mollusca. Marine Environmental Research 4(4):299-319.

Maurer, D., Keck, R. T., Tinsman, J. C., and Leathem, W. A. 1981b. Vertical migration and mortality of benthos in dredged material: Part II--Crustacea. Marine Environmental Research 5(4):310-317.

Maurer, D., Keck, R. T., Tinsman, J. C., and Leathem, W. A. 1982. Vertical migration and mortality of benthos in dredged material: Part III--Polychaeta. Marine Environmental Research 6(1):49-68.

Maurer, D., R.T. Keck, J.C. Tinsman, and W.A. Leathem. 1986. Vertical migration and mortality of marine benthos in dredged material: a synthesis. *Internationale Revue der Gesamten Hydrobiologie*. 17:49-63.

McCall, P. L. 1978. Spatial-temporal distributions of Long Island Sound infauna: The role of bottom disturbance in a nearshore marine habitat: In: Wiley, M.L. (Ed.). Estuarine Interactions: New York, New York, Academic Press, p. 191-219.

Neff, J.M. 1984. Bioaccumulation of organic micropollutants from sediments and suspended particulates by aquatic animals. *Frescnius Z. Anal. Chem*. 319:132-136.

Newman, M.C. and C.H. Jagoe. 1994. Ligands and the bioavailability of metals in aquatic environments. P. 39-61 in J.L. Hamelink, P.F. Landrum, H.L. Bergman, and W.H. Benson, Eds, Bioavailability. Physical, Chemical, and Biological Interactions. Proceedings of the Thirteenth Pellston Workshop, August 17-22, 1992, Pellston, MI. Lewis Publishers, Boca Raton, FL.

O'Connor, J.M. 1991. Evaluation of Turbidity and Turbidity-Related Effects on the Biota of the San Francisco Bay-Delta Estuary. Submitted to U.S. Army Corps of Engineers, San Francisco District.

Ólafsson, E.B., C.H. Peterson, and W.G. Ambrose, Jr. 1994. Does recruitment limitation structure populations and communities of macro-invertebrates in marine soft sediments: the relative significance of pre- and post-settlement processes. Oceanography and Marine Biology: an Annual Review 32:65-109.

Oeschger, R. 1990. Long-term anaerobiosis in subtidal marine invertebrates from the western Baltic Sea: *Halicryptus spinulosus* (Priapulida), *Astarte borealis* and *Arctica islandica* (Bivalvia). Marine Ecology Progress Series 59:133-143.

Paul, W. 2003. Personal communication.

Peddicord, R.K. 1988. Summary of the U.S. Army Corps of Engineers/U.S. Environmental Protection Agency Field Verification Program. USACEWES Technical Report No. D-88-6. Vicksburg, MS. 46 pp.

Pratt, S.D., S.B. Saila, and M.P. Sissenwine. 1973. Study and Report on Environmental Effects of Dredged Material Rhode Island Sound – Phase III. SR-3.

Pranovi, F., O. Giovanardi, and G. Franceschini. 1998. Recolonization dynamics in areas disturbed by bottom fishing gears. *Hydrobiologia.* 376:125-135.

Rhoads, D.C. 1994. Analysis of the Contribution of Dredged Material to Sediments and Contaminant Fluxes in Long Island Sound. Contribution 88. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers, New England Division. Waltham, MA.

Rhoads, D.C., J.Y. Yingst, and W.J. Ullman. 1978. Seafloor stability in Central Long Island Sound: Part I. Temporal changes in erodibility of fine-grained sediment. In: Wiley, M.L. (Ed.). Estuarine Interactions: New York, New York, Academic Press, p.221-244.

Rhoads, D.C. and J.D. Germano. 1982. Characterization of Organism-sediment Relations using Sediment Profile Imaging: An Efficient Method of Remote Ecological Monitoring of the Seafloor (REMOTS™ System). *Marine Ecology Progress Series*. 8:115-128.

Rhoads, D.C. and J.D. Germano. 1986. Interpreting long-term changes in benthic community structure: a new protocol. *Hydrobiologia*. 142:291-308.

Rhoads, D. C., and D.A. Carey. 1997. Capping dredged materials in the New York Bight: Evaluation of the effects of bioturbation. Science Applications International Corporation Report No. 374, Report No. 39 of the New York Mud Dump Series submitted to the U.S. Army Engineer District, New York.

RIDEM. 2003. DEM Regulations, Air Resources. http://www.state.ri.us/dem/pubs/regs/index.htm#Air. September 11, 2003.

Rosenberg, R., B. Hellman, and B. Johansson. 1991. Hypoxic tolerance of marine benthic fauna. Marine Ecology Progress Series 79:127-131.

Ruggaber, G.J. and E.E. Adams. 2000a. Dynamics of Particle Clouds Related to Open-Water Sediment Disposal: 2. Loss of Material during Convective Descent in: Conference on Dredged Material Management: Options and Environmental Consideration. MIT Sea Grant College Program. Cambridge, MA.

Ruggaber, G.J. and E.E. Adams. 2000b. Dynamics of Particle Clouds Related to Open-Water Sediment Disposal: Sediment Trap Experiments in: Conference on Dredged Material Management: Options and Environmental Considerations. MIT Sea Grant College Program, Cambridge, MA.

Science Applications International Corporation (SAIC). 1988. Distribution of Dredged Material at the Rockland Disposal Sites, May 1985. Contribution 50. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers.

SAIC. 1994. Analysis of the Contribution of Dredged Material to Sediment and Contaminant Fluxes in Long Island Sound. Special Technical Report. Contribution #88. Prepared for the U.S. Army Corps of Engineers, New England District, Waltham, MA. Disposal Area Monitoring System (DAMOS) Report. June 1994.

SAIC. 2001a. Monitoring Cruise at the New London Disposal Site, 1992-1998, Volume I. Contribution 128. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers.

SAIC. 2001b. Monitoring Cruise at the New London Disposal Site, 1992-1998; Volume II, Seawolf Mound. Contribution 132. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers.

SAIC. 2001c. Monitoring Cruise at the New London Disposal Site, August 2000. Contribution 133. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers.

SAIC. 2001d. Monitoring Cruise at the Rockland Disposal Site, September 2000. Contribution 131. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers.

Saila, S.B., S.D. Pratt, and T.T. Polgar. 1971. Providence Harbor - Improvement Spoil Disposal Site Evaluation Study: Phase II. SR-2. Marine Experiment Station, University of Rhode Island. Kingston, RI.

Scorer, R.S. 1957. Experiments on convection of isolated masses of buoyant fluid. *Journal of Fluid Mechanics*. 2:583.

Sissenwine, M. P. and Saila, S. B. 1973. Rhode Island Sound Dredge Spoil Disposal and Trends in the Floating Trap Fishery. SR-4. University of Rhode Island. 103pp.

Spacie, A. and J.L. Hamelink. 1985. Alternative models for describing the bioconcentration of organics by fish. *Environmental Toxicology and Chemistry*. 1:309-320.

Tavolaro, J. 1984. A Sediment Budget Study of Clamshell Dredging and Ocean Disposal Activities in the New York Bight. Environmental Geology 6:133-140.

Taylor, A.C. 1976. Burrowing behavior and anaerobiosis in the bivalve Arctica islandica (L.). *Journal of the Marine Biological Association of the United Kingdom.* 56:95-109.

Tsai, J.J. and J.R. Proni. 1985. Acoustic Study of Dredged-Material Dumping in the New York Bight. Pages 357-381 in: Ketchum, B.H., J.M. Capuzzo, W.V. Burt, I.W. Duedall, P.K. Park, and D.R. Kester, (Eds.), Wastes in the Ocean. Volume 6: Nearshore Waste Disposal. John Wiley and Sons, New York, NY.

Williams, R.G. 1969. Physical Oceanography of Block Island Sound. USL Report No.966. U.S. Navy Underwater Sound Laboratory. Fort Trumbull, New London, CT.

Woodward, B. 1959. Motion in and around isolated thermals. *Quarterly Journal of the Royal Meteorological Society*. 85:154.

Wright, T.D. 1978. Aquatic Dredged Disposal Impacts. Technical Report DS-78-1. Chief of Engineers Office, U.S. Army. Washington DC. 57 pp.

Zajac, R.N. and R.B. Whitlatch. 1988. Population ecology of the polychaete *Nephtys incisa* in Long Island Sound and the effects of disturbance. Estuaries 11(2):117-133.

Zajac, R.N. and R.B. Whitlatch. 1989. Natural and disturbance induced demographic variation in an infaunal polychaete, *Nephtys incisa*. Marine Ecology Progress Series 57:89-102.

SECTION 5: SURVEILLANCE AND MONITORING

None

SECTION 6: AGENCY COORDINATION AND COMPLIANCE

Bourne, B.W. and J.J. Govoni. 1988. Distribution of fish eggs and larvae and patterns of water circulation in Narragansett Bay, 1972 – 1973. *American Fisheries Society Symposium* Vol. 3: 132 – 148.

Corps. 2001a. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers, New England Division. Concord, MA.

Corps. 2001b. Essential Fish Habitat Assessment. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix O. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers. May 2001.

Corps. 2003a. Memorandum for Record. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project – Site Screening Presentation to Cooperating Agencies, May 15, 2003.

Corps. 2003b. Memorandum for Record. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project – Site Finalization Presentation to Cooperating Agencies, September 8, 2003.

Corps. 2003c. Survey Report for the Rhode Island Region Side-Scan Sonar and Bathymetric Survey. Prepared under Contract No. DACW33-01-D-0004 by SAIC and Battelle for the U.S. Army Corps of Engineers, New England District. SAIC Report No. 645. 24pp. November 2003.

Corps. 2004. Historic Shipwreck Background Study. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by UMASS Archeological Services for the U.S. Army Corps of Engineers. April 2004.

Keller, A.A., G Klein-MacPhee, and J. St. Onge Burns. 1999. "Abundance and Distribution of Ichthyoplankton in Narragansett Bay, Rhode Island, 1989 – 1990." *Estuaries,* Vol. 22, No.1, pp 149 – 163.

Marine Research Inc. (MRI). 1996. Aquatic Ecology Studies in the Providence and Seekonk Rivers in the Vicinity of the Manchester Street Repowering Project, April – October 1995. Submitted to Narragansett Electric Company and New England Power Company, Westborough, MA

Marine Research Inc. (MRI). 1997. Aquatic Ecology Studies in the Providence and Seekonk Rivers in the Vicinity of the Manchester Street Repowering Project, April – October 1996. Submitted to Narragansett Electric Company and New England Power Company, Westborough, MA

Marine Research Inc. (MRI). 1998. Aquatic Ecology Studies in the Providence and Seekonk Rivers in the Vicinity of the Manchester Street Repowering Project, April – October 1997. Submitted to Narragansett Electric Company and New England Power Company, Westborough, MA

Marine Research Inc. (MRI). 1999. Aquatic Ecology Studies in the Providence and Seekonk Rivers in the Vicinity of the Manchester Street Repowering Project, April – October 1998. Submitted to Narragansett Electric Company and New England Power Company, Westborough, MA

Marine Research Inc. (MRI). 2000. Aquatic Ecology Studies in the Providence and Seekonk Rivers in the Vicinity of the Manchester Street Repowering Project, April – October 1999. Submitted to Narragansett Electric Company and New England Power Company, Westborough, MA

SECTION 7: PUBLIC INVOLVEMENT

Coastal Institute, University of Rhode Island (URI). 2003a. Working Group Meeting Minutes [Online]. Available http://www.ci.uri.edu/projects/dd.

Coastal Institute, University of Rhode Island (URI). 2003b. *Coastal Institute Working Group Review of the Siting Criteria for an Offshore Long-Term Dredged Material Disposal Site(s) for the Rhode Island Region, Final Report on Working Group Meetings* (August 2003) [Online]. Available http://www.ci.uri.edu/projects/dd.

Corps. 2002a. Task 12F Dredging Needs Study. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle and the Maguire Group Inc. for the U.S. Army Corps of Engineers. November 2002.

Corps. 2002b. Task 13 Zone of Siting Feasibility. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by the Maguire Group Inc. for the U.S. Army Corps of Engineers. September 2002.

EPA and Corps. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual. EPA Report No. EPA-503-8-91/001. Available http://www.epa.gov/OWOW/oceans/gbook/index.html. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection and Department of the Army, U.S. Army Corps of Engineers. Washington, DC.

10.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS WHO WERE NOTIFIED OF OPPORTUNITY FOR PUBLIC COMMENT

UNITED STATES SENATORS

Honorable Lincoln Chafee
United States Senate
505 Dirksen Senate Office Building
Washington, DC 20510-3902

Honorable Lincoln Chafee
United States Senate
170 Westminster Street
Suite 1100
Providence, RI 02903

Honorable Edward Kennedy
United States Senate
2400 JFK Building
Boston, MA 02203

Honorable John Kerry
United States Senate
222 Milliken Place
Suite 311
Fall River, MA 02722

Honorable Jack Reed
United States Senate
1 Exchange Terrace
418 Federal Building
Providence, RI 02903

Honorable Jack Reed
United States Senate
339 Russell Senate Office Building
Washington, DC 20510-3901

UNITED STATES CONGRESSMEN

Honorable William Delahunt
146 Main Street
Suite 200
Hyannis, MA 02601

Honorable Barney Frank
558 Pleasant Street
Room 309
New Bedford, MA 02740

Honorable Patrick Kennedy
U.S. House of Representatives
249 Roosevelt Ave.
Suite 200
Pawtucket, RI 02860

Honorable Patrick Kennedy
U.S. House of Representatives
312 Cannon House Office Building
Washington, DC 20515-3902

Honorable James Langevin
U.S. House of Representatives
300 Centerville Road
Summit West Suite 205
Warwick, RI 02886

Honorable James Langevin
U.S. House of Representatives
507 Cannon House Office Building
Washington, DC 20515-3902

STATE GOVERNORS

Governor Donald Carcieri
Office of the Governor
State House
Room 115
Providence, RI 02903

Governor Mitt Romney
Office of the Governor
State House
Room 360
Boston, MA 02133

STATE ELECTED OFFICIALS

Honorable Edith Ajello
RI House of Representatives
29 Benefit Street
Providence, RI 02904

Honorable Dennis Algiere
Rhode Island State Senate
6 Elm St.
Westerly, RI 02891

Honorable Joseph Almeida
RI House of Representatives
299 California Ave.
Providence, RI 02905

Honorable Joseph Amaral
RI House of Representatives
27 Linda Rd.
Tiverton, RI 02878

Honorable Fausto Anguilla
RI House of Representatives
55 Peck Ave.
Bristol, RI 02809

Honorable David Bates
Rhode Island State Senate
65 Primrose Hill Road
Barrington, RI 02806

Honorable Melvoid Benson
RI House of Representatives
70 Shore Acres Ave.
North Kingstown, RI 02852

Honorable Maxine Bradford-Shavers
RI House of Representatives
16 Heath St.
Newport, RI 02840

Honorable Kevin Breene
Rhode Island State Senate
21-D Victory Highway
West Greenwich, RI 02817

Honorable Christine Callahan
RI House of Representatives
5 Cedar Ave.
Middletown, RI 02842

Honorable David Caprio
RI House of Representatives
545 Ocean Rd.
Narragansett, RI 02882

Honorable Frank Caprio
Rhode Island State Senate
29 Jones Street
Providence, RI 02903

Honorable Kenneth Carter
RI House of Representatives
325 Railroad Ave.
Saunderstown, RI 02874

Honorable Mary Cerra
RI House of Representatives
975 Atwood Ave.
Johnston, RI 02919

Honorable Frank Ciccone III
Rhode Island State Senate
15 Mercy St.
Providence, RI 02909

Honorable Elaine Coderre
RI House of Representatives
18 Angle St.
Pawtucket, RI 02860

Honorable Brian Coogan
RI House of Representatives
172 Grove Ave.
East Providence, RI 02914

Honorable Robert Correia
Mass. House of Representatives
State House
Room 122
Boston, MA 02133

Honorable Steven Costantino
RI House of Representatives
120 Courtland St.
Providence, RI 02909

Honorable Paul Crowley
RI House of Representatives
29 Harrison Ave.
Newport, RI 02840

Honorable Michael Damiani
Rhode Island State Senate
887 Willet Avenue
Riverside, RI 02915

Honorable Daniel DaPonte
Rhode Island State Senate
116 Ivy St.
East Providence, RI 02914

Honorable Elizabeth Dennigan
RI House of Representatives
54 Horsford Avenue
East Providence, RI 02916

Honorable John DeSimone
RI House of Representatives
735 Smith St.
Providence, RI 02908

Honorable William Enos
RI House of Representatives
4230 Main Rd.
Tiverton, RI 02878

Honorable Walter Felag Jr.
Rhode Island State Senate
51 Overhill Rd.
Warren, RI 02885

Honorable Robert Flaherty
RI House of Representatives
936 Buttonwoods Avenue
Warwick, RI 02886

Honorable Gordon Fox
RI House of Representatives
323 State House
Providence, RI 02906

Honorable Raymond Gallison Jr.
RI House of Representatives
50 King Philip Ave.
Bristol, RI 02809

Honorable Hanna Gallo
Rhode Island State Senate
23 Rushkin St.
Cranston, RI 02910

Honorable Joanne Giannini
RI House of Representatives
584 Pleasant Valley Pkwy
Providence, RI 02908

Honorable June Gibbs
Rhode Island State Senate
163 Riverview Ave.
Middletown, RI 02842

Honorable Peter Ginaitt
RI House of Representatives
177 Hope Avenue
Warwick, RI 02889

Honorable Maryellen Goodwin
Rhode Island State Senate
325 Smith Street
Providence, RI 02908

Mr. Clark Green
Office of the Governor
State House
Room 143
Providence, RI 02903

Honorable Patricia Haddad
MA House of Representatives
State House
Room 167
Boston, MA 02133

Honorable Arthur Handy
RI House of Representatives
26 Welfare Ave.
Cranston, RI 02910

Honorable John Harwood
RI House of Representatives
72 Capwell Ave.
Pawtucket, RI 02860

Honorable Mark Howland
MA House of Representatives
State House
Room 443
Boston, MA 02133

Honorable Daniel Issa
Rhode Island State Senate
1140 Lonsdale Ave.
Central Falls, RI 02863

Honorable Robert Jacquard
RI House of Representatives
34 Sagamore Rd.
Cranston, RI 02910

Honorable Brian Kennedy
RI House of Representatives
P.O. Box 1001
Ashaway, RI 02804

Honorable Peter Kilmartin
RI House of Representatives
598 Armistice Blvd.
Pawtucket, RI 02861

Honorable Robert Koczera
MA House of Representatives
38 State House
Boston, MA 02133

Honorable Donald Lally Jr.
RI House of Representatives
19 Oak St.
Wakefield, RI 02879

Honorable N. Landroche Jr.
RI House of Representatives
88 Silverwood Lane
West Warwick, RI 02893

Honorable Beatrice Lanzi
Rhode Island State Senate
70 Scituate Farms Dr.
Cranston, RI 02921

Honorable J. Lenihan
Rhode Island State Senate
255 Tillinghast Road
East Greenwich, RI 02818

Honorable Peter Lewiss
RI House of Representatives
79 Franklin St.
Westerly, RI 02891

Honorable Charlene Lima
RI House of Representatives
301 State House
Providence, RI 02903

Honorable Bruce Long
RI House of Representatives
9 Wood Rd.
Middletown, RI 02842

Honorable Jan Malik
RI House of Representatives
23 Hezekiah Dr.
Warren, RI 02885

Honorable John McBurney III
Rhode Island State Senate
5 Nancy St.
Pawtucket, RI 02860

Honorable Michael McCaffrey
Rhode Island State Senate
115 Twin Oak Dr.
Warwick, RI 02889

Honorable John McCauley Jr.
RI House of Representatives
71 Common Street
Providence, RI 02908

Honorable Matthew McHugh
RI House of Representatives
91 Seabreeze Terr.
South Kingstown, RI 02879

Honorable William McManus
RI House of Representatives
57 Rockridge Rd.
Lincoln, RI 02865

Honorable Joseph McNamara
RI House of Representatives
23 Howie Avenue
Warwick, RI 02888

Honorable Joan Menard
Massachusetts State Senate
State House
Room 216
Boston, MA 02133

Honorable Joseph Montalbano
Rhode Island State Senate
10 Gale Court
North Providence, RI 02904

Honorable Frank Montanaro
RI House of Representatives
214 Locust Glen Dr.
Cranston, RI 02921

Honorable Paul Moura
RI House of Representatives
144 George M. Cohan Blvd.
Providence, RI 02903

Honorable Carol Mumford
RI House of Representatives
141 Betty Pond Rd.
Hope, RI 02831

Honorable William Murphy
RI House of Representatives
323 State House
Providence, RI 02903

Honorable Eileen Naughton
RI House of Representatives
100 Old Homestead Road
Warwick, RI 02889

Honorable Robert O'Leary
Massachusetts State Senate
State House
Boston, MA 02133

Honorable Marc Pacheco
Massachusetts State Senate
State House
Room 312-B
Boston, MA 02133

Honorable M. Paiva-Weed
Rhode Island State Senate
43 Thurston Ave.
Newport, RI 02840

Honorable Peter Palumbo
RI House of Representatives
67 Kearney St.
Cranston, RI 02920

Honorable Mary Parella
Rhode Island State Senate
249 High St.
Bristol, RI 02809

Mr. Kenneth Payne
Senate Policy Office
State House
Room 145
Providence, RI 02903

Mr. Kenneth Payne
Senate Policy Office
20 Elton Street
Providence, RI 02906

Honorable Rhoda Perry
Rhode Island State Senate
916-918 Hope Street
Providence, RI 02906

Honorable Juan Pichardo
Rhode Island State Senate
229 Atlantic Ave.
Providence, RI 02907

Honorable John Quinn
MA House of Representatives
State House
Room 42
Boston, MA 02133

Honorable Leonidas Raptakis
Rhode Island State Senate
2080 Nooseneck Hill Rd.
Coventry, RI 02816

Honorable John Revens Jr.
Rhode Island State Senate
250 Burt St.
Warwick, RI 02886

Honorable Elizabeth Roberts
Rhode Island State Senate
254 Norwood Ave.
Cranston, RI 02905

Honorable Michael Rodrigues
MA House of Representatives
State House
Room 43
Boston, MA 02133

Honorable Henry Rose
RI House of Representatives
245 Warren Ave.
East Providence, RI 02914

Honorable Dominick Ruggerio
Rhode Island State Senate
1046 Douglas Avenue
Providence, RI 02904

Honorable William San Bento Jr.
RI House of Representatives
25 Nathanael Ave.
Pawtucket, RI 02860

Senator Eleanor Sasso
Secretary Comm. Special Legislation
District #14 60 Glenmere Dr.
Cranston, RI 02920

Honorable John Savage
RI House of Representatives
126 Thurston St.
East Providence, RI 02915

Honorable Joseph Scott
RI House of Representatives
410 Kingston Rd.
West Kingstown, RI 02892

Honorable John Shanley Jr.
RI House of Representatives
29 Briarwood Dr.
South Kingstown, RI 02879

Honorable James Sheehan
Rhode Island State Senate
40 Blueberry Lane
North Kingstown, RI 02852

Honorable Thomas Slater
RI House of Representatives
70 Sawyer Street
Providence, RI 02907

Honorable Steven Smith
RI House of Representatives
20 Neutaconkanut Rd.
Providence, RI 02909

Honorable V. Sosnowski
Rhode Island State Senate
680 Glen Rock Road
West Kingston, RI 02892

Honorable Susan Story
RI House of Representatives
26 Broadview Dr.
Barrington, RI 02806

Honorable David Sullivan
MA House of Representatives
State House
Room 39
Boston, MA 02133

Honorable Paul Tavares
General Treasurer
102 State House
Providence, RI 02903

Honorable Leon Tejada
RI House of Representatives
197 Calla St.
Providence, RI 02905

Honorable Philip Travis
MA House of Representatives
State House
Room 236
Boston, MA 02133

Honorable Joseph Trillo
RI House of Representatives
19 Gilbert Stuart Dr.
Warwick, RI 02818

Honorable William Walaska
Rhode Island State Senate
140 Aldrich Avenue
Warwick, RI 02889

Honorable Peter Wasylyk
RI House of Representatives
164 Hillcrest Avenue
Providence, RI 02909

Honorable Robert Watson
RI House of Representatives
103 South Pierce Road
East Greenwich, RI 02818

Honorable Sheldon Whitehouse
Attorney General
150 S. Main St.
Providence, RI 02903

Ms. Sandra Whitehouse
RI House of Representatives
State House
Room B07A
Providence, RI 02903

Honorable Anastasia Williams
RI House of Representatives
32 Hammond St.
Providence, RI 02909

FEDERAL AGENCIES

Ms. Lois Adams
U.S. Environmental Protection Agency
JFK Federal Building
Rhode Island State Office
Boston, MA 02203-2211

Mr. Michael Bartlett
U.S. Fish & Wildlife Service
70 Commercial St.
Suite 300
Concord, NH 03301-4901

Mr. Walter Berry
U.S. Environmental Protection Agency
27 Tarzwell Drive
Narragansett, RI 02882

Mr. Bruce Blanchard
U.S. Department of the Interior
Office of Environmental Project Review
Washington, DC 20240

LT. Casey Chmielewski
Waterways Management Officer
MSO Providence
20 Risho Ave.
East Providence, RI 02914

First Coast Guard District
408 Atlantic Ave
Boston, MA 02110-3350

Ms. Betsy Higgins
U.S. Environmental Protection Agency
Environmental Review Program
JFK Federal Building
Boston, MA 02203-2211

Mr. Peter Holmes
U.S. Environmental Protection Agency
JFK Federal Building
Boston, MA 02203-2211

Mr. Lief Horwitz
NOAA/OSDIA US Dept. of Commerce
Room 5222
Washington, DC 20230

Mr. Paul Howard
New England Fisheries Management Council
50 Water Street Mill 2
Newburyport, MA 01950

Dr. Norbert Jaworski
Environmental Research Laboratory
U.S. Environmental Protection Agency
27 Tarzwell Drive
Narragansett, RI 02882

Ms. Kimberlee Keckler
U.S. Environmental Protection Agency
1 Congress Street
Suite 1100
Boston, MA 02114

Captain Mary Landry
U.S. Coast Guard
Marine Safety Office
20 Risho Avenue
East Providence, RI 02914

Mr. Vern Lang
U.S. Fish and Wildlife Service
70 Commercial Street
Concord, NH 03301

Ms. Nancy Langrall
U.S. District Courthouse
Senator Jack Reed's Office
One Exchange Terrace
Suite 408
Providence, RI 02903-1773

Mr. Edward LeBlanc
U.S. Coast Guard
Marine Safety Office
20 Risho Ave.
East Providence, RI 02914

Mr. Gordon Leich
U.S. Department of the Interior
Office of Environmental Policy
1849 C Street NW
Room 2340
Washington, DC 20240

Mr. Michael Ludwig
National Marine Fisheries Service
212 Rogers Avenue
Milford, CT 06460-6498

Mr. Francis Mardula
U.S. Department Of Transportation
400 7th Street SW
Room 7221
Washington, DC 20590

Ms. Peg Nelson
U.S. Environmental Protection Agency
New England Region
1 Congress Street
Suite 1100 - EPA Library
Boston, MA 02114-2023

Mr. Tom O'Connor
Noaa-Orca-21
1305 East West Highway
Silver Springs, MD 20910

Mr. Douglas Pabst
U.S. Environmental Protection Agency
290 Broadway
New York, NY 10007

Mr. Eric Palola
National Wildlife Federation
Northeast Field Office
58 State Street
Montpelier, VT 05602

Ms. Margherita Pryor
Oceans and Coastal Protection Div.
U.S. Environmental Protection Agency
401 M Street SW
Mail Code 4504f
Washington, DC 20960

Mr. Andrew Raddant
U.S. Department of the Interior
Office of Environ. Policy/Compliance
408 Atlantic Ave
Room 142
Boston, MA 02210-3334

Dr. Andy Rosenberg
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930-2298

Dr. Norman Rubenstein
U.S. Environmental Protection Agency
27 Tarzwell Drive
Narragansett, RI 02882

Stellwagen Bank NMS
175 Edwards Foster Rd.
Scituate, MA 02066

U.S. Coast Guard
Marine Safety Office
20 Risho Ave.
East Providence, RI 02914

U.S. Coast Guard
Marine Safety Office
455 Commercial St.
Boston, MA 02109-1096

U.S. Environmental Protection Agency
Office of Federal Activities (A-104)
401 M Street SW
Washington, DC 20460

Ecology and Conservation
National Oceanic and Atmospheric Administration
Department of Commerce
14th and Constitution Avenue, NW
Washington, DC 20230

TRIBES

Ms. Dinalyn Audette
Narragansett Indian Tribe
P.O. Box 268
Charlestown, RI 02813

Mr. John Brown
Narragansett Indian Tribe
P.O. Box 90
Wyoming, RI 02898

Chief Sachem Thomas
Narragansett Indian Tribe
P.O. Box 268
Charlestown, RI 02813

Ms. Beverly Wright
Wampanoag Tribe of Gay Head
20 Blackbrook Rd.
Chilmark, MA 02535

STATE AGENCIES

Mr. Thomas Angell
RIDEM/Fish & Wildlife/Marine Fisheries
3 Fort Wetherill Road
Jamestown, RI 02835

Mr. William Ankner
Department of Transportation
Two Capitol Hill
Providence, RI 02903

Mr. Deerin Babb-Brott
MA Coastal Zone Management Office
251 Causeway Street
Suite 800
Boston, MA 02114

Mr. David Borden
Rhode Island Marine Fisheries Council
RI DEM
235 Promenade Street
Providence, RI 02908-5767

Mr. David Chopy
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02908

Mr. Thomas Conboy
RI Dept of Transportation
Two Capitol Hill
Room 372
Providence, RI 02903

Ms. June Conradi
Rhode Island Marine Trades Association
44 Avondale Road
Westerly, RI 02891

Ms. Mary Cooper
RI Economic Development Corp
One West Exchange Street
Providence, RI 02903

Ms. Kristin Decas
Massachusetts Seaport Council
40 Center Street
Fairhaven, MA 02719

Mr. George Dimuro
Coastal Resources Management Council
Oliver H Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879-1900

Mr. Paul Diodati
Division of Marine Fisheries
251 Causeway Street
Suite 400
Boston, MA 02114

Mr. Robert Durand
Executive Office of Environmental Affairs
251 Causeway Street
9th Floor
Boston, MA 02114

Mr. Thomas Epstein
Rhode Island Department of Environmental Management
291 Promenade Street
Providence, RI 02908

Mr. Grover Fugate
Coastal Resources Management Council
Oliver H Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879-1900

Mr. Ronald Gagnon
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02908

Mr. Art Ganz
Marine Fisheries Section
3 Fort Wetherill Rd.
Jamestown, RI 02835

Mr. Robert Golledge Jr.
Department of Environmental Protection
One Winter Street
Boston, MA 02108-4746

Ms. Alicia Good
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02908

Mr. Dan Goulet
Coastal Resources Management Council
Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879

Mr. Roger Greene
Rhode Island Department of Environmental Management
235 Promenade Street
4th Floor
Providence, RI 02908

Mr. M. Holland
Rhode Island Department of Transportation
Office of Environmental & Intermodal Planning
2 Capitol Hill
Room 368
Providence, RI 02903-1124

Ms. Joyce Karger
RI Statewide Planning Program
One Capitol Hill
Providence, RI 02908

Ms. Alicia Karpick
Environmental Council of Rhode Island
P.O. Box 9061
Providence, RI 02940

Ms. Marjorie Keefe
RI Dept of Transportation
2 Capitol Hill Rm 344
Providence, RI 02903

Ms. Jean Lambert
Rhode Island Department of Environmental Management
291 Promendade Street
Providence, RI 02908

J. Luchka
RI Economic Development Corp
30 Enterprise Dr.
N. Kingston, RI 02852

Mr. Andrew MacCleod
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02908

Mr. Vin Malkoski Sr.
MA Division of Marine Fisheries
50A Portside Drive
Pocasset, MA 02559

Mr. George Mason
Governors Office
State House
Providence, RI 02903-1196

Ms. Sherry Mulhearn
Rhode Island Resource Recovery Corporation
65 Shun Pike
Johnston, RI 02919-4512

Mr. John Mullen
Department of Health
3 Capitol Hill
Rm 203
Providence, RI 02908

Dr. Patricia Nolan
Rhode Island Department of Health
3 Capitol Hill
Providence, RI 02908

Mr. Robert O'Connor
Watersheds and Land Policy
251Causeway Street
Suite 900
Boston, MA 02114

Mr. William Parsons
Rhode Island Economic Development Corporation
One West Exchange St.
Providence, RI 02903

Mr. Paul Robinson
RI Historical Preservation & Heritage Commission
Old State House
150 Benefit Street
Providence, RI 02903

Mr. Jim Saletnik
RI Economic Development Corp
1 West Exchange Street
Providence, RI 02903

Ms. Beverly Scott
Rhode Island Public Transit Authority
265 Melrose Place
Providence, RI 02907

Mr. Anthony Simeone
Clean Water Finance Agency
235 Promenade Street
Suite 119
Providence, RI 02908

Mr. Brian Tefft
RI Div. of Fish and Wildlife
P.O. Box 218
W. Kingston, RI 02892

Mr. Michael Tikoian
Coastal Resources Management Council
Oliver H Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879-1900

Ms. Robin Wallace
Rhode Island State Yachting Commission
P.O. Box 3673
Newport, RI 02840

Mr. Jeff Willis
Coastal Resources Management Council
Oliver H Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879-1900

MUNICIPAL GOVERNMENT

Acushnet Town Hall
122 Main Street
Acushnet, MA 02743

Mayor Scott Avedisian
Warwick City Hall
3275 Post Road
Warwick, RI 02886

Ms. Martha Ball
Town of New Shoreham
P.O. Drawer 220
Block Island, RI 02807

Mr. Charles Bradley
Marion Harbormaster
Marion Townhouse
2 Spring Street
Marion, MA 02738

Ms. Susan Cabeceiras
City of Warwick
Planning Department
3275 Post Road
Warwick, RI 02886

Mr. Christopher Capone
Conservation Agent
Westport Town Hall
816 Main Road
Westport, MA 02790

Mr. Mark Carruoo
Warwick Planning Dept.
3275 Post Road Annex
Warwick, RI 02886

Ms. Becky Cipriani
North Kingstown Conservation
55 Brown Street
North Kingstown, RI 02852

Mr. Larry Constantine
Harbormaster
Town of New Shoreham
P.O. Drawer 220
Block Island, RI 02807

Mr. John Demello
Conservation Commission
Mattapoisett Town Hall
P.O. Box 435
16 Main Street
Mattapoisett, MA 02739

Mr. William DePasquale
Warwick Planning Dept.
3275 Post Road Annex
Warwick, RI 02886

Mr. Richard Earle
Westport Harbormaster
Westport Town Hall
816 Main Road
Westport, MA 02770

East Providence City Hall
145 Taunton Avenue
East Providence, RI 02914

Edgartown Town Dock
P.O. Box 739
Foot of Main St.
Edgartown, MA 02539

Mr. Wayne Fostin
Building Commissioner
Fairhaven Town Hall
40 Center Street
Fairhaven, MA 02719

Mr. Gerald Franklin
Conservation Commission
Dartmouth Town Hall
P.O. Box 9399
400 Slocum Road
North Dartmouth, MA 02747

Mr. David Fronzuto
Town of Nantucket
Marine & Coastal Resourses Dept.
34 Washington St.
Nantucket, MA 02554

Mr. Gary Golas
Fairhaven Harbormaster
Fairhaven Public Works
Arsene Street
Fairhaven, MA 02719

Mr. Leonard Gonsalves
Town of Dartmouth
Town Hall
P.O. Box 79399
N. Dartmouth, MA 02747

Ms. Roberta Groch
City of Providence
Dept. of Planning and Development
400 Westminster St.
Providence, RI 02903

Mr. John Gurney
Conservation Commission
New Bedford City Hall
133 William St.
New Bedford, MA 02740

Mr. Robert Hamilton
Board of Selectmen
Fairhaven Town Hall
40 Center Street
Fairhaven, MA 02719

Mr. Everett Hardy Jr.
Board of Selectmen
Acushnet Town Hall
122 Main Street
Acushnet, MA 02743

Mr. Joel Hartley
Conservation Commission
Marion Town Hall
2 Spring Street
Marion, MA 02738

Mr. Calvin Hopkinson
Conservation Commission
Westport Town Hall
816 Main Road
Westport, MA 02790

Mr. Paul Lambalot
Board of Selectmen
Mattapoisett Town Hall
P.O. Box 435
16 Main Street
Mattapoisett, MA 02739

Mr. Denis Lawrence Jr.
City Council
New Bedford City Hall
1000 South Rodney French Blvd.
New Bedford, MA 02744

Ms. Elizabeth Leighold
Conservation Agent
New Bedford City Hall
1000 South Rodney French Blvd.
New Bedford, MA 02744

Mr. Steven Mach
Harbormaster
Mattapoisett Town Hall
P.O. Box 435
16 Main Street
Mattapoisett, MA 02739

Martha's Vineyard Commission
P.O. Box 1477
Oak Bluffs, MA 02557

Mr. James Mathes
New Bedford Area Chamber of Commerce
794 Purchase Street
New Bedford, MA 02740

Mr. Clarence Merrit
Bourne Harbormaster
Town Hall
24 Perry Ave.
Buzzards Bay, MA 02532

Mr. Greg Montagur
Harbormaster
Falmouth Town Hall
59 Town Hall Square
Falmouth, MA 02540

Nantucket Town Pier
34 Washington St.
Nantucket, MA 02554

New Bedford City Hall
133 William Street
New Bedford, MA 02740

North Kingstown Town Hall
55 Brown Street
North Kingstown, RI 02852

Oak Bluff Conservation Commission
P.O. Box 1327
Oak Bluffs, MA 02557

Mr. Mike O'Riely
Conservation Agent
Dartmouth Town Hall
P.O. Box 9399
400 Slocum Road
North Dartmouth, MA 02747

Mr. Kenneth Pacheco
Dartmouth Harbormaster
Dartmouth Town Hall
400 Slocum Road
N. Dartmouth, MA 02747

Mr. Michael Parola
Wareham Harbormaster
Wareham Town Hall
54 Marion Road
Wareham, MA 02571

Mr. Fred Pease
Jamestown Town Council
29 Maple Drive
Jamestown, RI 02835

Mr. Robert Perault
Board of Selectmen
Dartmouth Town Hall
P.O. Box 9399
400 Slocum Road
North Dartmouth, MA 02747

Mr. Paul Picard
Conservation Commission
Acushnet Town Hall
122 Main Street
Acushnet, MA 02743

Mr. Dave Pichette
Wareham Town Hall
54 Marion Road
Wareham, MA 02571

Portsmouth Town Hall
2200 East Main Road
Portsmouth, RI 02871

Mr. John Simpson
New Bedford Harbor Development Commission
P.O. Box 50899
New Bedford, MA 02740

South Kingstown Town Hall
66 High Street
Wakefield, RI 02879

Ms. Sarah Storer
Acushnet Town Hall
122 Main Street
Acushnet, MA 02743

Town of Johnston
1385 Hartford Avenue
Johnston, RI 02919

Town of Westport
816 Main Rd.
Westport, MA 02790

Mr. Stephen Tripp
Board of Selectmen
Westport Town Hall
816 Main Road
Westport, MA 02790

Mr. Marinus Vander Pol Jr.
Conservation Commission
Fairhaven Town Hall
40 Center Street
Fairhaven, MA 02719

Mr. Douglas Westgate
Conservation Commission
Wareham Town Hall
54 Marion Road
Wareham, MA 02571

Mr. Albert Winters
Board of Selectmen
Marion Town Hall
2 Spring Street
Marion, MA 02738

Ms. Sarah Woods
Board of Selectmen
Wareham Town Hall
54 Marion Road
Wareham, MA 02571

LIBRARIES

Barrington Public Library
281 County Rd.
Barrington, RI 02806

Berkley Public Library
1 North Main St.
Berkley, MA 02779

Brownell Library
Commons
Little Compton, RI 02837

Cranston Public Library
140 Sockanosset Cross Rd.
Cranston, RI 02920

Cross Mills Public Library
4417 Old Post Rd.
Charlestown, RI 02813

Davisville Free Library
481 Davisville Rd.
North Kingstown, RI 02852

Dighton Public Library
395 Main St.
Dighton, MA 02715

East Greenwich Free Library
82 Pierce St.
East Greenwich, RI 02818

East Providence Public Library
41 Grove Ave.
East Providence, RI 02914

Ecology Division Library
U.S. Environmental Protection Agency
27 Tarzwell Drive
Narragansett, RI 02882

Essex Public Library
238 Highland Rd.
Tiverton, RI 02878

Fall River Public Library
104 North Main St.
Fall River, MA 02720

George Hail Free Library
530 Main St.
Warren, RI 02885

Island Free Library
P.O. Box 1830
Dodge St.
Block Island, RI 02807

James White Memorial Library
5 Washburn Rd.
East Freetown, MA 02717

Jamestown Philomenian Library
26 North Rd.
Jamestown, RI 02835

Kingston Free Library
2605 Kingstown Rd.
Kingston, RI 02881

Middletown Public Library
700 West Main Rd.
Middletown, RI 02842

Narragansett Public Library
35 Kingston Rd.
Narragansett, RI 02882

Newport Public Library
300 Spring St.
Aquidneck Park
Newport, RI 02840

North Kingstown Free Library
100 Boone St.
North Kingstown, RI 02852

Pawtucket Public Library
13 Summer St.
Pawtucket, RI 02860

Pell Marine Science Library
Ms. Roberta Doran
University of Rhode Island
URI Bay Campus Box 55
South Ferry Road
Narragansett, RI 02882

Pontiac Free Library
101 Greenwich Ave.
Warwick, RI 02886

Portsmouth Free Public Library
2658 East Main Rd.
Portsmouth, RI 02872

Providence Public Library
225 Washington St.
Providence, RI 02903

Rhode Island State Library
R. Evans
State House
Room 208
Providence, RI 02903

Robert Beverly Hale Library
2601 Commodore Perry Highway
Wakefield, RI 02879

Rogers Free Library
525 Hope St.
Brisol, RI 02809

Somerset Public Library
1464 County St.
Somerset, MA 02726

South Kingstown Public Library
1057 Kingstown Rd.
Peace Dale, RI 02879

Swansea Free Public Library
69 Main St.
Swansea, MA 02777

Warwick Public Library
600 Sandy Lane
Warwick, RI 02889

Westerly Public Library
44 Broad St.
Westerly, RI 02891

Willett Free Library
45 Ferry Rd.
Saunderstown, RI 02874

PUBLIC

Mr. Bill Adler
8 Otis Place
Scituate, MA 02066

Mr. Charles Allott
37 Hilltop Drive
Portsmouth, RI 02871

Mr. Jim Bajek
Normandeau Assoc.
25 Nashua Road
Bedford, NH 03110

Mr. Bruce Banks
Ocean Technology Foundation
40 Howland Avenue
Jamestown, RI 02835

Barden's Boat Yard
P.O. Box 577
Marion, MA 02738

Barnstable Marine Service
P.O. Box 366
Barnstable Harbor
Barnstable, MA 02630

Barnstable Yacht Club
P.O. Box 80
Barnstable, MA 02630

Bass River Yacht Club
Pleasant St.
Bass River, MA 02664

Mr. Dan Baudouin
30 Exchange Terrace
Providence, RI 02903

Mr. Chris Baxter
University of Rhode Island
Dept.Ocean Engineering
Narragansett, RI 02882

Ms. Nancy Beattie
300 Centerville Rd.
Suite 200 South
Warwick, RI 02886

Mr. John Beebe-Center
25 West Side Road
Wakefield, RI 02879

Mr. Donald Belanger
P.O. Box 9248
Providence, RI 02940

Beverly Yacht Club
P.O. Box 181
Marion, MA 02738

Dr. Jon Boothroyd
University of Rhode Island
9 East Alum
314 Woodward Hall
Kingston, RI 02881

Mr. Ralph Boragine
Rhode Island Seafood Council
10 Tarpon lane
Charlestown, RI 02813

Borden Light Marina
One Ferry St.
Fall River, MA 02721

Mr. Peter Borrelli
Center for Coastal Studies
P.O. Box 1036
Provincetown, MA 02657

Ms. Bonnie Brady
Long Island Commercial Fishing
Association
5 Midland Rd.
Montauk, NY 11954

Dr. Dominique Brocard
Metcalf and Eddy, Inc.
P.O. Box 4043
Woburn, MA 01880-4043

Mr. Pete Brodeur
F/V Wendy Gail
One Hahn Avenue
Wakefield, RI 02879

Ms. Priscilla Brooks
Conservation Law Foundation
CLF Boston Advocacy Center
62 Summer St.
Boston, MA 02110-1016

Mr. Christopher Brown
Rhode Island Commercial Fishermen's
Association
35 Erica Ct.
West Kingston, RI 02892

Burr Brothers Boats, Inc.
309 Front St.
Marion, MA 02738

Mr. Richard Burroughs
University of Rhode Island
CELS - MAF
Washburn Hall
Kingston, RI 02881

Cape Cod Commission
P.O. Box 226
3225 Main St.
Barnstable, MA 02630

Cape Cod Shipbuilding Co.
P.O. Box 152
Wareham, MA 02571

Capt. Joseph J. O’Connell Co.
180 River St.
Fall River, MA 02720

Capt. Leroy Deep Sea Fishing
Marine Park One
Pope's Island
New Bedford, MA 02740

Mr. Drew Carey
Coastal Vision
215 Eustis Ave.
Newport, RI 02840

Mr. Gerald Carvalho
Rhode Island Inshore Fishermen's Association
11 Pontiac Road
Narragansett, RI 02881

Ms. Ann Chace
254 Arnolds Neck Drive
Warwick, RI 02886

Mr. David Chace
1 Country Court
East Greenwich, RI 02818

Mr. John Clarke
Massachusetts Audubon Society
208 South Great Road
Lincoln, MA 01773

Mr. Mike Clavet
52 Fairmont Avenue
Pawtucket, RI 02860

Mr. J. Cobb
University of Rhode Island
Biological Science Center
Kingston, RI 02881

Mr. Ted Colburn
Ocean Technology Foundation
6 Bayberry Court
Mystic, CT 06355

Mr. Jeremy Collie
University of Rhode Island
Bay Campus
South Ferry Rd.
Narragansett, RI 02882

Concordia Co., Inc.
P.O. Box P203
South Wharf
South Dartmouth, MA 02748

Continental Marine
3236 Cranberry Highway
Buzzards Bay, MA 02532

Dr. Joe Costa
Buzzards Bay Project
2870 Cranberrry Highway
East Wareham, MA 02538

Davis & Tripp, Inc.
1 Bridge Street
South Dartmouth, MA 02748

Davis and Tripp
1/2 Cherry and Webb Lane
Westport, MA 02790

Earl's Marina
56 Goulart Memorial Drive
Fairhaven, MA 02719

East Chop Yacht Club
P.O. Box 525
Oak Bluffs, MA 02557

Mr. Robert Eddy
217 Terrace Avenue
Riverside, RI 02915

Falmouth Harbor Marina
180 Scranton Ave.
Falmouth, MA 02540

Captain Bruce Fisher
Northeast Marine Pilots Association
243 Spring Street
Newport, RI 02840

Ms. Kristen Fletcher
R. Papitto School of Law
Marine Affairs Institute
Roger Williams University
Ten Metacom Ave.
Bristol, RI 02809-5171

Mr. Daniel Furlong
Mid Atlantic Fisheries Management Council
300 S. New St.
Room 2115 Fed. Bldg
Dover, DE 19904

Mr. Jim Gallagher
GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01810-1970

Mr. William Gash
Connecticut Maritime Coalition
228 State Street
Second Floor
New London, CT 06320

Gear Locker Marina
255 Pope's Island
New Bedford, MA 02740

Mr. Tom Geary
106 Woodland Trail
Wakefield, RI 02879

Mr. M. Giacobbe
10 Birch Lane
Townsend, MA 01469

Ms. Gay Gillespie
Westport River Watershed Alliance
P.O. Box 3427
1151 Main Road
Westport, MA 02790

Mr. Robert Gilstein
2200 East Main Road
Portsmouth, RI 02871

Mr. Greg Glavin
Onset Bay Marina
R.F.D. 3
Buzzards Bay, MA 02532

Gloria Point Marina
750 Davol Street
Fall River, MA 02722

Ms. Judith Graham
105 River Street
Wakefield, RI 02879

Mr. Carl Grandquist
37 Sunset Avenue
Wakefield, RI 02879

Ms. Catherine Graziano
42 Rowley Street
Providence, RI 02909

Mr. John Hadley
4 Ship Street
Jamestown, RI 02835

Mr. Tom Hall
9 Touisset Road
Warren, RI 02885

Mr. William Harsch
170 Westminster Street
Suite 800
Providence, RI 02903

Mr. Richard Haverly
F/V Miss Jayme
40 Scapaflow Road
Charleston, RI 02813

Dr. Bernard Hay
The Louis Berger Group, Inc.
75 Second Ave
Suite 700
Needham, MA 02494

Mr. Ted Hayes
Bristol Phoenix
1 Bradford Street
Bristol, RI 02809

Mr. Dan Horton
3225 Gallows Road
Fairfax, VA 22031

Mr. Robert Horton
475 Warren Ave.
Swansea, MA 02777

Mr. David Jordan
2641 Harkney Hill Road
Coventry, RI 02816

Mr. John Kellam
19 Firglade Avenue
Providence, RI 02906-2623

Mr. Jim Kendall
New Bedford Seafood Coalition
19 Weaver Street
New Bedford, MA 02740

Mr. Richard Kennelly
Conservation Law Foundation
Advocacy Center
55 Dorrance Street
Providence, RI 02903

Mr. Michael Keyworth
Brewers Cove Haven Marina
101 Narragansett Avenue
Barrington, RI 02806

Professor Chris Kincaid
University of Rhode Island-Graduate School of Oceanography
South Ferry Road
Narragansett, RI 02882

Mr. John King
University of Rhode Island
Bay Campus
South Ferry Rd.
Narragansett, RI 02882

Ms. Grace Kleen-Macphee
University of Rhode Island
16 Conch Road
Narragansett, RI 02882

Mr. Bruce Knight
F/V Catherine and Gloria
4452 South County Road
Charlestown, RI 02813

Mr. Ken Kubic
Rhode Island Marine Trades Association
P.O. Box 1028
10 Montauk Rd.
Charlestown, RI 02813

Ms. Andrea Langhauser
EOEA Watershed Initiative
20 Riverside Drive
Lakeville, MA 02348

Mr. George Leach Jr.
Leach & Sons
2055 Main Road
Westport Point, MA 02791

Ms. Virginia Lee
Coastal Resources Center/URI
South Ferry Road
Narragansett, RI 02882

Mr. Edward Lenahan
Propeller Club
Maguire Group Inc.
225 Chapman Street
4th Floor
Providence, RI 02905-4507

Lobster Cove Marina & Market
33 River Road
Annisquam, MA 01930

Mr. Peter Lombardi Jr.
Oil Heat Institute, Inc.
1395 Atwood Avenue
Suite 209A
Johnston, RI 02919-4931

Mr. William Long
F/V C-Kat
263 South Road
Wakefield, RI 02879

Mr. Edward Longo
The Gear Locker
255 Pope's Island
New Bedford, MA 02740

Mr. Peter Lord
Providence Journal
75 Fountain Street
Providence, RI 02902

Mad Max Marina
P.O. Box 2821
Edgartown, MA 02539

Madaket Marine
20 North Cambridge
Nantucket, MA 02554

Madaket Market
20 North Cambridge
Nantucket, MA 02554

Mr. Michael Marchetti
Rhode Island Lobstermen's Association
P.O. Box 421
3119 Post Road
Wakefield, RI 02880

Mr. Juan Mariscal
Narragansett Bay Commission
One Service Road
Providence, RI 02905

Ms. Eugenia Marks
Audubon Society
12 Sandersen Road
Smithfield, RI 02902

Marshall Marine Corp.
P.O. Box P266
South Dartmouth, MA 02748

Mr. Brad Marston
Sierra Club RI Chapter
21 Meeting Street
Garden Entrance
Providence, RI 02903

Mattapoisett Boat Yard
Ned's Point Road
Mattapoisett, MA 02739

Mr. Robert Mattiucci
Rhode Island Commercial Rod and Reel
Anglers
P.O. Box 5307
Wakefield, RI 02880

Ms. Katherine Maxwell
P.O. Box 268
Charleston, RI 02813

Mr. Terry McCarthy
Dockside Marine
P.O. Box 1511
Circuit Ave.
Oak Bluffs, MA 02557

Mr. Michael McCarthy
249 Roosevelt Ave.
Suite 200
Pawtucket, RI 02860

Mr. James McCauley
Pt. Judith Fishermens Association
P.O. Box 730
75 State St.
Narragansett, RI 02882

Ms. Judith McDowell
WHOI Sea Grant
MS #2
193 Oyster Pond Road
Woods Hole, MA 02543

Mr. William McElroy
F/V Ellen June
3229 Tower Hill Road
Wakefield, RI 02879

Mr. Michael McGiveney
11 Pontiac Road
Narragansett, RI 02882

Mr. Michael McGiveney
Rhode Island Shellfishermen's Association
130 Lincoln Street
North Kingstown, RI 02852

Ms. Lynn McLeod
Battelle Memorial Institute
397 Washington Street
Duxbury, MA 02332

Captain E. McVay Jr.
Northeast Marine Pilots Association
243 Spring St.
Newport, RI 02840

Mr. Arthur Medeiros
Southern NE Fishermens Association
236 North Water Street
Stonington, CT 06378

Mr. Steve Medeiros
Rhode Island Salt Water Anglers Association
6 Arnold Road
Coventry, RI 02816

Memorial Wharf
P.O. Box 739
Dock Street
Edgartown, MA 02539

Mr. Alan Middleton
2000 Wrangle Hill Road
Delaware City, DE 19706

Mr. James Milardo
Rhode Island Mobile Sportfishermen
86 Hubbard Drive
Glastonbury, CT 06033

Millway Marina
Barnstable Harbor
Barnstable, MA 02630

Mr. Michael Miranda
North Atlantic Distribution, Inc. (NORAD)
QPD Industrial Park
100 Tidal Drive
North Kingstown, RI 02852

Mr. James Moran
145 Taunton Avenue
East Providence, RI 02914

Mr. Steve Moreau
P.O. Box 19
Jamestown, RI 02835

Mr. John Morris
SAIC
221 Third Street
Newport, RI 02840

Mr. Richard Murdock
GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890-1970

Nantucket Boat Basin
P.O. Box 1139
Nantucket, MA 02554

Nantucket Moorings
85 Bartlett Road
Nantucket, MA 02554-2707

Nantucket Yacht Club
P.O. Box 667
Nantucket, MA 02554

Mr. R. Nelson
P.O. Box 9248
Providence, RI 02940

New Bedford Yacht Club
P.O. Box P-4
South Dartmouth, MA 02748

Mr. Jeff Nield
Brown University
Center For Environmental Studies
P.O. Box 1943
Providence, RI 02912

Mr. Augustine Nunez
397 Bullocks Point Avenue
East Providence, RI 02915

Oak Bluffs Harbor Marina
P.O. Box 2676
Oak Bluffs, MA 02557

Mr. Jeffrey Oakes
CLE Engineering, Inc.
15 Creek Rd.
Marion, MA 02738

Ms. Pamela Okolita
295 Promenade Street
Providence, RI 02908

Ms. Candace Oviatt
University of Rhode Island-Graduate School of Oceanography
11 Aquarium Rd.
Narragansett, RI 02882

Mr. Patrick Paquette
The Massachusetts Striped Bass Association, Inc.
Viking Club Route 53
Quincy Avenue
Braintree, MA 02184

Mr. Paul Parker
Cape Cod Commercial Hookfishermans Association
210 Orleans Road
North Chatham, MA 02650

Mr. Anthony Passaretti
Annisquam Yacht Club
85 Linden St.
So. Hamilton, MA 01982

Ms. Rebecca Pellerin
55 Brown St.
North Kingstown, RI 02852

Mr. Corry Platt CEP
Concept 2 Delivery, Inc.
104 Eagles Nest Court
Cary, NC 27513

Point Independence Yacht Club
Box 367, Ind. A
Independence Lane
Onset, MA 02558

Popes Island Marina
102 Popes Island
New Bedford, MA 02740
Mr. Robin Porter
99 Main Street
Wickford, RI 02852

Mr. Sheldon Pratt
University of Rhode Island-Graduate School of Oceanography
South Ferry Road
Narragansett, RI 02882

Mr. Donald Pryor
28 Doane Avenue
Providence, RI 02906

Mr. Richard Pumple
51 Monmouth Drive
Riverside, RI 02915

Professor James Quinn
University of Rhode Island
130 Horn Laboratory
Narragansett, RI 02882-1197

Mr. John Rainone
Rhode Island Party and Charter Boat Association
431 Morning Dove Drive
Saunderstown, RI 02874

Mr. Kenneth Raposa
17 Linden Street
Riverside, RI 02915

Mr. Mark Rasmussen
Coalition for Buzzards Bay
P.O. Box 3006
17 Hamilton Street
New Bedford, MA 02741

Mr. Brad Read
Sail Newport
60 Fort Adams Road
Newport, RI 02840

Mr. George Redman
29 Church St.
Apt. 18
East Providence, RI 02914

Mr. Jack Reynolds
P.O. Box 83
Westport, MA 02791

Mr. Tim Rockwell
Ocean State Fishermens Association
390 Poppasquash Road
Bristol, RI 02809

Mr. Patrick Rogers
111 Don Avenue
Rumford, RI 02916

Dr. Brian Rothschild
University of Massachusetts, Dartmouth
706 S. Rodney French Blvd
New Bedford, MA 02744-1221

Ms. Elizabeth Rowell
RI Commercial Fisherman's Assoc.
100 Arbutus Trail
Charlestown, RI 02813

Mr. Steve Salamon
52 Bridge Street
Warren, RI 02885

Scituate Harbor Yacht Club
P.O. Box 275
Scituate, MA 02066

Mr. James Scott
300 Prospect Avenue
Wickford, RI 02852

Seaport Marine
110 Middle Street
Fairhaven, MA 02719

Ms. Meredith Simas
USGen New England, Inc.
Brayton Point Station
P.O. Box 440
Somerset, MA 02726-0040

Mr. Arthur Smith
F/V Deliberate
49 County Drive
Charlestown, RI 02813

Mr. Stephen Smith
Southeastern Regional Planning &
Economic Development District
88 Broadway
Taunton, MA 02780

Mr. Robert Smith
46 Woodlock Terrace
Charlestown, RI 02813

Mr. Kenneth Smith
1210 Narragansett Parkway
Warwick, RI 02888

Somerset Marine
3828 Riverside Ave.
Somerset, MA 02726

Mr. John Sorlien
RI Lobstermens Association
P.O. Box 421
Wakefield, RI 02880-0421

Mr. Curt Spalding
Save the Bay
434 Smith Street
Providence, RI 02908

Ms. Polly Stiles
724 Pleasant Street
Pawtucket, RI 02860

Mr. Nils Stolpe
Garden State Seafood Association
212 West State St.
Trenton, NJ 08608

Terry Sullivan
The Nature Conservancy
Rhode Island Chapter
159 Waterman Street
Providence, RI 02906

Swansea Marina
161 Calef Ave.
South Swansea, MA 02777

Mr. Craig Swanson
Applied Science Assoc., Inc.
70 Dean Knauss Drive
Narragansett, RI 02882-1143

Tabor Academy Waterfront
66 Spring St.
Marion, MA 02738

Mr. Robert Taylor
41 Teal Pond Road
Narragansett, RI 02882

Taylor Marine
68 Woodlawn Circle
Marshfield, MA 02050

Ms. Sandra Thornton-Whitehouse
32 Elmgrove Avenue
Providence, RI 02906

Mr. John Torgan
Save the Bay
Narragansett BayKeeper
434 Smith Street
Providence, RI 02906

Tripp & Sons, Inc.
P.O. Box 23
211 Cherry & Webb Lane
Westport Point, MA 02791

Mr. Jim Turek
VHB, Inc.
530 Broadway
Providence, RI 02909

Mr. James Vaill
Ocean Technology Foundation
40 Howland Avenue
Jamestown, RI 02835

Mr. Ray Valente
SAIC
221 Third Street
Newport, RI 02840

Mr. Russel Wallis
Ocean State Fishermens Association
9 Walnut Road
Barrington, RI 02806

Wareham Boatyard, Inc.
Rose Point
West Wareham, MA 02576

Mr. Steve Warner
TRC
5 Waterside Crossing
Windsor, CT 06095

Warr's Marine, Inc.
Lower Main St.
Wareham, MA 02571

Mr. David Westcott
225 Chapman Street
4th Floor
Providence, RI 02905-4507

Mr. Dudley Williams
100 Griswold Ave.
Bristol, RI 02809

Mr. Richard Wood
Sprague Energy
144 Allens Avenue
Providence, RI 02903

APPENDIX A

DATA APPENDIX

RHODE ISLAND REGION LONG-TERM DREDGED MATERIAL DISPOSAL SITE EVALUATION PROJECT

FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A-1

HISTORIC INFORMATION ON THE EFFECTS OF PREVIOUS DISPOSAL WITHIN THE RHODE ISLAND REGION ZONE OF SITING FEASIBILITY

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A general understanding of the dynamics of dredged material disposal plumes and the types of impacts resulting from dredged material disposal is summarized in Sections 4.1.1 thru 4.1.4 of this Final EIS. This section expands on the details of studies at dredged material disposal Site 16 (also known commonly as the Brenton Reef Disposal Site) to provide information on dredged material disposal impacts specific to the Rhode Island Region (RIR). The section addresses mound stability, benthic impacts and recovery, water column impacts from elevated turbidity, and impacts to biological and commercial resources.

Site 16

The University of Rhode Island (URI) Graduate School of Oceanography (GSO) conducted research and monitoring at Site 16 prior to, during, and following completion of disposal activities for the Providence River and Harbor Navigation Project (1967 to 1970). These studies were specifically conducted to evaluate potential impacts from the disposal at this location. Other studies conducted since 1970 provided information on the long-term impacts (Boehm and Quinn, 1978; Corps, 1979; Morton and Paquetter, 1981) from the historic dredged material disposal at Site 16. Site 16 is located 4.6 nautical miles (nmi) from Brenton Reef Light in Rhode Island Sound and occupies one square nautical mile (nmi^2). It is centered at latitude $41^{0}23^{'}25^{''}$N and longitude $71^{0}17^{'}58^{''}$W.

Data gathered at Site 16 prior to the late 1960s disposal included short-term tolerance studies of locally important marine organisms to turbidity and siltation, estimates of the volume of material deposited on the site, and turbidity measurements (Saila *et al.,* 1969). Studies conducted during disposal addressed physical aspects of the disposal and the response of benthic invertebrates to the disturbance from the disposal (Saila *et al.*, 1971). Pratt *et al.* (1973) assessed the mound structure, recolonization by benthic organisms, and surface sediment quality and water column turbidity in the area of the site, and observed the natural history of animals in the area in terms of possible effects of the dredged material disposal. They also examined records for the trap fishery in Rhode Island Sound to determine whether catch reductions reported during the disposal period could be related to dredged material disposal. Details of these and other relevant dredged material disposal effects studies are discussed in detail in Section 4.1, General Environmental Consequences. The following paragraphs briefly summarize observations and effects directly related to disposal at Site 16.

Initial findings by Saila *et al*. (1971) showed that no large-scale loss of dredged material had occurred during or after disposal. There was no indication of significant erosion in the early 1970s; however, by 1978, the apex of the mound had changed to a sand cover (Corps, 1979), probably as a result of winnowing by waves and currents. The sand armor was believed to have increased resistance to erosion.

Recolonization of the mound was well under way within three years of final disposal activities (Saila *et al*., 1971). In addition, even though the material at the disposal site was generally silty, most of the species colonized on the disposal mound were members of the surrounding sand bottom assemblage. Recent studies (Corps, 2002c) showed that the infaunal communities at Site 16 consisted of the same two general faunal assemblages found elsewhere in Rhode Island Sound (see Section 3.10). These community types bore little resemblance to the communities present on the disposal mound shortly after disposal ceased in the early 1970s. Many of the taxa present at the site in the 1970s were not found there in 2001. Therefore, it appears that the infaunal communities at Site 16 in 2001 are more similar to present-day Rhode Island Sound benthic infaunal communities than to those that initially colonized the disposal mound 30 years ago, indicating a progression on the mound from a disturbed community to one that is typical of the Sound today.

Rhode Island Sound is home to a wide array of both commercial and sport fisheries. Commercial fishing methods, including line trawling, gill netting, and floating traps, are still used in and around Site 16. The major trap fisheries in the vicinity of the site are located off Newport and Sakonnet (within approximately 3 nmi); scup is the primary fish caught. In the mid-1960s, scup landings were substantial from the Site 16 area. However, the landings declined during disposal of the Providence River sediments (Corps, 1979). Although fishing interests suggested that suspended sediments from eroded dredged material had caused the scup to change their migratory paths, Sissenwine and Saila (1973) showed that a decline in scup catches had occurred from Block Island to Virginia between 1958 and 1963. Scup fishing recovered in all areas in 1975 and 1976, which led the researchers to conclude that the decline in Rhode Island scup catches during the active disposal period was part of a regional trend. Preliminary observations on turbidity in the early 1970s (Pratt *et al.*, 1973) found no evidence of increased turbidity in the vicinity of the disposal site. The Disposal Area Monitoring System (DAMOS) report (Corps, 1979) concluded that fishing in the disposal site was as good as or better than in areas of natural bottom outside Site 16, and that the absence of draggers in the area had increased fishable grounds for other fishermen.

Lobster fishing conducted at and around Site 16 out of Point Judith, Newport, and Sakonnet, Rhode Island, in the late 1970s found that pot catches were better on the disposed sediment than the surrounding sandy bottom but were similar to other soft-bottom areas in the region (Corps, 1979). Whether this was an effect of the mound or a change in the types of fishery that could operate at the mound is inconclusive; the presence of the disposal mound excluded fishing by draggers, which had been the primary fishery prior to disposal. However, the exclusion enabled lobstermen to fish the area.

Prior to disposal, the area within Site 16 was predominantly sand and contained a large population of ocean quahogs that were commercially harvested. As a result of disposal activities, a large population of these ocean quahogs was buried, and shellfishing had to be curtailed around the edges of the area because some clams were killed by shallow burial or were unmarketable due to foul-smelling mud on their shells (Corps, 1982). By the late 1970s, ocean quahog fishing took place north and northeast of the disposal site at depths of less than 98 ft, where sandy bottom sediments yielded higher quality organisms (Corps, 1979).

After disposal activities at Site 16, contaminant concentrations associated with sediment at the site were found to be elevated relative to surrounding sediments (Boehm and Quinn, 1978). Recent contaminant measurements in and around Site 16 still show slightly elevated concentrations of selected sediment contaminants within the historic mound area compared to sediments collected just outside the boundaries of the site and to other areas sampled within the zone of siting feasibility (ZSF) that are further offshore (Corps, 2002d).

Studies have shown there to be a decreasing gradient in sediment contaminant concentrations from Providence River, through Narragansett Bay and out into Rhode Island Sound (Bricker, 1990; King *et al*., 1995; Corps, 2002d). In the early 1990s, similar decreasing geographic trends were observed in levels of polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and selected trace metals measured in hundreds of winter flounder (*Pseudopleuronectes americanus*) (Wang *et al.*, 1996). More recently, slight increases in total PCB in winter flounder collected from Site 16 relative to locations farther offshore were also observed (Corps, 2002e). Organic contaminant concentrations in lobster collected at Site 16 were also slightly higher than concentrations in lobster collected from farther offshore (Corps, 2003b). Total PAH in ocean quahogs collected from Site 16 were slightly higher than from the other offshore locations, while no differences were noted for other organic contaminants or metals (Corps, 2003c). In contrast, PAHs, dichlorodiphenyl-trichloroethane (DDT), dioxin, and mercury (Hg) concentrations in the flounder and metals in lobster were not different at Site 16 when compared to locations farther offshore. These trends in decreasing offshore biota contaminant concentrations are consistent with the decreasing gradient in sediment contaminant concentrations as one moves farther from the Providence River and Narragansett Bay areas. Elevated concentrations in mobile organisms, such as lobster and winter flounder, may be a result of urban impacts on sediment quality rather than a result of past disposal activities at Site 16.

Except for the burial of the quahog fishery, only short-term direct impacts have been noted at Site 16. Recovery of the benthic organisms has progressed, resulting in communities indistinguishable from communities in sediments beyond Site 16. A slight increase of some contaminants observed in 2001 (Corps, 2001a) in some species collected at the site suggested an availability of contaminants to organisms from sediments at Site 16. However, concentrations of contaminants measured in the affected organisms were well below the FDA action/tolerance limits for food safety. In addition, extensive testing is currently required to determine a material's acceptability for ocean disposal, unlike 30 years ago when material disposed of at Site 16 had relatively high levels of metals and organic compounds (Saila et al., 1971). Thus, other than altering the type of fisheries accessible on and near the mound, long-term or cumulative environmental impacts to fisheries within Rhode Island Sound do not appear to have developed from the use of Site 16 for dredged material disposal 30 years ago.

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APPENDIX A-2

TOC, METALS, AND ORGANIC CONTAMINANT CONCENTRATIONS IN SURFACE SEDIMENTS WITHIN THE RIR ZSF

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Summary of Ranges in TOC, Metals, and Organic Contaminant Concentrations in Surface Sediments of the RIR ZSF over Time.

Parameter	Unit	Corps, 2003[1] (a)	Corps, 2000[2] (b)	Brown and Neff, 1993[3]	Boehm and Quinn, 1978[4]
TOC	%	0.06 to 0.92	0.64 to 0.65	--	0.02 to 0.58
Aluminum	ppm dry	7,600 to 40,000	--	--	--
Antimony	ppm dry	0.16 to 0.35	--	--	--
Arsenic	ppm dry	3.2 to 13	4.9 to 31	5 to 15	--
Beryllium	ppm dry	0.58 to 5.2	--	--	--
Cadmium	ppm dry	ND to 0.054	0.082 to 0.13	0.1 to 0.6	--
Chromium	ppm dry	8.6 to 36	28 to 34	50 to 100	--
Copper	ppm dry	2.2 to 7.7	7.1 to 8.8	10 to 50	--
Iron	ppm dry	2,300 to 32,000	--	--	--
Lead	ppm dry	2.7 to 18	12 to 13	5 to 30	--
Mercury	ppm dry	ND to 0.014	0.025 to 0.05	0.2 to 0.3	--
Nickel	ppm dry	2.9 to 15	12 to 21	50	--
Selenium	ppm dry	0.058 to 0.33	--	0.4 to 0.75	--
Silver	ppm dry	ND to 0.058	--	0.06	--
Zinc	ppm dry	4.4 to 50	40 to 53	2 to 70	--
Total PAH	ppb dry	5.1 to 51	11, 120	--	--
Total PCB	ppb dry	ND to 5.22	1.6 to 4.3	--	--
Total DDT	ppb dry	ND	ND to 0.23	--	--
Dieldrin	ppb dry	ND	ND to 0.16	--	--
Tributyltin	ppb dry	ND (c)	--	2	--
2378-TCDD	ppt dry	ND	ND	--	--
PCB 77	ppt dry	4.6 to 24	--	--	--
PCB 126	ppt dry	ND to 1.7	--	--	--
Bis(2-ethylhexyl)phthalate	ppb dry	ND (c)	ND (c)	--	--

(a) Samples collected from Sites 18, 69A and 69B.
(b) Samples collected from Site 18.
(c) Not detected at appreciable levels above laboratory blank values.
ND, Not detected.

[1] Corps. 2003. Fall 2001 Sediment Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. April 2003.

[2] Corps. 2000b. Final Data Report for Providence River and Rhode Island Sound, RI. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers. 34 pp + Appendices.

[3] Brown, B. and J. Neff. 1993. Bioavailability of Sediment-Bound Contaminants to Marine Organisms. Prepared for the National Ocean Pollution Program Office, National Oceanic and Atmospheric Administration under a Related Services Agreement with the U.S. Department of Energy. Contract DE-AC06-76RLO 1830. September 1993.

[4] Boehm, P.D. and J.G. Quinn. 1978. Benthic Hydrocarbons of Rhode Island Sound. *Estuarine and Coastal Marine Science*. 6:471-494.

Summary of Ranges in TOC, Metals, and Organic Contaminant Concentrations in Surface Sediments of Site 16 (Brenton Reef Historic Disposal Site) Over Time.

Parameter	Unit	Corps, 2003[5]	Corps, 1979[6]	Boehm and Quinn, 1978[7]
TOC	%	0.12 to 0.90		0.45 to 1.1
Aluminum	ppm dry	36,000 to 46,000	--	--
Antimony	ppm dry	0.15 to 0.61	--	--
Arsenic	ppm dry	2.8 to 10	--	--
Beryllium	ppm dry	1.4 to 2.7	--	--
Cadmium	ppm dry	0.026 to 0.096	0.12 to 0.24	--
Chromium	ppm dry	13 to 43	3.1 to 24	--
Copper	ppm dry	4 to 19	2.0 to 11	--
Iron	ppm dry	9,000 to 20,000	4,600 to 14,000	--
Lead	ppm dry	10 to 22	2.3 to 13	--
Mercury	ppm dry	ND to 0.051	ND to 0.03	--
Nickel	ppm dry	4.8 to 13	4.2 to 29	--
Selenium	ppm dry	ND to 0.24	--	--
Silver	ppm dry	ND to 0.21	--	--
Zinc	ppm dry	19 to 48	8.1 to 36	--
Total PAH	ppb dry	16 to 410	--	--
Total PCB	ppb dry	ND to 11	--	--
Total DDT	ppb dry	ND to 1.3	--	--
Dieldrin	ppb dry	ND to 0.081	--	--
Tributyltin	ppb dry	ND (a)	--	--
2378-TCDD	ppt dry	ND to 2.3	--	--
PCB 77	ppt dry	7.6 to 67	--	--
PCB 126	ppt dry	ND to 4.9	--	--
Bis(2-ethylhexyl)phthalate	ppb dry	ND (a)	--	--

(a) Not detected at appreciable levels above laboratory blank values.
ND, Not detected.

[5] Corps. 2003. Fall 2001 Sediment Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. April 2003.
[6] Corps. 1979. Disposal Area Monitoring System (DAMOS) Annual Data Report - 1978 Supplement E Brenton Reef Disposal Site. U.S. Army Corps of Engineers, New England Division. Waltham, MA. 36 pp.
[7] Boehm, P.D. and J.G. Quinn. 1978. Benthic Hydrocarbons of Rhode Island Sound. *Estuarine and Coastal Marine Science*. 6:471-494.

APPENDIX A-3

FISH CATCH DATA FROM THE RIR ZSF

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Annual Landings of the Top Species Harvested from the RIR ZSF.

Species	1994 Landings[a]	% of Total Landings	Species	1998 Landings[a]	% of Total Landings
Squid - all	8,751,329	35.50	Atlantic herring	15,692,687	44.60
Skates	3,830,189	15.54	Skates	8,429,480	23.96
Silver hake	3,004,803	12.19	Silver hake	2,654,937	7.55
Monkfish	1,366,485	5.54	Monkfish	1,547,730	4.40
Scup	1,230,088	4.99	Squid -all	1,527,059	4.34
Spiny dogfish	1,145,629	4.65	Winter flounder	1,011,602	2.88
Butterfish	683,451	2.77	Spiny dogfish	751,728	2.14
Winter flounder	601,412	2.44	White hake	639,888	1.82
White hake	595,272	2.41	Summer flounder	471,994	1.34
Summer flounder	583,522	2.37	Scup	383,161	1.09
Species	**1995 Landings[a]**	**% of Total Landings**	**Species**	**1999 Landings[a]**	**% of Total Landings**
Atlantic herring	42,586,739	61.46	Atlantic herring	23,723,950	47.66
Skates	7,258,900	10.48	Skates	10,533,872	21.16
Monkfish	5,903,359	8.52	Squid - all	2,753,266	5.53
Silver hake	2,740,703	3.96	Monkfish	2,473,699	4.97
Squid - all	2,033,814	2.93	Silver hake	2,305,295	4.63
Spiny dogfish	1,946,663	2.81	Winter flounder	1,103,286	2.22
Winter flounder	1,090,730	1.57	Atlantic mackerel	931,844	1.87
Scup	890,024	1.28	Yellowtail flounder	921,711	1.85
Summer flounder	667,917	0.96	Scup	841,890	1.69
Butterfish	484,364	0.70	Spiny dogfish	665,069	1.34
Species	**1996 Landings[a]**	**% of Total Landings**	**Species**	**2000 Landings[a]**	**% of Total Landings**
Atlantic herring	32,824,130	58.99	Atlantic herring	32,515,870	57.66
Skates	8,667,777	15.58	Skates	8,405,141	14.90
Monkfish	2,951,049	5.30	Silver hake	4,211,938	7.47
Silver hake	2,739,933	4.92	winter flounder	2,032,158	3.60
Spiny dogfish	1,164,624	2.09	Squid - all	2,015,044	3.57
Winter flounder	1,090,160	1.96	Monkfish	1,703,137	3.02
Squid - all	1,087,398	1.95	Yellowtail flounder	1,014,115	1.80
Butterfish	722,963	1.30	Summer flounder	792,457	1.41
Scup	602,590	1.08	Red hake	707,646	1.25
White hake	476,198	0.86	Butterfish	461,518	0.82
Species	**1997 Landings[a]**	**% of Total Landings**	**Species**	**2001 Landings[a]**	**% of Total Landings**
Atlantic herring	31,550,437	56.05	Skates	9,757,579	29.47
Skates	9,773,280	17.36	Atlantic herring	8,987,006	27.15
Silver hake	2,950,947	5.24	Silver hake	2,927,909	8.84
Squid - all	2,816,977	5.00	Monkfish	2,517,112	7.60
Monkfish	2,520,836	4.48	Squid - all	1,724,123	5.21
Winter flounder	1,072,836	1.91	Winter flounder	1,535,372	4.64
Blueback herring	950,645	1.69	Yellowtail flounder	1,100,720	3.32
Spiny dogfish	900,483	1.60	Summer flounder	842,218	2.54
Atlantic mackerel	603,385	1.07	Scup	700,958	2.12
Summer flounder	558,795	0.99	Red hake	591,083	1.79

Source: NMFS VTR Data (1994 – 2001)
[a] All landings are in pounds.

Composite List of Finfish and Squid Collected During Long-Term Trawl Surveys Within or Adjacent to the RIR ZSF.

Common name	Scientific name	URI-GSO	RIDFW	NMFS	MDMF
Sea lamprey	*Petromyzon marinus*		X	X	
Roughtail stingray	*Dasyatis centroura*			X	
Smooth dogfish	*Mustelus canis*	X	X	X	X
Spiny dogfish	*Squalus acanthias*	X	X	X	X
Skates	Rajidae spp.		X		
Atlantic torpedo	*Torpedo nobiliana*		X		X
Barndoor skate	*Dipturus laevis*			X	X
Winter skate	*Leucoraja ocellata*			X	X
Little skate	*Leucoraja erinacea*	X		X	X
Smooth skate	*Malacoraja senta*			X	
Thorny skate	*Amblyraja radiata*			X	
Round herring	*Etrumeus teres*	X	X	X	X
Atlantic herring	*Clupea harengus*	X	X	X	X
Alewife	*Alosa pseudoharengus*	X	X	X	X
Blueback herring	*Clupea Harengus*	X	X	X	X
American shad	*Alosa sapidissima*	X	X	X	X
Atlantic menhaden	*Brevoortia tyrannus*	X	X	X	
Bay anchovy	*Anchoa mitchilli*	X	X	X	X
Striped anchovy	*Anchoa hepsetus*	X	X	X	X
Rainbow smelt	*Osmerus mordax*	X	X	X	
Atlantic argentine	*Argentina silus*			X	
Conger eel	*Conger oceanicus*	X	X	X	X
Silver hake	*Merluccius bilinearis*	X	X	X	X
Atlantic cod	*Gadus morhua*	X	X	X	X
Haddock	*Melanogrammus aeglefinus*	X	X	X	X
Pollock	*Pollachius virens*	X	X	X	X
White hake	*Urophycis tenuis*	X	X	X	X
Red hake	*Urophycis chuss*	X	X	X	X
Spotted hake	*Urophycis regia*	X	X	X	X
Longfin hake	*Urophycis chesteri*			X	
Fourbeard rockling	*Enchelyopus cimbrius*	X	X	X	X
Cusk	*Brosme brosme*	X	X		
Threebeard rockling	*Gaidropsarus ensis*		X		
Hakes	*Urophycis sp*			X	
Summer flounder	*Paralichthys dentatus*	X	X	X	X
Fourspot flounder	*Paralichthys oblongus*	X	X	X	X
Yellowtail flounder	*Limanda ferruginea*	X	X	X	X
Winter flounder	*Pseudopleuronectes americanus*	X	X	X	X
Witch flounder	*Glyptocephalus cynoglossus*			X	
Windowpane	*Scophthalmus aquosus*	X	X	X	X
Gulf stream flounder	*Citharichthys arctifrons*	X	X	X	X
Atlantic silverside	*Menidia menidia*	X	X	X	

Composite List of Finfish and Squid Collected During Long-Term Trawl Surveys Within or Adjacent to the RIR ZSF (continued).

Common name	Scientific name	URI-GSO	RIDFW	NMFS	MDMF
Threespine stickleback	*Gasterosteus aculeatus*		X		
Northern pipefish	*Syngnathus fuscus*	X	X	X	X
Smallmouth flounder	*Etropus microstomus*		X	X	X
Hogchoker	*Trinectes maculatus*	X	X		X
Bluespotted cornetfish	*Fistularia tabacaria*	X	X		X
Atlantic mackerel	*Scomber scombrus*	X	X	X	X
Atlantic bonito	*Sarda sarda*	X		X	
Blue runner	*Caranx crysos*		X		
Butterfish	*Peprilus triacanthus*	X	X	X	X
Atlantic moonfish	*Selene setapinnis*	X	X	X	X
Lookdown	*Selene vomer*	X	X	X	X
Bigeye	*Priacanthus arenatus*	X	X		X
Bluefish	*Pomatomus saltatrix*	X	X	X	X
Stripped Bass	*Morone saxatilis*	X	X	X	
Black sea bass	*Centropristis striata*	X	X	X	X
Scup	*Stenotomus chrysops*	X	X	X	X
Weakfish	*Cynoscion regalis*	X	X	X	X
Northern kingfish	*Menticirrhus saxatilis*	X	X	X	X
Black drum	*Pogonias cromis*		X		
Spot	*Leiostomus xanthurus*	X	X	X	X
Hookear sculpin	*Artediellus* spp.			X	
Moustache sculpin	*Triglops murrayi*			X	
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	X	X	X	X
Sea raven	*Hemitripterus americanus*	X	X	X	X
Grubby	*Myoxocephalus aenaeus*	X		X	
Atlantic seasnail	*Liparis atlanticus*	X	X	X	
Northern searobin	*Prionotus carolinus*	X	X	X	X
Striped searobin	*Prionotus evolans*	X	X	X	X
Flying gurnard	*Dactylopterus volitans*				X
Cunner	*Tautogolabrus adspersus*	X	X	X	X
Tautog	*Tautoga onitis*	X	X	X	X
Rock gunnel	*Pholis gunnellus*		X	X	X
Northern sand lance	*Ammodytes dubius*	X	X	X	X
Radiated shanny	*Ulvaria subbifurcata*			X	
Oyster toadfish	*Opsanus tau*	X			
Red goatfish	*Mullus auratus*		X		X
Striped cusk-eel	*Ophidion marginatum*				X
Wrymouth	*Cryptacanthodes maculatus*	X	X	X	
Ocean pout	*Macrozoarces americanus*	X	X	X	X
Fawn cusk-eel	*Lepophidium profundorum*		X	X	
Northern puffer	*Sphoeroides maculatus*	X	X	X	X

Composite List of Finfish and Squid Collected During Long-Term Trawl Surveys Within or Adjacent to the RIR ZSF (continued).

Common name	Scientific name	URI-GSO	RIDFW	NMFS	MDMF
Monkfish	*Lophius americanus*	X	X	X	X
Planehead filefish	*Monacanthus hispidus*	X	X	X	X
Gray triggerfish	*Balistes capriscus*	X	X		
Banded rudderfish	*Seriola zonata*			X	
Mackerel scad	*Decapterus macarellus*	X	X	X	X
Bigeye scad	*Selar crumenophthalmus*	X	X		
Round scad	*Decapterus punctatus*			X	
Rough scad	*Trachurus lathami*		X	X	X
Cownose ray	*Rhinoptera bonasus*		X		
Bristled longbeak shrimp	*Dichelopandalus leptocerus*			X	
Conger eels	Congridae spp.			X	
Snake eels	Ophichthidae spp.			X	
Inshore lizardfish	*Synodus foetens*	X	X	X	
Snakefish	*Trachinocephalus myops*		X		
Atlantic tomcod	*Microgadus tomcod*	X	X		
Lined seahorse	*Hippocampus erectus*			X	
Longsnout seahorse	*Hippocampus reidi*			X	
Northern shortfin squid	*Illex illecebrosus*		X	X	
Longfin squid	*Loligo pealeii*	X	X	X	X
Bobtail squids	Sepiolidae spp.			X	
Rock sea bass	*Centropristis philadelphica*			X	
Snowy grouper	*Epinephelus niveatus*		X		
Glasseye snapper	*Priacanthus cruentatus*	X		X	
Short bigeye	*Pristigenys alta*	X	X		X
Red snapper	*Lutjanus campechanus*			X	
Snappers	Lutjanidae spp.			X	
Dwarf goatfish	*Upeneus parvus*	X		X	
Northern sennet	*Sphyraena borealis*	X	X	X	
Guaguanche	*Sphyraena guachancho*	X			X
Gobies	Gobiidae spp.		X		
Orange filefish	*Aluterus schoepfi*	X	X		
Porcupinefish	*Diodon hystrix*		X		
Silver anchovy	*Engraulis eurystole*			X	X
TOTAL		72	83	91	64

Average CPUE per 15-min Tow and Length of Species Collected from Deep and Shallow Otter-Trawl Surveys During November and December 2002.

Deep (>120 ft)			Shallow (<120 ft)		
Species	**Mean CPUE**	**Mean Length (cm)**	**Species**	**Mean CPUE**	**Mean Length (cm)**
Four-bearded rockling	0.1	29.0	Four-spot flounder	1.7	29.1
Four-spot flounder	6.4	28.7	Alewife	2.8	17.8
Alewife	0.2	23.3	Atlantic herring	2.1	26.3
Atlantic herring	0.3	25.4	Atlantic mackerel	0.7	32.1
Atlantic mackerel	0.1	30.0	Black sea bass	0.2	12.0
Black sea bass	0.9	16.6	Blueback herring	0.1	12.0
Bluefish	0.3	48.0	Bluefish	0.1	56.0
Butterfish	144.0	10.8	Butterfish	202.4	10.8
Monkfish	0.2	53.0	Cunner	0.3	32.5
Lobster	4.1	8.6	Monkfish	0.1	83.0
Longhorn sculpin	4.4	32.0	Lobster	0.5	8.0
Ocean pout	0.3	48.8	Longhorn sculpin	3.2	30.3
Red hake	5.2	28.7	Ocean pout	0.3	43.0
Scup	260.2	23.7	Red hake	2.3	22.7
Sea raven	0.1	27.0	Rough scad	0.1	14.0
Sea robin	1.3	15.0	Round herring	0.1	15.0
Silver hake	0.9	12.8	Scup	116.5	23.5
Skate sp.	17.8	44.7	Sea robin	0.1	12.0
Spiny dogfish	48.3	79.6	Sea scallop	6.4	–
Spot	0.1	20.0	Silver hake	1.5	13.5
Squid spp.	49.7	–	Silverside	0.1	11.0
Summer flounder	13.1	16.1	Skate sp.	22.7	42.7
Tautog	0.2	30.3	Spiny dogfish	141.6	82.0
Weakfish	0.1	23.0	Squid spp.	24.7	–
Windowpane flounder	0.2	22.7	Summer flounder	1.6	18.3
Winter flounder	14.9	29.5	Windowpane flounder	1.4	27.0
Yellowtail flounder	0.1	42.0	Winter flounder	20.0	28.8
			Yellowtail flounder	0.1	36.0

Source: Corps. 2003e. Fall 2002 Finfish Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. June 2003.

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APPENDIX A-4

ESSENTIAL FISH HABITAT DESIGNATIONS

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Species Having EFH Designated for Eggs, Larvae, Juveniles, or Adults Within the RIR ZSF (Only 3 EFH grids used in EFH analysis).

Species	Eggs	Larvae	Juveniles	Adults
Albacore tuna (*Thunnus alalunga*)			X	
American plaice (*Hippoglossoides platessoides*)		X	X	X
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic cod *(Gadus morhua)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic sea herring (*Clupea harengus*)		X	X	X
Atlantic sea scallop *(Placopecten magellanicus)*	X	X	X	X
Basking shark *(Cetorhinus maximus)*			X	X
Black sea bass *(Centropristis striata)*		X	X	X
Blue shark (*Prionace glauca)*		X	X	X
Bluefin tuna *(Thunnus thynnus)*		X	X	X
Bluefish *(Pomatomus saltatrix)*	X	X	X	X
Cobia *(Rachycentron canadum)*	X	X	X	X
Common thresher shark *(Alopias vulpinus)*		X	X	X
Dusky shark *(Carcharhinus obscurus)*			X	X
Haddock *(Melanogrammus aeglefinus)*	X	X		
King mackerel *(Scomberomorus cavalla)*	X	X	X	X
Little Skate *(Leucoraja erinacea)*			X	X
Longfin squid (*Loligo pealeii*)			X	X
Monkfish *(Lophius americanus)*	X	X	X	X
Ocean pout (*Macrozoarces americanus*)	X	X	X	X
Ocean quahog (*Arctica islandica*)			X	X
Offshore hake (*Merluccius albidus*)		X		
Red hake *(Urophycis chuss)*	X	X	X	X
Sand tiger shark *(Odontaspis taurus)*		X		
Sandbar shark *(Carcharhinus plumbeus)*		X	X	X
Scup *(Stenotomus chrysops)*	X	X	X	X
Shortfin squid (*Illex illecebrosus*)			X	X
Shortfin mako shark *(Isurus oxyrhinchus)*		X	X	X
Skipjack tuna (*Katsuwonus pelamis*)				X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
Spiny dogfish (*Squalus acanthias*)			X	X
Summer flounder *(Paralichthys dentatus)*	X	X	X	X
Surf clam (*Spisula solidissima*)			X	X
Tiger shark *(Galeocerdo cuvier)*		X	X	X
White shark (*Carcharodon charcharias*)			X	
Whiting *(Merluccius bilinearis)*	X	X	X	X
Windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
Winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
Winter Skate *(Leucoraja ocellata)*			X	
Witch flounder *(Glyptocephalus cynoglossus)*	X	X		
Yellowfin tuna (*Thunnus albacares*)			X	X
Yellowtail flounder *(Pleuronectes ferruginea)*	X	X	X	X

Source: NOAA. 2003a. Guide to Essential Fish Habitat Designations in the Northeastern United States [Online]. Available http://www.nero.noaa.gov/ro/STATES4/massri.htm.

Species Having EFH Designated for Eggs, Larvae, Juveniles, or Adults Within Site E.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic butterfish *(Peprilus triacanthus)*	X		X	X
Atlantic cod *(Gadus morhua)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic sea herring (*Clupea harengus*)		X	X	X
Black sea bass *(Centropristis striata)*		X	X	
Blue shark (*Prionace glauca)*		X	X	X
Bluefin tuna *(Thunnus thynnus)*				X
Bluefish *(Pomatomus saltatrix)*		X	X	X
Cobia *(Rachycentron canadum)*	X	X	X	X
Common thresher shark *(Alopias vulpinus)*		X	X	X
Dusky shark *(Carcharhinus obscurus)*			X	
Haddock *(Melanogrammus aeglefinus)*	X	X		
King mackerel *(Scomberomorus cavalla)*	X	X	X	X
Little Skate *(Leucoraja erinacea)*			X	X
Longfin squid (*Loligo pealeii*)			X	
Monkfish *(Lophius americanus)*	X	X		
Ocean pout (*Macrozoarces americanus*)	X	X	X	X
Red hake *(Urophycis chuss)*	X	X	X	
Sandbar shark *(Carcharhinus plumbeus)*			X	X
Scup *(Stenotomus chrysops)*			X	X
Shortfin mako shark *(Isurus oxyrhinchus)*			X	
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
Spiny dogfish (*Squalus acanthias*)			X	X
Summer flounder *(Paralichthys dentatus)*	X	X		X
Whiting *(Merluccius bilinearis)*	X	X	X	X
Windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
Winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
Winter Skate *(Leucoraja ocellata)*			X	
Witch flounder *(Glyptocephalus cynoglossus)*		X		
Yellowtail flounder *(Pleuronectes ferruginea)*	X	X	X	X

Source: NOAA, 2003a. Guide to Essential Fish Habitat Designations in the Northeastern United States [Online]. Available http://www.nero.noaa.gov/ro/STATES4/massri.htm.

Species Having EFH Designated for Eggs, Larvae, Juveniles, or Adults Within Site W.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic butterfish *(Peprilus triacanthus)*			X	
Atlantic cod *(Gadus morhua)*	X	X		X
Atlantic mackerel *(Scomber scombrus)*	X			
Atlantic sea herring (*Clupea harengus*)			X	X
Black sea bass *(Centropristis striata)*			X	
Blue shark (*Prionace glauca)*		X	X	X
Bluefin tuna *(Thunnus thynnus)*				X
Bluefish *(Pomatomus saltatrix)*				X
Cobia *(Rachycentron canadum)*	X	X	X	X
Common thresher shark *(Alopias vulpinus)*		X	X	X
Dusky shark *(Carcharhinus obscurus)*			X	
Haddock *(Melanogrammus aeglefinus)*		X		
King mackerel *(Scomberomorus cavalla)*	X	X	X	X
Little Skate *(Leucoraja erinacea)*			X	
Monkfish *(Lophius americanus)*	X	X		
Ocean pout (*Macrozoarces americanus*)	X	X	X	X
Ocean quahog (*Arctica islandica*)			X	X
Red hake *(Urophycis chuss)*	X	X	X	
Sand tiger shark *(Odontaspis taurus)*		X		
Sandbar shark *(Carcharhinus plumbeus)*			X	X
Scup *(Stenotomus chrysops)*			X	X
Shortfin mako shark *(Isurus oxyrhinchus)*			X	
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
Spiny dogfish (*Squalus acanthias*)			X	X
Summer flounder *(Paralichthys dentatus)*	X	X		X
Whiting *(Merluccius bilinearis)*	X	X	X	X
Windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
Winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
Winter Skate *(Leucoraja ocellata)*			X	
Witch flounder *(Glyptocephalus cynoglossus)*	X			
Yellowtail flounder *(Pleuronectes ferruginea)*	X	X	X	

Source: NOAA, 2003a. Guide to Essential Fish Habitat Designations in the Northeastern United States [Online]. Available http://www.nero.noaa.gov/ro/STATES4/massri.htm.

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APPENDIX A-5

COASTAL AND MARINE BIRDS RECORDED IN THE RIR ZSF

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List of Coastal and Marine Birds Recorded in the RIR ZSF.

Common Name	Scientific Name	Classification	Habitat	Prey	Feeding Technique	Status
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	Pelagic	Coastline and offshore islands; winters on open ocean; sitings of 20-40 pairs breeding at a single island site off the coast of southwest Massachusetts	Crustaceans, fish, plankton	Flutters over surface of water	Rare and seriously declining in Massachusetts
Common Loon	*Gavia immer*	Pelagic	Shoreline in spring to breed and nest; in winter, open ocean and bays along coast from Maine to Texas	Principal food source is fish, also shellfish, frogs, aquatic insects	Dives deeply in pursuit of prey; have been caught in nets as much as 200 ft below the water's surface	Species of Special Concern in Massachusetts
Red-throated Loon	*Gavia stellata*	Pelagic	Winters along ocean coast during migration; breeds mostly on fresh water	Small or medium sized fish (cod, herring, sprat, sculpins); occasionally crustaceans, mollusks, frogs, fish spawn and insects	Dives recorded at 7–30 ft and average for 1 minute. Prefer clear water for foraging and don't fish at night	No special status
Piping Plover	*Charadrius melodus*	Shorebird	Coastlines, sandy beaches	Marine worms, mollusks, insects, crustaceans	Running on shoreline, feeling vibrations in feet, pecking at the sand for food	Federal and State listed as threatened
Bufflehead	*Bucephala albeola*	Waterfowl	Winters on salt bays and estuaries	Freshwater and saltwater aquatic invertebrates (insects, crustaceans, mollusks)	Feed in open, shallow water; dives for food and swallows while underwater	No special status
Common Goldeneye	*Bucephala clangula*	Waterfowl	Winters on coastal bays and estuaries	Mollusks, aquatic plants and insects	Dives for prey	No special status
Hooded Merganser	*Lophodytes cucullatus*	Waterfowl	Winters on coastal marshes and inlets	Small fish, frogs, aquatic insects	Dives for fish in long, rapid, underwater dives	No special status
Red-breasted Merganser	*Mergus serrator*	Waterfowl	Winters mainly on salt water	Fish	Swift, underwater dives	No special status
Ruddy Duck	*Oxyura jamaicensis*	Waterfowl	Winters on marshes and in shallow coastal bays	Pondweeds and other aquatic plants, midge larvae	Surface diver; excellent underwater swimmer; strains bottom material through bill	No special status

List of Coastal and Marine Birds Recorded in the RIR ZSF (continued).

Common Name	Scientific Name	Classifi-cation	Habitat	Prey	Feeding Technique	Status
American Black Duck	*Anas rubripes*	Waterfowl	Marshes, lakes, streams, coastal mudflats, estuaries. Outside of breeding season, lives on open lagoons and on the coast, even in rough sea waters	Aquatic plants, also invertebrates (insects, mollusks, crustaceans)	Grazing, probing, dabbling for prey; occasionally dives	No special status
Greater Scaup	*Aythya marila*	Waterfowl	Brackish lakes, bays, and ponds; in winter, often on salt water bays and estuaries of the Atlantic coast	Green plant matter, seeds, mollusks	Grazing and probing for prey; dives for mollusks	No special status
Common Eider	*Somateria mollissima*	Waterfowl	Rocky coasts; breeds from Canada to Massachusetts; winters south to Long Island; Most sea-going of all waterfowl, never leaving the salt water	Mussels and other shellfish	Dives for prey	No special status
Harlequin Duck	*Histrionicus histrionicus*	Waterfowl	Rocky wave-lashed coasts and jetties in winter; prefers the rugged seacoast	Loose snails, limpets, barnacles, small shrimp, crabs, small fish	Diving for fish or pulling prey off rocks	No special status
Surf Scoter	*Melanitta perspicillata*	Waterfowl	Winters almost entirely on the ocean and in large coastal bays	Mollusks and crustaceans	Diving for food	No special status
White-winged Scoter	*Melanitta fusca*	Waterfowl	Winters mainly on ocean and large coastal bays	Mollusks, crabs, starfish, sea urchin, some fish	Dives for mussels at depths of 15-40 ft	No special status
Black Scoter "Common Scoter"	*Melanitta nigra*	Waterfowl	Winters on ocean and in large salt bays	Mussels and other mollusks, barnacles, chitons, limpets	Feeds off rocks and reefs	No special status
Redhead	*Aythya americana*	Waterfowl	Shallow freshwater lakes, ponds, marshlands, coastal waters and bays; migrates south in winter	Plants, invertebrates, fish eggs, insects	Grazing, probing for prey in water	No special status
Roseate Tern	*Sterna dougallii*	Colonial water bird	Coastal beaches, islands; possibly become pelagic in the winter	Sand lance and small herring; reported as feeding in the open ocean	Dives into water and also steals smaller fish being chased by larger predatory fish	Federal and State listed as endangered

List of Coastal and Marine Birds Recorded in the RIR ZSF (continued).

Common Name	Scientific Name	Classifi-cation	Habitat	Prey	Feeding Technique	Status
Common Tern	*Sterna hirundo*	Colonial water bird	Sandy or rocky islands, sand dunes or barrier beaches; breeds along Atlantic coastline	Primarily sand lance (up to 22 cm) but also other small fish, crustaceans, invertebrates	Feeds close to shore in water less than 15 inches deep; sometimes in deeper water over schools of predatory fish; dives and dips for prey	Species of special concern in Massa-chusetts
Arctic Tern	*Sterna paradisaea*	Colonial water bird	Sandy, gravelly areas on islands and barrier spits; occasionally on mainland shores; migrates from Cape Cod to Africa then to Antarctica	Small fish such as sand lance, capelin, herring, minnows; also invertebrates and small crustaceans	Hovers over water and dives from heights of 30-40 ft splashing the surface and becoming submerged	Species of special concern in Massa-chusetts
Least Tern	*Sterna antillarum*	Colonial water bird	Coastal beaches and barrier islands	Fish less than 8-94 cm; minnows, sand lance, herring, hake	Hover, dive, skim the surface of the water	Species of special concern in Massa-chusetts
Sooty Shearwater	*Puffinus griseus*	Colonial water bird	Open ocean; arrive on east coast in May as part of great migration; one of most abundant birds in the world	Fish	Dives from surface and swims underwater with wings	No special status
Northern Gannet	*Morus bassanus*	Colonial water bird	Open seas	Fish	Dives into sea after fish, sometimes plunging headlong from heights as great as 50 ft or more	No special status
Double-crested Cormorant	*Phalacrocorax auritus*	Colonial water bird	Coastlines; marine and inland waters	Fish, crustaceans, amphibians from fresh water	Swims low in water to feed; dives and catches their prey underwater	No special status
Great Cormorant	*Phalacrocorax carbo*	Colonial water bird	Sea cliffs, rocky coasts, and inshore waters; winters from Maine to New Jersey	Fish; in coastal waters during breeding season, herring and eel	Dives for fish	No special status
Great Blue Heron (Blue form)	*Ardea herodias*	Colonial water bird	Lakes, ponds, rivers, marshes	Fish or frogs primarily; occasionally small mammals, reptiles, and birds	Fishes day and night but prefer dawn and dusk; wades in shallow water and spears the food	No special status

List of Coastal and Marine Birds Recorded in the RIR ZSF (continued).

Common Name	Scientific Name	Classifi-cation	Habitat	Prey	Feeding Technique	Status
Great Egret	*Casmerodius albus*	Colonial water bird	Freshwater and salt marshes, tidal flats, nests in colonies	Fish, frogs, snakes, crayfish	Wades in shallow water and spears the prey	No special status
Bonaparte's Gull	*Larus Philadelphia*	Colonial water bird	Ocean bays, coastal waters, islands, and lakes	Fish, crustaceans, snails, marine worms	Feed by dipping to the surface of the water. Occasionally they drop into the water, take a few deep strokes, then glide to the surface	No special status
Herring Gull	*Larus argentatus*	Colonial water bird	Common in all aquatic habitats	Aquatic and marine animals, clams, shellfish	Scavenger	No special status
Great Black-backed Gull	*Larus marinus*	Colonial water bird	Coastal beaches, estuaries, lagoons	Anything smaller than itself, including, small ducks, fish, shellfish	Scavenger	No special status
Laughing Gull	*Larus atricilla*	Colonial water bird	Salt marshes, bays, estuaries; very rare inland	Insects, fish, shellfish, crabs	Carnivore, scavenger, dives for prey	No special status
Ring-billed Gull	*Larus delawarensis*	Colonial water bird	Lakes and rivers; many move to salt water in winter	Fish, small mammals and rodents	Scavenger	No special status
Black-legged Kittiwake	*Rissa tridactyla*	Colonial water bird	Cliffs and seacoasts; generally spends the entire winter on the open ocean	Small fish and plankton	Only gull that occasionally dives and swims underwater to capture food	No special status
Razorbill	*Alca torda*	Colonial water bird	Coastal waters	Fish, shrimp, and squid	Very adept at diving and have been caught in gill nets as deep as 60 ft	No special status
Bald Eagle	*Haliaeetus leucocephalus*	Raptor	Coastal areas, estuaries, large inland waterways; overwintering along the Atlantic coastlines and islands	Fish, other birds (waterfowl and seabirds), small mammals, carrion	Swooping from a perch or by coursing low over the water and dropping straight down when a fish is spotted	Federal and State listed as threatened
Osprey	*Pandion haliaetus*	Raptor	Lakes, rivers, seacoasts	Fish	Flies over the water and catches prey in talons.	No special status

List of Coastal and Marine Birds Recorded in the RIR ZSF (continued).

Common Name	Scientific Name	Classifi-cation	Habitat	Prey	Feeding Technique	Status
Horned Grebe	*Podiceps auritus*	Marsh bird	Population moves to coast in fall; once on wintering grounds, they seldom fly	Insects, crustaceans, small fish; on wintering grounds, mollusks are also consumed	Excellent swimmer and diver; during dives it may stay submerged for up to three minutes and travel 490-660 ft horizontally in that time	No special status
Red-necked Grebe	*Podiceps grisegena*	Marsh bird	Coastal bays and estuaries during migration and winter	Fish, crustaceans, and aquatic insects	Diving and propelling through the water	No special status
Mute Swan	*Cygnus olor*	Marsh bird	Freshwater ponds, rivers, coastal lagoons, bays; in winter, common on marine waters	Aquatic vegetation, aquatic insects, fish, frogs	Plunge head below water surface	No special status
American Coot	*Fulica americana*	Marsh bird	Open ponds and marshes; winters on coastal bays and inlets; feeds with ducks	Aquatic plants	Swims and dives for food	No special status
Pie-billed Grebe	*Podilymbus podiceps*	Marsh bird	Marshes, ponds; saltwater in winter if freshwater freezes	Fish, crustaceans, aquatic insects, crayfish	Dives for food	No special status
Eared Grebe	*Podiceps nigricollis*	Marsh bird	Prefers freshwater wetlands with large expanses of open water; open bays and ocean in winter	Aquatic insects, small crustaceans, and fish	Grazing, probing, dives for prey	No special status
American Bittern	*Botaurus lentiginosus*	Marsh bird	Saltwater marshes during migration and winter; does not nest in colonies	Insects, amphibians, crayfish, small fish and mammals	Forages; waits motionless for prey then catches and shakes or bites to kill	No special status

Information from several sources:
- *National Audubon Society Field Guide to North American Birds, Eastern Region*. Knopf, Alfred A. 1994.
- Fish and Wildlife Service Natural Heritage and Endangered Species Program, Massachusetts Natural Heritage Program fact sheets: http://www.state.ma.us/dfwele/dfw/nhesp/nhrare.html
- University of Michigan website : http://animaldiversity.wmmz.umich.edu/chordata/aves.html
- Audubon Society Christmas Bird Counts (http://www.audubon.org).

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APPENDIX A-6

CONTAMINANT CONCENTRATIONS IN FINFISH, LOBSTER, AND OCEAN QUAHOG FROM THE RIR ZSF

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Chemical Concentrations in Finfish Fillet and Liver.

Analyte	Winter Flounder Fillet							
	Site 16		Site 18		Site 69A		Site 69B	
	Mean n=1	Q	Mean n=2	Q	Mean n=2	Q	Mean n=2	Q
Lipid (%)	1.34		1.87		0.878		1.92	
Organic Chemicals (ppb wet wt)								
Total PAH	2.25		4.96		5.38		3.9	
Total PCB	37.3		27.4		16.0		29.8	
Total DDT	1.58		2.16		1.40		2.50	
Total Chlordane	0.480		0.753		0.431		0.882	
2,3,7,8-TCDD	0.110		0.755	U	0.100		0.195	
Anthracene	0.025	U	0.0474	U	0.0278	U	0.0422	
Benzo(a)pyrene	0.0706		0.0812	U	0.124		0.0666	
Aldrin	0.0384	U	0.0395		0.0393	U	0.0443	U
Dieldrin	0.276		0.116		0.069		0.186	
Endosulfans	0.11		0.119		0.118		0.123	
Heptachlor	0.0445	U	0.0477	U	0.0474	U	0.0474	U
Heptachlor epoxide	0.0309	U	0.0357	U	0.0355	U	0.0355	U
Metals (ppm wet wt)								
Arsenic	3.64		3.98		6.81		4.18	
Beryllium	0.00582		0.00697		0.00588		0.00615	
Cadmium	0.00217		0.00289	U	0.00199		0.00265	U
Chromium	0.431		0.358		0.398		0.366	
Copper	0.337		0.196		0.172		0.206	
Lead	0.0256		0.0121		0.0156		0.0091	
Mercury	0.0309		0.0241		0.0391		0.0272	
Nickel	0.0627		0.051		0.0431		0.0474	
Selenium	0.341		0.376		0.451		0.383	
Silver	0.00053		0.00294		0.00188		0.00602	
Zinc	5.77		7.5		6.67		5.66	

Q = Qualifier
U = not detected above Method Detection Limit

Chemical Concentrations in Finfish Fillet and Liver (continued).

Analyte	Butterfish Fillet							
	Site 16		Site 18		Site 69A		Site 69B	
	Mean n=1	Q	Mean n=2	Q	Mean n=2	Q	Mean n=2	Q
Lipid (%)	2.34		1.75		4.00		3.10	
Organic Chemicals (ppb wet wt)								
Total PAH	6.17		7.46		10.1		9.42	
Total PCB	64.8		28.0		43.6		28.3	
Total DDT	3.37		2.55		4.24		3.02	
Total Chlordane	1.57		1.17		1.56		1.15	
2,3,7,8-TCDD	0.12		0.09	*	0.81	U*	0.09	*
Anthracene	0.148		0.142	J	0.345		0.204	
Benzo(a)pyrene	0.271		0.103		0.124		0.211	
Aldrin	0.0381	U	0.0444	U	0.0446	U	0.0446	U
Dieldrin	1.20		0.400		0.641		0.751	
Endosulfans	0.109		0.126		0.124		0.124	
Heptachlor	0.0441	U	0.0475	U	0.0478	U	0.0477	U
Heptachlor epoxide	0.0306	U	0.356	U	0.0358	U	0.0358	U
Metals (ppm wet wt)								
Arsenic	0.509		0.819		0.645		0.733	
Beryllium	0.00554		0.0059		0.011		0.00886	
Cadmium	0.0151		0.0155		0.019		0.0143	
Chromium	0.304		0.417		0.422		0.374	
Copper	0.468		0.382		0.480		0.461	
Lead	0.00857		0.00908	U	0.006		0.00679	
Mercury	0.0333		0.0481		0.033		0.0341	
Nickel	0.0134		0.0279		0.022		0.0221	
Selenium	0.425		0.402		0.436		0.393	
Silver	0.00099		0.00416		0.002		0.00158	
Zinc	6.73		7.52		6.750		6.44	

Q = Qualifier
U = not detected above Method Detection Limit
* 2,3,7,8 TCDD only analyzed in one replicate.

Chemical Concentrations in Finfish Fillet and Liver (continued).

Analyte	Scup Fillet			
	Site 69A		Site 69B	
	Mean n=2	Q	Mean n=1	Q
Lipid (%)	2.14		2.33	
Organic Chemicals (ppb wet wt)				
Total PAH	8.18		6.37	
Total PCB	55.2		52.	
Total DDT	3.56		5.56	
Total Chlordane	0.719		1.11	
2,3,7,8-TCDD	NM		NM	
Anthracene	0.0805	U	0.0994	
Benzo(a)pyrene	0.0439	U	0.0571	U
Aldrin	0.04	U	0.06	U
Dieldrin	0.05		0.06	U
Endosulfans	0.125	U	0.165	
Heptachlor	0.05	U	0.07	U
Heptachlor epoxide	0.04		0.05	U
Metals (ppm wet wt)				
Arsenic	2.17		2.19	
Beryllium	0.00995	U	0.00995	U
Cadmium	0.00408		0.00318	
Chromium	0.418		0.46	
Copper	0.445		0.484	
Lead	0.0133		0.0245	
Mercury	0.0628		0.0475	
Nickel	0.118		0.102	
Selenium	0.548		0.572	
Silver	0.00406		0.00298	
Zinc	4.97		3.83	

Q = Qualifier
U = not detected above Method Detection Limit
NM = not measured

Chemical Concentrations in Finfish Fillet and Liver (continued).

Analyte	Silver Hake Fillet							
	Site 16		Site 18		Site 69A		Site 69B	
	Mean n=1	Q	Mean n=1	Q	Mean n=1	Q	Mean n=1	Q
Lipid (%)	1.45		2.01		1.98		1.37	
Organic Chemicals (ppb wet wt)								
Total PAH	2.79		2.73		2.84		3.38	
Total PCB	52.4		67.8		43.2		49.2	
Total DDT	3.32		5.75		3.67		3.84	
Total Chlordane	1.53		2.59		1.70		2.00	
2,3,7,8-TCDD	0.070		1.35	U	0.140	U	1.65	U
Anthracene	0.0861		0.0698		0.0631		0.0687	
Benzo(a)pyrene	0.107		0.0909		0.100		0.154	
Aldrin	0.0391	U	0.0392	U	0.0388	U	0.038	U
Dieldrin	0.307		0.824		0.441		0.574	
Endosulfans	0.113		0.113		0.112		0.109	
Heptachlor	0.0454	U	0.0455	U	0.045	U	0.0441	U
Heptachlor epoxide	0.0315	U	0.0316	U	0.0312	U	0.0306	U
Metals (ppm wet wt)								
Arsenic	2.06		2.76		2.93		3.20	
Beryllium	0.00531		0.00432		0.00395		0.00444	
Cadmium	0.00721		0.00422		0.00614		0.00412	
Chromium	0.417		0.345		0.310		0.342	
Copper	0.449		0.336		0.404		0.312	
Lead	0.00477		0.0052		0.0124		0.00738	
Mercury	0.0274		0.0211		0.0197		0.0241	
Nickel	0.636		0.0229		0.0268		0.0308	
Selenium	0.225		0.213		0.210		0.217	
Silver	0.00154		0.00045		0.00124		0.00082	
Zinc	3.83		3.53		5.43		3.46	

Q = Qualifier
U = not detected above Method Detection Limit

Chemical Concentrations in Finfish Fillet and Liver (continued).

Analyte	Winter Flounder Liver							
	Site 16		Site 18		Site 69A		Site 69B	
	Mean n=1	Q	Mean n=2	Q	Mean n=2	Q	Mean n=2	Q
Lipid (%)	25.9		20.2		22.9		22.5	
Organic Chemicals (ppb wet wt)								
Total PAH	20.5		68.3		33.8		18.6	
Total PCB	1,070		625		622		564	
Total DDT	45.6		54.5		52.4		48.3	
Total Chlordane	16.1		19.8		14.1		14.8	
2,3,7,8-TCDD	1.94		1.04		1.41		1.24	
Anthracene	1.06		0.972		0.752		1.10	
Benzo(a)pyrene	0.308	U	0.139	U	0.147	U	0.454	
Aldrin	0.323	U	0.143	U	0.154	U	0.129	U
Dieldrin	8.32		3.70		5.02		3.17	
Endosulfans	0.928		3.43		0.439		0.378	
Heptachlor	0.374	U	0.167	U	0.177	U	0.151	U
Heptachlor epoxide	0.26	U	0.414		0.122	U	0.104	U
Metals (ppm wet wt)								
Arsenic	2.95		3.54		5.73		5.64	
Beryllium	0.00926		0.0126		0.0149		0.0142	
Cadmium	0.0525		0.091		0.137		0.122	
Chromium	0.541		0.466		0.513		0.55	
Copper	13.9		16.2		13.2		15.2	
Lead	0.202		0.106		0.158		0.156	
Mercury	0.0285		0.0299		0.0377		0.0339	
Nickel	0.077		0.0611		0.0766		0.958	
Selenium	1.79		1.74		1.80		1.76	
Silver	0.204		0.233		0.181		0.246	
Zinc	39.2		44.2		39.4		42.0	

Q = Qualifier
U = not detected above Method Detection Limit

Lobster Meat and Hepatopancreas Contaminant Concentrations.

Analyte	Lobster															
	Meat		Hepatopancreas		Meat		Hepatopancreas		Meat		Hepatopancreas		Meat		Hepatopancreas	
	Site 16 (n = 5)				Site 18 (n = 1)				Site 69A (n = 1)				Site 69B (n = 1)			
	Mean	Q	Mean	Q	Mean	Q	Mean	Q	Mean	Q	Mean	Q	Mean	Q	Mean	Q
Lipid (%)	0.794		10.9		0.713		14.0		0.871		17.6		0.886		14.6	
Organic Chemicals (ppb wet wt)																
Total PAH	3.05		78.2		1.67		55.1		2.12		75.5		1.77		44.4	
Total PCB	15.6		1,440		11.0		868		10.2		1,030		14.3		779	
Total DDT	0.790		88.8		0.604		49.8		0.607		69.5		0.928		60.9	
Total Chlordane	0.148		6.08		0.146		7.87		0.184		7.69		0.139		6.06	
2,3,7,8-TCDD	0.291		2.24		0.300	U	1.71		0.266		2.63		0.65	U	2.45	
Anthracene	0.0307		1.12		0.0188		1.16		0.0183		2.13		0.0167		1.14	
Benzo(a)pyrene	0.16		3.52		0.0465		1.5		0.099		2.92		0.0459		0.85	
Aldrin	0.0194	U	0.0752	U	0.0196	U	0.0538	U	0.0192	U	0.0554	U	0.048	U	0.0558	U
Dieldrin	0.276		3.55		0.306		2.95		0.236		2.36		0.338		2.32	
Endosulfans	0.0556		0.216		0.0562		0.155		0.0551		0.159		0.138		0.161	
Heptachlor	0.0224	U	0.0872	U	0.0227	U	0.0624	U	0.0222	U	0.0642	U	0.0557	U	0.0647	U
Heptachlor epoxide	0.0317		0.915		0.034		1.76		0.04	J	1.76		0.0302		1.95	
Metals (ppm wet wt)																
Arsenic	6.75		9.28		5.99		10.8		7.41		9.23		7.28		8.25	
Beryllium	0.00382		0.00537		0.0151	U	0.00252		0.0151	U	0.00149		0.0151	U	0.00068	
Cadmium	0.0271		7.54		0.0157		8.59		0.0166		5.45		0.02		5.17	
Chromium	0.686		1.06		0.549		1.45		0.789		1.25		0.785		0.96	
Copper	19.7		502		18.5		569		27.7		299		21.1		445	
Lead	0.0147		0.0496		0.0119		0.0576		0.0122		0.0533		0.0141		0.0503	
Mercury	0.140		0.113		0.122		0.180		0.131		0.118		0.159		0.0887	
Nickel	0.0628		0.479		0.0755		0.586		0.0582		0.563		0.0822		0.416	
Selenium	0.439		0.935		0.332		0.916		0.488		1.02		0.495		0.77	
Silver	0.46		12.2		0.415		13.3		0.534		9.59		0.409		9.99	
Zinc	24.6		30.9		21.0		30.7		24.1		35.2		23.5		26.3	

Q = Qualifier
U = not detected above Method Detection Limit

Ocean Quahog Contaminant Concentrations.

Analyte	Ocean Quahog							
	Site 16		Site 18		Site 69A		Site 69B	
	Mean n=3	Q	Mean n=1	Q	Mean n=1	Q	Mean n=1	Q
Lipid (%)	0.289		0.288		0.430		0.260	
Organic Chemicals (ppb wet wt)								
Total PAH	1.97		1.51		1.48		1.36	
Total PCB	4.92		4.84		4.12		3.33	
Total DDT	0.548		0.719		0.837		0.524	
Total Chlordane	0.228		0.458		0.391		0.226	
2,3,7,8-TCDD	0.147	U	0.12	U	0.17		0.64	
Anthracene	0.026	U	0.0268	U	0.027	U	0.0265	U
Benzo(a)pyrene	0.038	U	0.0392	U	0.0395	U	0.0388	U
Aldrin	0.401	U	0.0411	U	0.0413	U	0.0407	U
Dieldrin	0.426	U	0.0436	U	0.0439	U	0.0432	U
Endosulfans	0.115		0.118		0.119		0.117	
Heptachlor	0.0466	U	0.0611		0.0479	U	0.0472	U
Heptachlor epoxide	0.0839		0.15		0.17		0.118	
Metals (ppm wet wt)								
Arsenic	1.94		1.90		2.11		1.84	
Beryllium	0.005		0.00443		0.0075		0.00362	
Cadmium	0.175		0.219		0.239		0.213	
Chromium	0.622		0.540		0.735		0.578	
Copper	0.524		0.329		0.522		0.404	
Lead	0.677		0.565		0.677		0.459	
Mercury	0.00695		0.00598		0.00792		0.00628	
Nickel	1.07		1.21		1.21		1.15	
Selenium	0.102		0.0938		0.117		0.0944	
Silver	0.826		0.468		0.942		0.678	
Zinc	4.48		4.56		5.15		5.16	

Q = Qualifier
U = not detected above Method Detection Limit

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APPENDIX A-7

CURRENT DOLLAR VALUE OF COMMERCIAL CATCH BY SPECIES AND BY HARBOR

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Projected Current Dollar Value of Losses by Commercial Species over the 20-Year Study Period
1-Year Disposal Cycle/No Dredging Window[8]

Species	Site E ($)	Site E (% of Loss)	Site W ($)	Site W (% of Loss)
Alewife	1,518	0.25	1,333	0.14
American Lobster	162,676	26.54	383,451	39.68
American Plaice	1,467	0.24	1,450	0.15
Atlantic Cod	6,523	1.06	6,523	0.67
Atlantic Herring	4,015	0.65	4,015	0.42
Atlantic Mackerel	7,223	1.18	7,223	0.75
Bigeye Tuna	9,115	1.49	9,115	0.94
Black Sea Bass	7,672	1.25	7,672	0.79
Bluefin Tuna	8,266	1.35	8,266	0.86
Bluefish	7,533	1.23	7,533	0.78
Butterfish	4,368	0.71	14,477	1.50
Cunner	34	0.01	34	<0.01
Cusk	8	<0.01	8	<0.01
Dogfish	-	-	-	-
Haddock	60	0.01	46	0.00
Hard Clam	127,300	20.77	127,300	13.17
Long Finned Squid	6,870	1.12	11,192	1.16
Menhaden	8,586	1.40	8,586	0.89
Northern Shrimp	34	0.01	34	<0.01
Ocean Pout	362	0.06	362	0.04
Ocean Quahog	43,354	7.07	133,778	13.84
Pollock	28	0.00	28	0.00
Red Hake	3,576	0.58	49,235	5.09
Rock Crab	5,313	0.87	5,313	0.55
Scup	35,640	5.81	69,648	7.21
Sea Scallop	6,639	1.08	6,639	0.69
Short Finned Squid	13	<0.01	21	<0.01
Silver Hake	44,908	7.33	15,541	1.61
Skate	432	0.07	301	0.03
Striped Bass	625	0.10	625	0.06
Summer Flounder	29,955	4.89	9,505	0.98
Surf Clam	3,366	0.55	3,366	0.35
Swordfish	5,396	0.88	5,396	0.56
Tautog	291	0.05	291	0.03

Note: Includes only losses experienced during the Study Period.

[8] Sources: Corps. 2003. The Economic Cost to Fisheries from Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Economic Analysis, Inc. for the U.S. Army Corps of Engineers. September 2003.
Corps. 2003. Draft Task 15.3: Assessment of Economic Significance of and Potential Impacts to Navigation Dependent Facilities of Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. November 2003.

Projected Current Dollar Value of Losses by Commercial Species over the 20-Year Study Period (continued).

Species	Site E ($)	Site E (% of Loss)	Site W ($)	Site W (% of Loss)
Tilefish	38,070	6.21	38,070	3.94
White Hake	166	0.03	231	0.02
Winter Flounder	16,275	2.66	16,091	1.66
Witch Flounder	2,396	0.39	2,369	0.25
Yellowfin Tuna	6,532	1.07	6,532	0.68
Yellowtail Flounder	6,322	1.03	4,875	0.50
Total	612,925	100.00	966,475	100.00

Note: Includes only losses experienced during the Study Period.

Current Value Dollar Impacts to Commercial Fishing by Dredging Center over the 20-Year Study Period
1-Year Disposal Cycle/No Dredging Window[9]

Dredging Center/Harbor	Study Period Catch ($)	Site E Loss ($)	Portion of Study Period Catch Value (% of Loss)	Site W Loss ($)	Portion of Study Period Catch Value (% of Loss)
Buzzards Bay					
Dartmouth	131,748	141	0.11	148	0.11
Fairhaven	11,687,398	13,827	0.12	32,135	0.27
Mattapoisett	339,650	386	0.11	934	0.28
New Bedford	48,529,001	39,215	0.08	81,846	0.17
Westport	21,406,674	22,264	0.10	53,117	0.25
Dredging Center Total	82,094,472	75,832	0.09	168,181	0.20
Narragansett Bay					
Bristol	284,798	266	0.09	388	0.14
Fall River	2,796,163	1,313	0.05	1,592	0.06
Jamestown	1,280,190	1,564	0.12	3,686	0.29
Little Compton	22,250,648	15,636	0.07	25,978	0.12
Newport	34,374,182	32,411	0.09	53,094	0.15
North Kingstown	34,556,091	39,715	0.11	42,453	0.12
Portsmouth	7,755,098	7,457	0.10	8,001	0.10
Providence	2,930	4	0.12	7	0.23
Tiverton	27,351,580	12,261	0.04	18,031	0.07
Dredging Center Total	130,651,680	110,626	0.08	153,232	0.12
Southern Rhode Island and Block Island					
Avondale	97,600	67	0.07	89	0.09
New Shoreham	5,777,131	3,217	0.06	4,803	0.08
Old Harbor	89,003	106	0.12	193	0.22
Pt. Judith	341,919,856	208,701	0.06	354,765	0.10
South Kingstown	20,423	22	0.11	25	0.12
Westerly	14,937	17	0.11	19	0.13
Dredging Center Total	347,918,950	212,129	0.06	359,894	0.10
Southern Cape Cod and the Islands					
Chilmark	5,197,001	6,112	0.12	14,164	0.27
Cuttyhunk	90,614	111	0.12	261	0.29
Edgartown	206,081	235	0.11	494	0.24
Falmouth	15,752	18	0.11	19	0.12
Martha's Vineyard	27,608	34	0.12	79	0.29
Tisbury	48,596	56	0.12	66	0.13
Dredging Center Total	5,585,651	6,565	0.12	15,083	0.27

[9] Sources: Corps. 2003. The Economic Cost to Fisheries from Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Economic Analysis, Inc. for the U.S. Army Corps of Engineers. September 2003.
Corps. 2003. Draft Task 15.3: Assessment of Economic Significance of and Potential Impacts to Navigation Dependent Facilities of Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. November 2003.

Current Value Dollar Impacts to Commercial Fishing by Dredging Center over the 20-Year Study Period (continued).

Dredging Center/Harbor	Study Period Catch ($)	Site E Loss ($)	Portion of Study Period Catch Value (% of Loss)	Site W Loss ($)	Portion of Study Period Catch Value (% of Loss)
Total – All Dredging Centers	**566,251,234**	**405,152**	**0.07**	**696,389**	**0.12**
Massachusetts – Outside of Economic Study Area	150,794,574	153,415	0.10	221,008	0.15
Non-Rhode Island/Massachusetts	3,752,944	46,338	1.23	62,437	1.66

APPENDIX A-8

CURRENT DOLLAR VALUE OF RECREATIONAL CATCH

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Projected Current Dollar Value Losses by Recreational Species over the 20-Year Study Period
1-Year Disposal Cycle/No Dredging Window[10]

Species	Site E ($)	Site E (% of Loss)	Site W ($)	Site W (% of Loss)
Atlantic Cod	2,925	1.35	2,925	1.38
Atlantic Mackerel	944	0.44	944	0.45
Black Sea Bass	6,695	3.09	6,695	3.16
Bluefish	166,068	76.59	166,068	78.32
Cunner	647	0.30	647	0.31
Dogfish	409	0.19	806	0.38
Pollock	6	0.00	6	0.00
Scup	791	0.36	1,546	0.73
Striped Bass	930	0.43	930	0.44
Summer Flounder	8,669	4.00	2,751	1.30
Tautog	27,651	12.75	27,651	13.04
Winter Flounder	1,079	0.50	1,067	0.50
Total	216,814	100.00	212,036	100.00

Note: Includes only losses experienced during the Study Period. Species not noted were determined by EAI to suffer no adverse impact related to recreational fishing.

[10] Sources: Corps. 2003. The Economic Cost to Fisheries from Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Economic Analysis, Inc. for the U.S. Army Corps of Engineers. September 2003.
Corps. 2003. Draft Task 15.3: Assessment of Economic Significance of and Potential Impacts to Navigation Dependent Facilities of Marine Disposal of Dredged Sediments at Two Potential Sites in Rhode Island Sound. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle and the Greeley-Polhemus Group, Inc. for the U.S. Army Corps of Engineers. November 2003.

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APPENDIX A-9

DISPOSAL AND TRANSPORT COST DATA DISTANCES AND UNIT COSTS BY HARBOR

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Distances and Unit Costs by Harbor.

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Little Narragansett Bay & Pawcatuck River	35.8		26.2	
(CT & RI) 50,000 CY		$24.36		$23.09
26,000 CY		$28.04		$28.35
15,000 CY		$29.16		$28.56
5,000 CY		$52.04		$52.18
1,500 CY		$77.64		$77.74
Watch Hill Cove, Westerly, RI	35.5		26.2	
50,000 CY		$24.25		$23.09
26,000 CY		$27.98		$28.35
15,000 CY		$29.10		$28.56
5,000 CY		$51.99		$52.18
1,500 CY		$77.61		$77.74
Weekapaug Inlet, Westerly, RI	26.4		17.1	
50,000 CY		$21.52		$20.09
26,000 CY		$26.09		$24.17
15,000 CY		$27.68		$26.98
5,000 CY		$50.32		$49.01
1,500 CY		$76.57		$75.45
Charlestown Inlet, Charlestown, RI	22.0		13.2	
26,000 CY		$25.08		$23.57
15,000 CY		$27.28		$26.83
5,000 CY		$49.48		$48.90
1,500 CY		$76.04		$74.98
Narrow River, Narragansett, RI	16.3		12.7	
26,000 CY		$24.05		$23.49
15,000 CY		$26.95		$26.81
5,000 CY		$48.99		$48.88
1,500 CY		$75.36		$74.92
Point Judith Harbor of Refuge and Pond	16.2		9.2	
250,000 CY		$12.10		$11.54
100,000 CY		$15.62		$14.84
75,000 CY		$18.16		$17.12
50,000 CY		$19.97		$18.84
26,000 CY		$24.03		$22.77
15,000 CY		$26.95		$26.49
5,000 CY		$48.99		$48.43
1,500 CY		$75.34		$74.42

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Allens Harbor, N. Kingston, RI	27.3		24.6	
26,000 CY		$26.30		$25.68
15,000 CY		$27.76		$27.51
5,000 CY		$50.49		$49.97
1,500 CY		$76.68		$76.35
Wickford Harbor, N. Kingston, RI	24.2		21.5	
26,000 CY		$25.58		$24.96
15,000 CY		$27.48		$27.24
5,000 CY		$49.90		$49.39
1,500 CY		$76.30		$75.98
Quonset-Davisville Harbor, N. Kingston RI	26.2		23.6	
1,000,000 CY		$9.64		$9.33
750,000 CY		$9.81		$9.50
500,000 CY		$11.92		$11.87
250,000 CY		$12.65		$12.54
100,000 CY		$16.62		$18.97
Greenwich Cove, Greenwich, RI	31.8		29.1	
50,000 CY		$22.80		$21.96
26,000 CY		$27.27		$26.72
15,000 CY		$28.36		$27.92
5,000 CY		$51.32		$50.83
1,500 CY		$77.20		$76.89
Apponaug Cove, Warwick, RI	31.7		29.1	
26,000 CY		$27.25		$26.72
15,000 CY		$28.34		$27.92
5,000 CY		$51.31		$50.83
1,500 CY		$77.19		$76.89
Warwick Cove, Warwick, RI	30.1		27.1	
26,000 CY		$26.94		$26.25
15,000 CY		$28.02		$27.74
5,000 CY		$51.02		$50.45
1,500 CY		$77.01		$76.65
Brushneck Cove, Warwick, RI	30.1		27.5	
26,000 CY		$26.94		$26.35
15,000 CY		$28.02		$27.78
5,000 CY		$51.02		$50.53
1,500 CY		$77.01		$76.70

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Pawtuxet Cove, Warwick, RI	35.2		33.4	
50,000 CY		$24.13		$23.43
26,000 CY		$27.92		$27.58
15,000 CY		$29.04		$28.68
5,000 CY		$51.94		$51.61
1,500 CY		$77.57		$77.37
Providence River and Harbor, RI	38.2		36.4	
500,000 CY		$13.80		$13.41
250,000 CY		$14.77		$14.34
100,000 CY		$17.82		$17.64
50,000 CY		$25.30		$24.60
26,000 CY		$28.50		$28.15
15,000 CY		$29.64		$29.28
5,000 CY		$52.48		$52.15
1,500 CY		$77.90		$77.70
Bullocks Point Cove, E. Providence, RI	34.2		32.2	
26,000 CY		$27.73		$27.35
15,000 CY		$28.84		$28.44
5,000 CY		$51.76		$51.40
1,500 CY		$77.46		$77.24
Seekonk River, E. Providence, RI	38.7		37.1	
500,000 CY		$13.91		$13.56
250,000 CY		$14.89		$14.50
100,000 CY		$17.87		$17.71
50,000 CY		$25.49		$24.87
26,000 CY		$28.60		$28.29
15,000 CY		$29.74		$29.42
5,000 CY		$52.57		$52.28
1,500 CY		$77.96		$77.78
Barrington River, Barrington, RI	37.0		34.7	
26,000 CY		$28.27		$27.83
15,000 CY		$29.40		$28.94
5,000 CY		$52.26		$51.85
1,500 CY		$77.77		$77.52
Kickamuit River, Warren, RI	33.0		31.4	
26,000 CY		$27.50		$27.19
15,000 CY		$28.60		$28.28
5,000 CY		$51.54		$51.25
1,500 CY		$77.33		$77.15

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Bristol Harbor, Bristol, RI	29.3		27.9	
26,000 CY		$26.76		$26.44
15,000 CY		$27.94		$27.81
5,000 CY		$50.87		$50.60
1,500 CY		$76.92		$76.75
Newport Harbor, Newport, RI	18.2		16.6	
50,000 CY		$20.25		$20.02
26,000 CY		$24.34		$24.09
15,000 CY		$27.03		$26.96
5,000 CY		$49.05		$49.00
1,500 CY		$75.58		$75.39
Mellville Basin, Portsmouth, RI	24.2		22.7	
26,000 CY		$25.58		$25.24
15,000 CY		$27.48		$27.34
5,000 CY		$49.90		$49.61
1,500 CY		$76.30		$76.12
Coddington Cove, Middleton, RI	20.9		19.4	
26,000 CY		$24.82		$24.52
15,000 CY		$27.18		$27.08
5,000 CY		$49.27		$49.08
1,500 CY		$75.91		$75.73
Dutch Island Harbor, Jamestown, RI	19.2		16.5	
26,000 CY		$24.49		$24.08
15,000 CY		$27.07		$26.96
5,000 CY		$49.08		$49.00
1,500 CY		$75.70		$75.38
Sakonnet Harbor, Little Compton, RI	12.3		20.2	
26,000 CY		$23.43		$24.66
15,000 CY		$26.79		$27.12
5,000 CY		$48.87		$49.14
1,500 CY		$74.88		$75.82
Block Island Harbor of Refuge, RI	18.1		8.0	
50,000 CY		$20.23		$18.46
26,000 CY		$24.32		$22.31
15,000 CY		$27.02		$26.18
5,000 CY		$49.04		$47.88
1,500 CY		$75.57		$74.16

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Great Salt Pond, New Shoreham, RI	21.9		12.1	
50,000 CY		$20.80		$19.39
26,000 CY		$25.05		$23.40
15,000 CY		$27.27		$26.78
5,000 CY		$49.46		$48.86
1,500 CY		$76.03		$74.85
Taunton River, Taunton, MA	33.4		31.7	
50,000 CY		$23.43		$22.76
26,000 CY		$27.58		$27.25
15,000 CY		$28.68		$28.34
5,000 CY		$51.61		$51.31
1,500 CY		$77.37		$77.19
Fall River Harbor, Fall River, MA	34.0		32.3	
500,000 CY		$12.88		$12.51
250,000 CY		$13.76		$13.35
100,000 CY		$17.40		$17.23
50,000 CY		$23.66		$23.00
26,000 CY		$27.69		$27.37
15,000 CY		$28.80		$28.46
5,000 CY		$51.72		$51.41
1,500 CY		$77.44		$77.25
Assonet Bay, Freetown, MA	40.5		38.9	
26,000 CY		$28.96		$28.63
15,000 CY		$30.22		$29.78
5,000 CY		$53.04		$52.60
1,500 CY		$78.22		$77.98
Westport Harbor, Westport, MA	17.9		24.0	
26,000 CY		$24.29		$25.54
15,000 CY		$27.02		$27.46
5,000 CY		$49.04		$49.86
1,500 CY		$75.55		$76.28
New-Bedford - Fairhaven Harbor, MA	31.4		39.7	
500,000 CY		$12.31		$14.13
250,000 CY		$13.14		$15.13
100,000 CY		$17.14		$17.97
50,000 CY		$22.65		$25.88
26,000 CY		$27.19		$28.79
15,000 CY		$28.28		$29.94
5,000 CY		$51.25		$52.75
1,500 CY		$77.15		$78.07

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Nasketucket Bay, Fairhaven, MA	28.4		37.0	
100,000 CY		$16.84		$17.70
50,000 CY		$21.84		$24.83
26,000 CY		$26.55		$28.27
15,000 CY		$27.86		$29.40
5,000 CY		$50.70		$52.26
1,500 CY		$76.81		$77.77
Mattapoisett Bay, Mattapoisett, MA	37.3		45.0	
26,000 CY		$28.33		$30.00
15,000 CY		$29.46		$32.15
5,000 CY		$52.31		$55.15
1,500 CY		$77.80		$79.25
Sippican Harbor, Marion, MA	32.1		40.6	
26,000 CY		$27.33		$28.98
15,000 CY		$28.42		$30.26
5,000 CY		$51.38		$53.08
1,500 CY		$77.23		$78.24
Wareham Harbor, Wareham, MA	36.9		46.1	
50,000 CY		$24.79		$27.28
26,000 CY		$28.25		$30.25
15,000 CY		$29.38		$32.62
5,000 CY		$52.24		$55.67
1,500 CY		$77.76		$79.50
Weeweantic River, Wareham, MA	35.5		44.2	
50,000 CY		$24.25		$26.88
26,000 CY		$27.98		$29.82
15,000 CY		$29.10		$31.81
5,000 CY		$51.99		$54.77
1,500 CY		$77.61		$79.07
Onset Bay, Wareham, MA	36.8		45.0	
50,000 CY		$24.75		$27.05
26,000 CY		$28.23		$30.00
15,000 CY		$29.36		$32.15
5,000 CY		$52.22		$55.15
1,500 CY		$77.75		$79.25
Buttermilk Bay, Bourne, MA	39.0		46.9	
26,000 CY		$28.65		$30.44
15,000 CY		$29.80		$32.97
5,000 CY		$52.62		$56.04
1,500 CY		$77.99		$79.69

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor		Site E		Site W	
		Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Cape Cod Canal, MA		37.5		46.1	
	250,000 CY		$14.60		$15.69
	100,000 CY		$17.75		$19.83
	50,000 CY		$25.03		$27.28
	26,000 CY		$28.37		$30.25
	15,000 CY		$29.50		$32.62
	5,000 CY		$52.35		$55.67
	1,500 CY		$77.83		$79.50
Red Brook Harbor & Pocasset Cove		34.4		42.7	
Bourne, MA	26,000 CY		$27.77		$29.47
	15,000 CY		$28.88		$31.16
	5,000 CY		$51.79		$54.07
	1,500 CY		$77.48		$78.72
Pocasset River, Bourne, MA		35.9		44.0	
	26,000 CY		$28.06		$29.77
	15,000 CY		$29.18		$31.72
	5,000 CY		$52.06		$54.68
	1,500 CY		$77.65		$79.02
Wild Harbor, Falmouth, MA		31.8		40.3	
	26,000 CY		$27.27		$28.92
	15,000 CY		$28.36		$30.01
	5,000 CY		$51.32		$52.94
	1,500 CY		$77.20		$78.17
West Falmouth Harbor, Falmouth, MA		30.6		39.2	
	26,000 CY		$27.04		$28.69
	15,000 CY		$28.12		$29.84
	5,000 CY		$51.11		$52.66
	1,500 CY		$77.07		$78.01
Quisett Harbor, Falmouth, MA		28.6		37.2	
	26,000 CY		$26.60		$28.31
	15,000 CY		$27.87		$29.44
	5,000 CY		$50.73		$52.30
	1,500 CY		$76.83		$77.79
Great Harbor at Woods Hole, Falmouth		28.4		38.3	
	26,000 CY		$26.55		$28.52
	15,000 CY		$27.86		$29.66
	5,000 CY		$50.70		$52.49
	1,500 CY		$76.81		$77.91

Distances and Unit Costs by Harbor (continued).

Navigation Project or Harbor	Site E		Site W	
	Distance (nmi)	Cost/CY	Distance (nmi)	Cost/CY
Woods Hole Channel, Falmouth, MA	27.0		35.7	
50,000 CY		$21.62		$24.32
Canipisit Channel, Gosnold, MA	14.7		24.4	
50,000 CY		$19.76		$21.20
Cuttyhunk Harbor, Gosnold, MA	15.1		24.1	
50,000 CY		$19.76		$21.16
26,000 CY		$23.86		$25.56
15,000 CY		$26.90		$27.47
5,000 CY		$48.95		$49.88
1,500 CY		$75.21		$76.29
Lake Tashmoo, Tisbury, MA	27.0		37.5	
26,000 CY		$26.23		$28.37
15,000 CY		$27.73		$29.50
5,000 CY		$50.43		$52.35
1,500 CY		$76.64		$77.83
Menemsha Creek, Aquinnah, MA	18.9		30.0	
26,000 CY		$24.45		$26.92
15,000 CY		$27.06		$28.00
5,000 CY		$49.07		$51.00
1,500 CY		$75.67		$77.00
Average Unit Cost		**$40.53**		**$40.97**

APPENDIX B

AGENCY COORDINATION LETTERS

RHODE ISLAND REGION LONG-TERM DREDGED MATERIAL DISPOSAL SITE EVALUATION PROJECT

FINAL ENVIRONMENTAL IMPACT STATEMENT

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Office of the Governor
State of Rhode Island and Providence Plantations
State House
Providence, Rhode Island 02903-1196
401-222-2080

LINCOLN ALMOND
GOVERNOR

September 21, 2000

Colonel Brian E. Osterndorf
Commander
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Dear Colonel Osterndorf:

I would like to request that the Corps of Engineers and the United States Environmental Protection Agency initiate the necessary efforts to identify and designate a permanent dredged material disposal site for the State of Rhode Island. I understand that this requires a comprehensive assessment of all of our current and future dredging needs, identification of all the potential disposal sites and an assessment of all the associated impacts with utilizing these sites. Designation of a permanent site will allow us to maintain our existing channels and harbors and thereby avoid the added cost and risks associated with lightering or waiting on the tide.

The staff of the State's Coastal Resources Management Council, Department of Environmental Management and other appropriate agencies will be available to assist you in this effort.

My point of contact for this effort is Clark Greene, Policy Director, who may be reached at (401) 222-2080, Extension 263.

Sincerely,

Lincoln Almond

cc: RI Congressional Delegation
Grover Fugate, RI Coastal Resources Management Council
Jan Reitsma, RI Department of Environmental Management
Sam Reid, Washington Director

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Summary: No formal comment letter was sent to the preparing agency.

ERP No. F–AFS–L65351–ID East Slate Project, Harvesting Timber, Implementation, Idaho Panhandle National Forests, St. Joe Ranger District, Shoshone County, ID.

Summary: No formal comment letter was sent to the preparing agency.

ERP No. F–AFS–L65357–ID East Beaver and Miner's Creek Timber Sales and Prescribed Burning Project, Implementation, Caribou-Targhee National Forest, Dubois Ranger District, Clark County, ID.

Summary: No formal comment letter sent to the preparing agency.

ERP No. F–GSA–L81013–OR Eugene/Springfield New Federal Courthouse, Construction, Lane County, OR.

Summary: No comment letter sent on the Final EIS.

ERP No. F–SFW–L36100–WA Tacoma Water Green River Water Supply Operations and Watershed Protection Habitat Conservation Plan, Implementation, Issuance of a Multiple Species Permit for Incidental Take, King County, WA.

Summary: No formal comment letter was sent to the preparing agency.

ERP No. F–USN–A10072–00 Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA), To Improved Capability to Detect Quiter and Harder-to-Find Foreign Submarines, Implementation.

Summary: EPA continues to express environmental concerns related to impact on marine mammals.

ERP No. F–USN–E11047–00 USS Winston S. Churchill (DDG 81), Conducting a Shock Trial, Offshore of Naval Stations, Mayport, FL; Norfolk, VA and/or Pascagoula, MS.

Summary: Some environmental impact(s) on resident fishery populations are unavoidable; however, avian/marine mammals in the vicinity of testing should be adequately protected through planned mitigation measures.

Dated: April 03, 2001.

Joseph C. Montgomery,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. 01–8560 Filed 4–5–01; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–6962–5]

Designation of Dredged Material Disposal Sites in Rhode Island Sound and Adjacent Waters, Rhode Island and Massachusetts. Intent To Prepare an Environmental Impact Statement

AGENCIES: U.S. Environmental Protection Agency (EPA)—Region I, New England in cooperation with the U.S. Army Corps of Engineers (Corps), New England District.

ACTION: Notice of Intent to prepare an Environmental Impact Statement (EIS) to consider the potential designation of one or more long term dredged material disposal sites in the region of Rhode Island Sound under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed disposal sites in Rhode Island Sound, known as Site 69B, 69A, Site 18, as well as additional alternatives including other possible open water disposal sites in this and adjacent waters, other types of dredged material disposal and management, and the no action alternative.

PURPOSE: In accordance with EPA's Notice of Policy and Procedures for Voluntary Preparation of National Environmental Policy Act documents (FR 63(209): 38045–38047), EPA issues this Notice of Intent to prepare an EIS for the evaluation of Designation of Long Term Dredged Material Disposal Sites in the Rhode Island Sound region, offshore of Rhode Island and Massachusetts.

FOR FURTHER INFORMATION CONTACT: Mr. Larry Rosenberg, Public Affairs Office, U.S. Army Corps of Engineers, 696 Virginia Road, Concord, MA 01742–2751, (978) 318–8657 email: *larry.b.rosenberg@usace.army.mil* or Ms. Ann Rodney, U.S. EPA—New England Region, One Congress Street, Suite 1100, CWQ Boston, MA 02114–2023, (617) 918–1538, *rodney.ann@epa.gov*. Please contact Ann Rodney should you have special needs (sign language interpreters, access needs) at the above address or our TDY# (617) 918–1189.

SUMMARY: There are many harbors, channels and navigation dependant facilities in Rhode Island and southeastern Massachusetts that must undergo periodic maintenance dredging to ensure safe navigation. Some harbors occasionally must be deepened beyond historical depths to meet changing economic and safety needs. Many of these necessary public and private dredging projects have not been accomplished due to the unavailability of disposal sites for dredged material. In other cases, sites on land have been used and the agency or permit applicant had no alternative but to transport the dredged material outside of the project area, which can often increase the cost of the project substantially. Prior studies directed at resolving the dredged material disposal management problem in this area were limited in scope, addressing only the immediate disposal needs of a project pending at the time. EPA issued a Notice of Intent on a similar action in July 1984. Although that study identified the need for a dredged material site in the Rhode Island/southeast Massachusetts area, local opposition at the time halted the project early in its planning stage.

Historically, only one site in Rhode Island Sound has been extensively used. Dredged material was disposed at a site near Brenton Reef pursuant to an EIS released by the Corps in 1971 for the Providence River Dredging project. Another site in the Sound near Brown's Ledge was proposed and evaluated for the Fall River Improvement Dredging project in 1980, but never used. In 1998, the Corps issued a Draft EIS for the Providence River Maintenance Dredging project that evaluated three sites in Rhode Island Sound: Site 69A, 69 B and Site 18. A final EIS is due in June 2001. If the Providence EIS results in the selection of an ocean site by the Corps, the site may be used only for a 5–10 year period after the site has been selected for the Providence River Maintenance Dredging Project. Designation of a site for long term use must be performed under a separate designation process administered by EPA. The State of Rhode Island is currently in the process of identifying potential sites in Narragansett Bay for use by private marinas in the Bay area. Even if the state effort is successful, it is anticipated that there is need for a larger regional disposal site for bigger projects. Over the last two decades, a number of studies have confirmed the need for a regional site including two needs studies performed for each state in the late 1980's and a Rhode Island Governor directed task force (1993) and Rhode Island commission (1996). In response to recent requests of Governor Almond and Senator Reed, EPA and the Corps will consider designation of a long term disposal site in Rhode Island Sound and adjacent waters under section 102(c) of the MPRSA in a forthcoming EIS. The EIS will evaluate other possible alternatives including other open water disposal sites, other

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disposal and management options, and the no action alternative. It must be emphasized here that designation of a site does not by itself authorize or result in disposal of any particular material. It only serves to make the designated site a disposal option available for consideration in the alternatives analysis for each individual dredging project in the area. Each future project must assess whether it meets the ocean disposal criteria for discharge at such a site and demonstrate the need for ocean disposal.

The EPA and the Corps will enter an agreement to undertake evaluation of one or more long term dredged material disposal sites in Rhode Island Sound and adjacent waters under Section 102(c) of the MPRSA. The EPA has the responsibility of designating sites under Section 102(c) of the Act and 40 CFR 228.4 of its regulation. Because of its experience with the Providence project, the Corps, which has been funded for this effort, will administer the technical studies and public participation process of the EIS with EPA oversight.

An EIS will evaluate a range of potential sites in Rhode Island Sound and adjacent waters, and the disposal and management of dredged material, including the no action alternative. The EIS will support the EPA's final decision on whether one or more dredged material disposal sites will be designated under the MPRSA. The EIS will include analysis applying the five general and 11 specific site selection criteria for designating ocean disposal sites presented in 40 CFR Parts 228.5 and 228.6, respectively. The Draft and forthcoming Final EIS for the Providence River Dredging Project will serve as a starting point for further evaluation of sites in the EPA EIS. EPA will incorporate by reference to the extent possible all data and analyses developed by the Corps in the Providence River EIS, as well as supplement this with further studies.

Need for EIS: On October 29, 1998, (63 FR 38045–38047) the EPA published repeal of its May 7, 1994 Policy for Voluntary Preparation of Environmental Impact Statements (39 FR 16186–16187) and notice of a new policy and procedures. The new policy states that EPA will prepare an Environmental Assessment or, if appropriate, an Environmental Impact Statement in connection with Agency decisions where the Agency determines that such an analysis would be beneficial. Among the criteria that may be considered in making such a determination are: (a) The potential for improved coordination with other federal agencies taking related actions; (b) the potential for using an EA or EIS to comprehensively address large-scale ecological impacts, particularly cumulative effects; (c) the potential for using an EA or an EIS to facilitate analysis of environmental justice issues; (d) the potential for using an EA or EIS to expand public involvement and to address controversial issues; and (e) the potential of using an EA or EIS to address impacts on special resources or public health. Having considered these criteria EPA has determined that an EIS for designation of dredged material disposal sites in Rhode Island Sound and adjacent waters would be beneficial.

Alternatives: In evaluating the alternatives, the EIS will identify and evaluate locations within the Rhode Island Sound study area that are best suited to receive dredged material suitable for open water marine disposal. At a minimum, the EIS will consider various alternatives including:

- No-action (*i.e.*, no designation of any sites);
- Designation of one or more ocean sites;
- Designation of alternative open water sites identified within the study area that may offer environmental advantages to the existing sites; and
- Identification of other disposal and/or management options, either in or out of the water, including the potential for beneficial use opportunities for dredged material.

Scoping: Full public participation by interested federal, state, and local agencies as well as other interested organizations and the general public is invited. All interested parties are encouraged to submit their names and addresses to one of the addresses below, to be placed on the mailing list for reviewing any fact sheets, newsletters and related public notices. The Environmental Protection Agency—New England Region and the Corps of Engineers, New England District, will hold two public scoping meetings in May of 2001. The Massachusetts meeting will be held on May 17, 2001 at White's of Westport, 66 State Road, Westport, MA. The Rhode Island meeting will be on May 22, 2001 at the Lighthouse Inn, 307 Great Island Rd, Galillee, Narragansett, RI. Both meetings will begin at 7 p.m. with registration starting at 6 p.m. Details of the history of the project and the alternatives to be considered will be presented. The public is invited to attend and identify issues that should be addressed in the EIS.

Estimated Date of the Draft EIS Release

Summer 2003

Responsible Official: Ira Leighton, Acting Regional Administrator EPA—New England.

Dated: April 3, 2001.

Anne Norton Miller,

Acting Director, Office of Federal Activities.

[FR Doc. 01–8561 Filed 4–5–01; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–6964–2]

State Activities To Quantify and Reduce Greenhouse Gas Emissions: Assistance Competition

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice; solicitation of applications.

SUMMARY: Today's document announces the availability of funds and solicits proposals from state agencies involved with climate change and air quality issues, for greenhouse gas (GHG) emissions inventories and GHG mitigation plans. To this purpose, EPA will make available grants of up to $25,000 (for inventories) and up to $75,000 (for mitigation plans) to each recipient in the form of cooperative agreements.

DATES: *Deadline for Intents to Apply:* April 30, 2001.

Proposal Submissions Deadline: May 31, 2001.

FOR FURTHER INFORMATION CONTACT: Denise Mulholland, (202) 564–3471.

SUPPLEMENTARY INFORMATION: This solicitation notice falls under the authority of section 103 of the Clean Air Act. The Catalog of Federal Domestic Assistance number for this notice is 66.606.

Contents by Section

I. Eligible Entities
II. Background
III. Overview and Deadlines
IV. Funding Issues
V. Selection Criteria
VI. Evaluation and Selection
VII. Proposals
VIII. Other Items of Interest
IX. How to Apply

I. Eligible Entities

Organizations being targeted for cooperative agreements include but are not limited to state environmental agencies, energy offices, economic development agencies, and public utility commissions. 501(c)(4) entities and profit-makers are not eligible.

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 CAUSEWAY STREET, SUITE 900, BOSTON, MA 02114-2138
(617) 626-1200 FAX: (617) 626-1240

February 26, 2001

Mr. David Tomey
U.S. Environmental Protection Agency, Region I
JFK Federal Building
One Congress Street
Boston, MA 02203

Dear ~~Mr. Tomey~~ Dave,

Thank you for notifying the Massachusetts Office of Coastal Zone Management (CZM) that the U.S. Environmental Protection Agency intends to file a Notice of Intent to prepare an Environmental Impact Statement (EIS) to consider the designation of a dredged material disposal site for clean material in the waters of Rhode Island Sound.

We understand that the purpose of the EIS will be to evaluate the need for such a site, and to evaluate all potential management alternatives, including beneficial use, upland management, alternative technologies, aquatic disposal, and the no-action alternative. Based on our experience working with coastal municipalities and water-dependent marine facilities in Southeastern Massachusetts, CZM agrees that the proposed EIS is appropriate. We also agree that it is necessary to evaluate a wide area for potential sites for the disposal of clean material, an area that may include Massachusetts' waters. CZM will provide detailed comments on the alternatives analysis during the public scoping meetings.

Massachusetts is in the process of designating a state-managed disposal site for clean material in Buzzard's Bay. This site, used historically by the Corps of Engineers as a site for material from the Cape Cod Canal, and by municipal and private projects around the Bay, has a projected capacity sufficient for those projects. It will not accommodate larger, regional volumes of material. While CZM recognizes that this site will be evaluated under the federal EIS, we expect that due to its limited capacity it will be screened off the list of practicable alternatives. In addition, please note that the designation of any disposal site in Massachusetts' waters is subject to approval by the Commonwealth.

Again, we appreciate your interest in CZM's position and look forward to working with you over the course of this project.

Sincerely,

Thomas W. Skinner

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

August 30, 2002

Councilman John Brown
Narragansett Indian Tribe
P.O. Box 268
Charlestown, RI 02813

Re: Rhode Island Sound Environmental Impact Statement

Dear Councilman Brown:

The United States Environmental Protection Agency - New England and the U.S. Army Corps of Engineers, New England District are in the process of developing an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) for the Designation of a Long-Term Dredged Material Disposal Site in the Rhode Island Sound. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island Sound region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, as well as additional alternatives, including other possible open water disposal sites in this and adjacent waters, other dredged material disposal and management techniques, and a no action alternative.

EPA would like to take this opportunity to invite the Tribe to participate in the Rhode Island Sound EIS process. We will be notifying you of any upcoming public meetings and including the Tribe on the Agency's distribution lists for review and comment on the documents concerning this EIS.

Under NEPA, a tribe may be recognized as a cooperating agency if the tribe has any special expertise concerning a project. Accordingly, if the Tribe wants to participate as a cooperating agency, please provide us with documentation of your areas of special expertise for this project by September 30, 2002.

Morever, we are currently assessing the NHPA requirements for this project and hope to consult with you shortly concerning section 106 of the NHPA process.

If you have any questions, please contact Jean Brochi at (617) 918-1536 or Valerie Bataille at (617) 918-1674.

Sincerely,
Jean Brochi for
Melville P. Cote Jr.
Manager
Water Quality Unit
Office of Ecosystem Protection (CWQ)

cc: Mark Paivos, Army Corps of Engineers
Mike Keegan, Army Corps of Engineers
Cathy Rogers, Army Corps of Engineers
Valerie Bataille, EPA
David Tomey, EPA
Ann Rodney, EPA
Mel Cote, EPA
Jean Brochi, EPA
LeAnn Jensen, EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

August 30, 2002

Mr. Matthew Vanderhoop, Director of Natural Resources
Wampanoag Tribe of Gay Head (Aquinnah)
20 Black Brook Road
Aquinnah, MA 02535

Re: Rhode Island Sound Environmental Impact Statement

Dear Mr. Vanderhoop:

The United States Environmental Protection Agency - New England and the U.S. Army Corps of Engineers, New England District are in the process of developing an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) for the Designation of a Long-Term Dredged Material Disposal Site in the Rhode Island Sound. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island Sound region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, as well as additional alternatives, including other possible open water disposal sites in this and adjacent waters, other dredged material disposal and management techniques, and a no action alternative.

EPA would like to take this opportunity to invite the Tribe to participate in the Rhode Island Sound EIS process. We will be notifying you of any upcoming public meetings and including the Tribe on the Agency's distribution lists for review and comment on the documents concerning this EIS.

Under NEPA, a tribe may be recognized as a cooperating agency if the tribe has any special expertise concerning a project. Accordingly, if the Tribe wants to participate as a cooperating agency, please provide us with documentation of your areas of special expertise for this project by September 30, 2002.

Morever, we are currently assessing the NHPA requirements for this project and hope to consult with you shortly concerning section 106 of the NHPA process.

If you have any questions, please contact Jean Brochi at (617) 918-1536 or Valerie Bataille at (617) 918-1674.

Sincerely,

Jean Brochi for

Melville P. Cote Jr.
Manager
Water Quality Unit
Office of Ecosystem Protection (CWQ)

cc: Mark Paivos, Army Corps of Engineers
Mike Keegan, Army Corps of Engineers
Cathy Rogers, Army Corps of Engineers
Valerie Bataille, EPA
David Tomey, EPA
Ann Rodney, EPA
Mel Cote, EPA
Jean Brochi, EPA
LeAnn Jensen, EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

September 30, 2002

Matthew Thomas, Chief
Narragansett Indian Tribe
P.O. Box 268
Charlestown, RI 02813

Re: Rhode Island Sound Environmental Impact Statement

Dear Chief Thomas:

The United States Environmental Protection Agency - New England (EPA) and the U.S. Army Corps of Engineers, New England District are in the process of developing an Environmental Impact Statement (EIS) under National Environmental Policy Act (NEPA) for the Designation of Long-Term Dredged Material Disposal Sites in the Rhode Island Sound. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island Sound region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, as well as additional alternatives, including other possible open water disposal sites in this and adjacent waters, other dredged material disposal and management techniques, and a no action alternative.

EPA recently sent a letter to the Tribe's National Historic Preservation Act (NHPA) representative inviting the Narragansett Tribe's participation in the Long Island Sound EIS process. The letter indicates that EPA will notify the Tribe of all upcoming public meetings and will include the Tribe on the Agency's distribution lists for review and comment on documents concerning this EIS.

Under NEPA, the lead agency may invite others, including tribes, into the NEPA process as a cooperating agency if the invitee has special expertise concerning a project. Accordingly, we also requested that the Tribe's NHPA representative and the Natural Resource Directors provide EPA with documentation of the Tribe's areas of special expertise that could be of assistance to this project by September 30, 2002 if the tribe would like to participate as a cooperating agency.

Moreover, the Agency also indicated that it is in the process of evaluating National Historic Preservation Act requirements in connection with this project and that we hope to consult with you shortly concerning the Tribe's historic properties.

If you have any questions, please contact Jean Brochi at (617) 918-1536 or Valerie Bataille at (617) 918-1674.

Sincerely,

Robert W. Varney
Regional Administrator

cc: John Brown, Narragansett Indian Tribe
Dinalyn Spears, Narragansett Indian Tribe
Marcos Paiva, Army Corps of Engineers
Catherine Rogers, Army Corps of Engineers
Michael Keegan, Army Corps of Engineers
Valerie Bataille, EPA
David Tomey, EPA
Jean Brochi, EPA
LeAnn Jensen, EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

September 30, 2002

Beverly Wright, Chairperson
Wampanoag Tribe of Gay Head
20 Blackbrook Road
Gay Head, MA 02535

RE: Rhode Island Sound Environmental Impact Statement

Dear Chairperson Wright:

The United States Environmental Protection Agency - New England (EPA) and the U.S. Army Corps of Engineers, New England District are in the process of developing an Environmental Impact Statement (EIS) under National Environmental Policy Act (NEPA) for the Designation of Long-Term Dredged Material Disposal Sites in the Rhode Island Sound. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island Sound region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, as well as additional alternatives, including other possible open water disposal sites in this and adjacent waters, other dredged material disposal and management techniques, and a no action alternative.

EPA recently sent a letter to the Tribe's National Historic Preservation Act (NHPA) representative inviting the Wampanoag Tribe's participation in the Long Island Sound EIS process. The letter indicates that EPA will notify the Tribe of all upcoming public meetings and will include the Tribe on the Agency's distribution lists for review and comment on documents concerning this EIS.

Under NEPA, the lead agency may invite others, including tribes, into the NEPA process as a cooperating agency if the invitee has special expertise concerning a project. Accordingly, we also requested that the Tribe's NHPA representative and the Natural Resource Directors provide EPA with documentation of the Tribe's areas of special expertise that could be of assistance to this project by September 30, 2002 if the tribe would like to participate as a cooperating agency.

Moreover, the Agency also indicated that it is in the process of evaluating National Historic Preservation Act requirements in connection with this project and that we hope to consult with you shortly concerning the Tribe's historic properties.

If you have any questions, please contact Jean Brochi at (617) 918-1536 or Valerie Bataille at (617) 918-1674.

Sincerely,

Robert W. Varney
Regional Administrator

cc: Matthew Vanderhoop, Wampanoag Tribe
Bret Sterns, Wampanoag Tribe
Marcos Paiva, Army Corps of Engineers
Catherine Rogers, Army Corps of Engineers
Michael Keegan, Army Corps of Engineers
Valerie Bataille, EPA
David Tomey, EPA
Jean Brochi, EPA
LeAnn Jensen, EPA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

April 16, 2002

Mr. Roger A. Janson
Associate Director, Surface Water Programs
U.S. Environmental Protection Agency
1 Congress St., Suite 1100
Boston, MA 02114

Dear Mr. Janson:

This responds to your April 2, 2002 letter requesting the Fish and Wildlife Service to participate as a cooperating agency in the preparation of an environmental impact statement for the Designation of a Long-Term Dredged Material Disposal Site in the Rhode Island Sound Region.

We agree to participate as a cooperative agency in the Rhode Island Sound designation process. However, the level of our participation will be governed by staffing and budgetary constraints. We note that your letter is cognizant of these constraints as your scope of cooperating agency activities is generally limited to meetings and review of materials.

Mr. Vern Lang of this office will be the Service representative for this project. Questions may be directed to him at 603-223-2541 or email vernon_lang@fws.gov.

Sincerely yours,

Michael J. Bartlett
Supervisor
New England Field Office

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 CAUSEWAY STREET, SUITE 900, BOSTON, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

Dave

May 6, 2002

Mr. Roger Janson
Associate Director, Surface Water Programs
US Environmental Protection Agency, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Dear Mr. Janson:

This is to acknowledge that the Massachusetts Office of Coastal Zone Management (CZM) will participate as a cooperating agency as requested in the preparation of an Environmental Impact Statement for the designation of a Long-Term Dredged Material Disposal Site in the Rhode Island Sound Region.

We appreciate the opportunity to work cooperatively with your agency, the Corps of Engineers, and our neighbor state of Rhode Island to address the need for cost-effective and environmentally sound dredged material management solutions.

I will be the point of contact for this project and can be reached at (617) 626-1207 and deerin.babb-brott@state.ma.us. Also, please include Dave Janik, CZM's Southeast Shore Regional Coordinator, on all notices of meetings, hearings, etc. Dave can be reached at (508) 946-8990 and david.janik@massmail.state.ma.us.

Sincerely,

Deerin Babb-Brott
Assistant Director

Cc: Dave Janik, CZM

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, R.I. 02879-1900

(401) 783-3370
FAX: (401) 783-3767

July 30, 2002

US EPA, Region 1
Office of Ecosystem Protection
Surface Water Programs
1 Congress St
Boston, MA 02114-2023

Attn: Roger A. Janson

Dear Mr. Janson:

In response to your letter of April 4, 2002, requesting that the Coastal Resources Management Council (CRMC) participate in the preparation of an Environmental Impact Statement (EIS) as a cooperating agency per section 1501.6 the National Environmental Policy Act that the U.S. EPA - New England and the U.S. Army Corps of Engineers, NED are preparing for the Designation of a Long-Term Dredged Material Disposal Site in the Rhode Island Region. The CRMC will be a full partner in this and any similar effort.

The CRMC will provide assistance necessary to facilitate the preparation of an EIS. The scope of the EIS is to provide an evaluation of the proposed disposal sites in Rhode Island Sound, known as Sites 69a, 69b and 18, as well as additional alternatives including other possible open water disposal sites in this and adjacent waters, other types of dredged material disposal and management. This assistance will include attending working group meetings, active participation in alternative analysis, active participation in discussion of field sampling results, site selection, and response to requests on the regulations.

We look forward to working with you on this important project. If you have any questions or need any additional information, please don't hesitate to call.

Sincerely,

Jeff Willis, Deputy Director
Coastal Resources Management Council

/pjc

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

AUG 21 2002

Roger A. Janson
Associate Director, Surface Water Programs
Office of Ecosystem Protection
U.S. Environmental Protection Agency
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Dear Mr. Janson:

This responds to your letter of April 2, 2002, requesting the National Marine Fisheries Service (NMFS) to participate as a cooperating agency in the preparation of an Environmental Impact Statement (EIS) for the Designation of a Long-Term Dredged Material Disposal Site in the Rhode Island Region, in accordance with the Council of Environmental Quality (CEQ) regulations (40 CFR 1501.6). NMFS agrees to participate as a cooperating agency to help advance effective interagency coordination on an EIS for this significant project.

NMFS has been involved in interagency meetings and coordination with the Federal Resource Agency partners in this developing project. We will continue involvement as a cooperating agency to the National Environmental Policy Act (NEPA) environmental assessment and documentation processes providing input of issues requiring analysis, consideration, or comment, particularly in the areas of the Endangered Species Act and Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act. Our role and degree of involvement as a cooperator will be constrained by existing staff and fiscal resources capabilities. Our contributions generally will be limited to scoping, identification of issues and topics that need consideration and evaluation in the EIS, review of documents, and routine attendance at meetings. We are not in a position to undertake data collection, conduct EIS analyses, or prepare sections of the draft or final EIS as staff and resources are fully tasked in other obligatory NMFS programs.

I understand that the next steps will involve discussions of the Working Group. We expect to make every reasonable effort to work with your staff on this and other steps in the NEPA process associated with this project.

If you have any questions, please contact Stan Gorski at 732-872-3037 or Michael Ludwig at 203-882-6594. We look forward to exploring the issues associated with this important project.

Sincerely,

Patricia A. Kurkul
Regional Administrator

cc: Gorski
Ludwig
Godfrey-ACOE
Colosi

tag=RId-sitdes

FROM : FAX NO. : Apr. 12 2001 11:48AM P2

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

REPLY TO ATTENTION OF

September 17, 2002

Project Management Division
Programs and Civil Project Management Branch

Mr. Mike Ludwig
NOAA/NMFS
212 Rogers Avenue
Milford, CT 06460

Dear Mr. Ludwig,

As you are aware, the United States Environmental Protection Agency (EPA), Region 1 - New England and the U.S. Army Corps of Engineers (Corps), New England District are in the process of developing an Environmental Impact Statement (EIS) under the National Environmental Policy Act to evaluate the Designation of a Long-Term Dredged Material Disposal Site(s) in the Rhode Island Sound Region. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island Sound region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, as well as additional alternatives, including other possible open water disposal sites in this and adjacent waters, other dredged material disposal and management techniques, and a no action alternative.

As part of our evaluation and documentation effort, we have prepared a preliminary Purpose and Need Statement for the EIS. Although our sections of the entire Purpose and Need chapter are still under development such as narratives on Regulatory Framework, Proposed Action, etc., information on Purpose and Needs has been developed which as a cooperating agency we would like to submit to you for review.

We have also conducted a dredging needs evaluation to attempt to estimate dredging needs and identify future disposal requirements. As part of the dredging needs evaluation, questionnaires were sent to navigation dependent facilities in Rhode Island and Southeastern Massachusetts. These facilities were requested to estimate their dredging needs within the next 20 years. Historic dredging activities were reviewed to supplement the estimates for those facilities that did not respond to the questionnaire and to project future Federal dredging needs. The questionnaire was designed to: verify the facility location, type, nature and size of business; future dredging needs; and the financial impact of not dredging. The questionnaire in the survey and historic data regarding dredging activities in the study area were combined to calculate future maintenance and improvement or expansion activities over the 20-year period between 2002 and 2021 in the Rhode Island and southeastern Massachusetts region.

The identified future dredging locations and needs were consolidated into four dredging centers to determine where the largest quantities of dredged material would originate. This information and other information was used to identify a preliminary Zone of Siting Feasibility (ZSF) that included both upland and open water boundaries for potential disposal of dredged material from Rhode Island and southeastern Massachusetts. The ZSF sets the area requiring more detailed environmental analysis to establish potential specific disposal location(s) and ultimately a preferred disposal site. In addition to the dredging centers the boundary of the ZSF is dictated by several general factors:

- Cost of transporting dredged material to the disposal site.
- Type of dredging/disposal methods.
- Navigation restrictions.
- Political boundaries.
- Distance to the edge of the continental shelf (when feasible).

Enclosed are copies of the draft ZSF report that documents the analysis that was used in developing the ZSF has been identified for this EIS.

As a cooperating agency for the above EIS, the EPA and the Corps would like to request your review of the attached draft Purpose and Need Statement for the EIS and the draft ZSF report. We are requesting that a representative from your agency attend a meeting to discuss the draft Purpose and Need Statement and the draft ZSF. This meeting will be held Monday September 30, 2002 at 10:00 a.m. in the New England Conference Room at the U.S. Army Corps of Engineers office on 696 Virginia Road, Concord, Massachusetts. For security purposes we are required to inform building security the names of meeting participants so please inform Ms. Catherine Rogers at (978) 318-8231 if you will be attending the meeting.

If you have any questions or need additional information concerning the above material, please contact me at (978) 318-8087 or Ms. Catherine Rogers at (978) 318-8231.

Sincerely,

Michael F. Keegan

Michael F. Keegan, P.E; L.C.S.
Project Manager

Enclosures

FROM : FAX NO. : Apr. 19 2001 01:26PM P5
SEP-18-02 WED 12:28 BATTELLE DUXBURY FAX NO. 781 934 2124 P. 02

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

REPLY TO ATTENTION OF

September 17, 2002

Project Management Division
Programs and Civil Project Management Branch

Mr. Daniel Goulet
CRMC Dredging Coordinator
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, RI 02879-1900

Dear Mr. Goulet:

As you are aware, the United States Environmental Protection Agency (EPA), Region 1 - New England and the U.S. Army Corps of Engineers (Corps), New England District are in the process of developing an Environmental Impact Statement (EIS) under the National Environmental Policy Act to evaluate the Designation of a Long-Term Dredged Material Disposal Site(s) in the Rhode Island Sound Region. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island Sound region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. The EIS will provide an evaluation of the proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, as well as additional alternatives, including other possible open water disposal sites in this and adjacent waters, other dredged material disposal and management techniques, and a no action alternative.

As part of our evaluation and documentation effort, we have prepared a preliminary Purpose and Need Statement for the EIS. Although our sections of the entire Purpose and Need chapter are still under development such as narratives on Regulatory Framework, Proposed Action, etc., information on Purpose and Needs has been developed which as a cooperating agency we would like to submit to you for review.

We have also conducted a dredging needs evaluation to attempt to estimate dredging needs and identify future disposal requirements. As part of the dredging needs evaluation, questionnaires were sent to navigation dependent facilities in Rhode Island and Southeastern Massachusetts. These facilities were requested to estimate their dredging needs within the next 20 years. Historic dredging activities were reviewed to supplement the estimates for those facilities that did not respond to the questionnaire and to project future Federal dredging needs. The questionnaire was designed to: verify the facility location, type, nature and size of business; future dredging needs; and the financial impact of not dredging. The questionnaire in the survey and historic data regarding dredging activities in the study area were combined to calculate future maintenance and improvement or expansion activities over the 20-year period between 2002 and 2021 in the Rhode Island and southeastern Massachusetts region.

The identified future dredging locations and needs were consolidated into four dredging centers to determine where the largest quantities of dredged material would originate. This information and other information was used to identify a preliminary Zone of Siting Feasibility (ZSF) that included both upland and open water boundaries for potential disposal of dredged material from Rhode Island and southeastern Massachusetts. The ZSF sets the area requiring more detailed environmental analysis to establish potential specific disposal location(s) and ultimately a preferred disposal site. In addition to the dredging centers the boundary of the ZSF is dictated by several general factors:

- Cost of transporting dredged material to the disposal site.
- Type of dredging/disposal methods.
- Navigation restrictions.
- Political boundaries.
- Distance to the edge of the continental shelf (when feasible).

Enclosed are copies of the draft ZSF report that documents the analysis that was used in developing the ZSF has been identified for this EIS.

As a cooperating agency for the above EIS, the EPA and the Corps would like to request your review of the attached draft Purpose and Need Statement for the EIS and the draft ZSF report. We are requesting that a representative from your agency attend a meeting to discuss the draft Purpose and Need Statement and the draft ZSF. This meeting will be held Monday September 30, 2002 at 10:00 a.m. in the New England Conference Room at the U.S. Army Corps of Engineers office on 696 Virginia Road, Concord, Massachusetts. For security purposes we are required to inform building security the names of meeting participants so please inform Ms. Catherine Rogers at (978) 318-8231 if you will be attending the meeting.

If you have any questions or need additional information concerning the above material, please contact me at (978) 318-8087 or Ms. Catherine Rogers at (978) 318-8231.

Sincerely,

Michael F. Keegan

Michael F. Keegan, P.E; L.C.S.
Project Manager

Enclosures

January 10, 2003

Project Management Division
Programs and Civil Project Management Branch

Mr. Victor Mastone, Director
Board of Underwater Archaeological Resources
241 Causeway Street, Suite 900
Boston, Massachusetts 02114-2136

Dear Mr. Mastone:

The United States Environmental Protection Agency (EPA) - New England, Region 1 and the U.S. Army Corps of Engineers (Corps), New England District are in the process of developing an Environmental Impact Statement (EIS) under the National Environmental Policy Act to evaluate the Designation of a Long-Term Dredged Material Disposal Site(s) in the Rhode Island Region. The purpose of this EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island region, including potential sites in the southeastern Massachusetts area, under section 102(c) of the Marine Protection, Research and Sanctuaries Act. During the Providence River Maintenance Dredging Project EIS, many potential disposal sites were identified and evaluated. Four proposed disposal sites remained after screening of alternatives. An evaluation of these four proposed offshore disposal sites in Rhode Island Sound, known as Sites 69a, 69b, 16 and 18, other potential upland and open water alternatives, inclusive of dredged material disposal and management techniques, and a no action alternative will be addressed in the EIS.

Please note that the Corps has completed an archaeological assessment of the offshore disposal sites above (with the exception of Site 16), as well as remote sensing and underwater archaeological investigations at Site 69b specifically (Battelle Ocean Sciences, April 2001). No significant cultural resources were identified at Site 69b. The Rhode Island Historic Preservation Commission concurred with this determination by letter dated January 29, 2001. As recommended in the Battelle report, additional evaluation and investigations would be required for Sites 16, 18, and 69a, as well as for any other open water or upland site selected as a result of this EIS.

As part of our evaluation and documentation effort, we are requesting pertinent information from your agency. Pursuant to 36 CFR 800.3, we would like to initiate study coordination of this undertaking in accordance with Section 106 of the National Historic Preservation Act, as amended, concerning historic, architectural, or archaeological resources that may be present within the study area. The Zone of Siting Feasibility (ZSF) has been determined to include both an upland and open water boundary for potential sites for dredged material disposal. The upland limit is marked by the State boundary between Connecticut and Rhode Island and the 50-mile limit from the study area's coastline. The open water limit is delineated by the State boundary between Connecticut and Rhode Island to the west, 20 miles south of Block Island, and east to the western limit of the 3-mile Territorial Limit around Martha's Vineyard. A map indicating the ZSF is enclosed to aid you in your work.

If you have any questions or need additional information concerning the above material, please contact me at (978) 318-8087 or Mr. Marc Paiva, Corps archaeologist at (978) 318-8796. Your response within 30 days of the date of this letter is requested to facilitate the timely completion of the draft EIS.

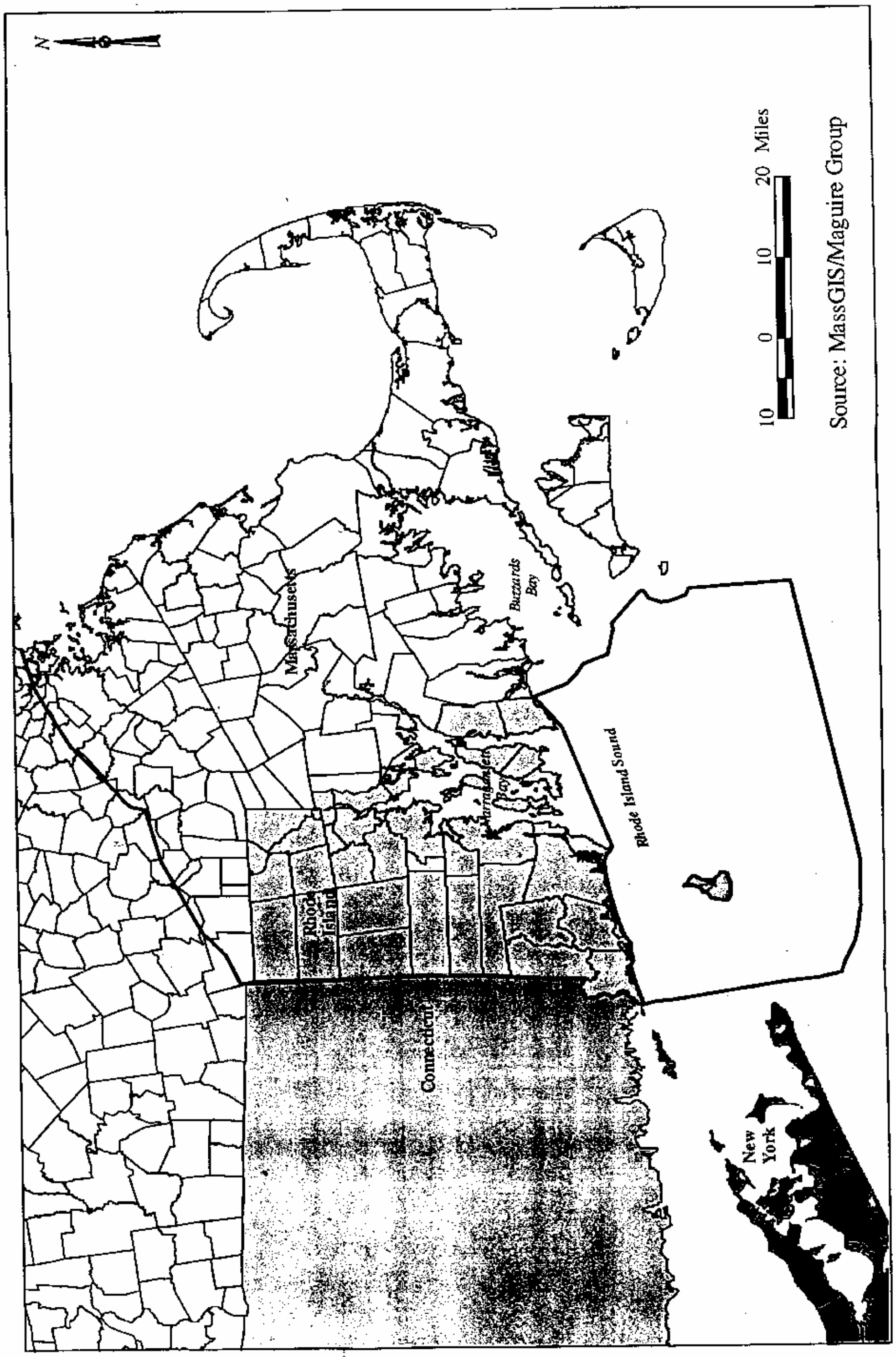
Sincerely,

Michael F. Keegan, P.E; L.C.S.
Project Manager

Enclosure

cc:
Ms. Rogers
Mr. Paiva
Mr. Keegan
Mr. Ring
Ms. Deb Walker - Battelle
Ms. Olga Guza – US EPA

Zone of Siting Feasibility for the RI Region Long-Term Dredged Material Disposal Site Evaluation Study



The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

January 27, 2003

Michael Keegan
Project Manager
US Army Corps of Engineers
New England Division
696 Virginia Road
Concord, MA 1742-2751

RE: ACE Long-Term Dredged Material Disposal Site(s), Massachusetts & Rhode Island. MHC #RC.32268.

Dear ~~Ms. Gardner~~ Mike Keegan:

Thank you for your inquiry regarding the proposed project referenced above. Staff of the Massachusetts Historical Commission (MHC) have reviewed the information and have the following comments.

MHC recommends that Army Corps of Engineers staff or its designee come to the MHC to consult the Inventory of the Historic and Archaeological Assets of the Commonwealth to determine whether known historical or archaeological resources may be affected by the proposed disposal sites. The Army Corps is encouraged to consult with the Board of Underwater Archaeological Resources as to the location of underwater archaeological resources that could be affected by proposed underwater disposal sites. The study area seems unnecessarily broad. MHC looks forward to additional consultation once alternative disposal sites are identified.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (36 CFR 800), Massachusetts General Laws, Chapter 9, Sections 26-27C as amended by Chapter 254 of the Acts of 1988 (950 CMR 71), and Massachusetts General Laws, Chapter 6, Sections 179-180 (312 CMR 2). If you have any questions, please feel free to contact Margo Muhl Davis, Archaeologist/Preservation Planner, or me at this office.

Sincerely,

Edward L. Bell
Senior Archaeologist
Massachusetts Historical Commission

xc: Marc Paiva, USACOE–NED
Victor Mastone, Board of Underwater Archaeological Resources
Laurie Perry, Acting THPO, WTGHA
Frederick C. Williamson Rhode Island SHPO

RECEIVED
JAN 29 2003
DIVISION

220 Morrissey Boulevard, Boston, Massachusetts 02125
(617) 727-8470 • Fax: (617) 727-5128
www.state.ma.us/sec/mhc

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
HISTORICAL PRESERVATION & HERITAGE COMMISSION
Old State House • 150 Benefit Street • Providence, R.I. 02903-1209
Preservation (401) 222-2678 FAX (401) 222-2968
Heritage (401) 222-2669 TDD (401) 222-3700

February 6, 2003

Mr. Michael F. Keegan
Programs and Civil Project Management Branch
USAC
696 Virginia Road
Concord, MA 01742-2751

Re: Designation of Long-Term Dredged Material Sites
Rhode Island

Dear Mr. Keegan:

The Rhode Island Historical Preservation and Heritage staff have reviewed your letter of January 10, 2003 regarding the referenced project and have the following comments.

As your letter notes, many potential offshore disposal sites were initially identified; subsequently the list of sites was narrowed to four potential offshore disposal sites in Rhode Island Sound-- 69a, 69b, 16 and 18. An archaeological assessment of sites 69a, 69b, and 18 was conducted by Battell Ocean Sciences. This assessment determined that no significant submerged Native American sites were likely to be found at these three sites. Because of the possibility that historic shipwrecks were present, remote sensing and underwater archaeological investigation was conducted at site 69b; no significant cultural resources were identified. The disposal of dredged material at site 69b would therefore have no effect on any significant cultural resources. It is possible that sites 69a and 18 may contain significant shipwreck sites; if either of these sites is selected as the preferred alternative, further archaeological investigations would be necessary. No archaeological assessment has been conducted for site 16. Additional evaluation of this site, and any other open water or upland site selected, would be required before a determination could be made by this office regarding potential effects to cultural resources. These comments were conveyed to the USAC in our letter dated January 29, 2001.

These comments are provided in accordance with Section 106 of the National Historic Preservation Act. If you have any questions please contact Richard E. Greenwood, Project Review Coordinator, or Charlotte Taylor, Underwater Archaeologist, of this office.

Very truly yours,

Edward F. Sanderson
Executive Director
Deputy State Historic Preservation Officer

cc: Peter August - Coastal Institute; John Brown - NTHPO

(030206.01)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

DEC 3 1 2002

Mr. Michael F. Keegan, P.E., L.C.S.
Project Manager
Department of the Army
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Keegan:

This letter responds to your inquiry dated December 13, 2002 requesting information on the presence of any federally listed threatened or endangered species and/or designated critical habitat for listed species in Rhode Island Sound.

The Army Corps of Engineers (ACOE) and the Environmental Protection Agency (EPA) are in the process of developing an Environmental Impact Statement (EIS) to evaluate the Designation of a Long-Term Dredged Material Disposal Site(s) in the Rhode Island Region. The purpose of the EIS is to consider the potential designation of one or more long term dredged material disposal sites in the Rhode Island region, including potential sites in the southeastern Massachusetts area. As such, the ACOE is requesting information on the presence in the action area of any federally listed species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries).

Federally threatened loggerhead (*Caretta caretta*), endangered Kemp's ridley sea turtles (*Lepidochelys kempi*), and endangered green sea turtles (*Chelonia mydas*) can be found in New England waters during the summer months. The general trend for sea turtles found in this area is to migrate to the region in early summer, typically in June, and return south when the water temperature decreases around October. Sea turtles in this area are known to inhabit shallow harbors and embayments. Federally endangered leatherback sea turtles (*Dermochelys coriacea*) are located in New England waters during the warmer months as well. Concentrations of leatherbacks were observed during the summer off the south shore of Long Island. Leatherbacks in these waters are thought to be pursuing their preferred jellyfish prey.

Federally endangered North Atlantic right whales (*Eubalaena glacialis*), humpback whales (*Megaptera novaeangliae*), and fin whales (*Balaenoptera physalus*) may all also be found seasonally in New England waters. North Atlantic right whales have been documented in the nearshore waters of this region from January through September. Humpback whales feed during the spring, summer, and fall over a range, which encompasses the eastern coast of the United States. Fin whales are common in waters of the United States Exclusive Economic

Zone, principally offshore from Cape Hatteras northward. While these whale species are not considered residents of Buzzard's Bay, it is possible that transients may enter the Bay during seasonal migrations.

Should you have any questions about these comments, please contact Kim Damon-Randall at (978) 281-9112.

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

cc: MacDuffee, F/NER4

File Code: 1514-05 (A) General

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

January 10, 2003

Michael F. Keegan
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Keegan:

This responds to your December 13, 2002 letter requesting information on the presence of federally-listed and proposed endangered or threatened species within the proposed Zone of Siting Feasibility for the long-term dredged material disposal sites in Rhode Island. Our comments are provided in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543). We will provide Fish and Wildlife Coordination Act comments in a separate letter.

The project area delineated on the map enclosed in your letter includes the entire coastal area of Rhode Island (including Block Island). The federally threatened piping plover (*Charadrius melodus*) is known to occur on sandy beaches in Washington and Newport Counties, Rhode Island. These beaches include (but may not be limited to) the following:

Green Hill Beach	Misquamicut Beach
Quonochontaug Beach	Maschaug Beach
Trustom Pond	Watch Hill
Ninigret Beach	Napatree Beach
Charlestown Beach	East Beach
Satchuest Point	Briggs Beach
South Shore Beach	Block Island

Piping plover nests are situated above the high tide line on coastal beaches, sand flats at the ends of sandspits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and washover areas cut into or between dunes. They may also nest on areas where suitable dredge material has been deposited. Nest sites are shallow scraped depressions in substrates ranging from fine grained sand to mixtures of sand and pebbles, shells or cobble. Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass (Ammophila breviligulata) or other vegetation.

Roseate terns (*Sterna dougalii dougalii*) are historic to a few island off the coast of Rhode Island. Seabeach Amaranth (*Amaranthus pumilus*) and the Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) are also historic to a number of beaches in Rhode Island. If you need additional information on historic locations, please contact me. I have enclosed a list of federally threatened and endangered species in Rhode Island for your information.

Thank you for your cooperation and please contact me at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Susanna L. von Oettingen

Susanna L. von Oettingen
Endangered Species Biologist
New England Field Office

Enclosure

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN RHODE ISLAND

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Atlantic coastal waters and rivers
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	T	Entire state, occasional
Plover, piping	Charadrius melodus	T	Atlantic coast, Washington and Newport Counties
Tern, roseate	Sterna dougallii dougallii	E	Atlantic coast
MAMMALS:			
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
NONE			
INSECTS:			
Beetle, American burying	Nicrophorus americanus	E	Washington
Beetle, Northeastern beach tiger	Cicindela dorsalis dorsalis	T	Washington, extirpated
PLANTS:			
Small whorled pogonia	Isotria medeoloides	T	Providence, Kent Counties
Sandplain gerardia	Agalinus acuta	E	Washington

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service

Rev. 1/8/02

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director*

January 24, 2003

Michael F. Keegan
Department of the Army
New England District Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Re: Dredged Material Disposal Site
Norfolk, Plymouth, Bristol, Barnstable, Dukes, and Nantucket Counties, MA
NHESP File: 03-11445

Dear Mr. Keegan,

Thank you for contacting the Natural Heritage and Endangered Species Program for information regarding state-protected rare species in the vicinity of the above referenced site.

We have enclosed a list of all rare species and exemplary natural communities that are known to occur within the counties you indicated on your map. These species are protected under the Massachusetts Endangered Species Act (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00) as well as the state's Wetlands Protection Act (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for many of these species can be found on our website at www.state.ma.us/dfwele/dfw.

This evaluation is based on the most recent information available in the Natural Heritage database, which is constantly being expanded and updated through ongoing research and inventory. Should your site plans change, or new rare species information become available, this evaluation may be reconsidered.

Please do not hesitate to call me at (5· '792-7270 x154 if you have any questions.

Sincerely,

Christine Vaccaro
Environmental Review Assistant

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
Habitat Conservation Division
Milford Biological Laboratory
212 Rogers Avenue
Milford, CT 06460

DATE: March 3, 2003

TO: Cathy Rogers, New England District, Army Corps of engineers

FROM: Mike Ludwig, NOAA/NMFS, Milford, CT *Mike Ludwig*

SUBJECT: Rhode Island Sound and Buzzards Bay ESA and EFH Consultation Coordination for the identification and designation of a MPR&SA, Section 103, Open Water Disposal Site in those State or Federal waters.

1. The National Marine Fisheries Service (NMFS) has offered its assistance to the New England District of the U.S. Army Corps of Engineers (NAE) and US Environmental Protection Agency (EPA) as a cooperating agency in this matter. The assessment effort is being guided by the National Environmental Policy Act (NEPA). NMFS is using this memorandum to characterize the issues of importance and available resource assessment tools for the identification and designation of an open water disposal site in State or Federal waters between Cape Cod and Connecticut.

2. NMFS has responsibilities for protecting and managing aquatic species as well as their habitat that occur in the assessment area. The NAE / EPA information request seeks identification of the species and extent of their habitat use within the subject area. To expedite these initial discussions, we have concluded that a memorandum between our agencies is the most efficient coordination instrument.

3. To facilitate the interagency coordination regarding endangered species and essential fish habitat, we reviewed recently completed, NEPA actions for similar projects in the region. In particular, we revisited the Providence River Federal Navigation Project final Environmental Impact Statement (FEIS). The Endangered Species Act (ESA) Biological Assessment in that document was produced for the same type of activities (dredging and disposal) now under consideration. The FEIS and our subsequent, Biological Opinion were crafted to assess and manage both near and far field impacts associated with the disposal of almost 5 million cubic yards of sediments at a site in Rhode Island Sound.

4. In view of the general uniformity of the aquatic resource use patterns and habitat characteristics throughout the assessment area and described in the Providence River Project, we suggest that the FEIS documentation could be directly applied to the site designation evaluation effort, now underway. The standards used to determine what dredged sediment is "suitable for unrestricted openwater disposal," the list and characterization of marine mammals and sea turtle use of the waters are particularly applicable throughout most of the region, seaward of the 10 meter isobath. The EFH discussion holds less value, but does merit consideration. NMFS is confident that the ESA information and management practices presented in the Providence River Final EIS are applicable, directly, to the assessment at hand.

5. The NEPA documentation and NMFS responses to the ESA issues raised by the Providence River and associated, non-Federal actions provide a comprehensive evaluation of the issues. That work appears transferrable to the designation effort. However, the EFH assessment was based on a one project (The Providence River and associated work) use of a **selected** open water disposal site known as 69(b). Since the EFH discussions in the Providence River NEPA documentation assessed an impact period of 18 months and a recovery period approaching the same length of time, we recommend a more through and updated EFH assessment for the designation effort.

6. NMFS has been providing information and a physical presence at most of the outreach and State/Federal interagency meetings regarding site designation. We plan to continue that level of coordination. Should you wish to discuss this mater further, please call or e-mail me.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

April 8, 2004

Ms. Linda M. Murphy, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency
Region 1
1 Congress Street, Suite 1100
Boston, Massachusetts 02114-2023

Dear Ms. Murphy:

We are responding to your letter of March 8, 2004 regarding the ongoing effort to identify and designate an open water disposal site for dredged materials in the waters off Rhode Island. The designation would be authorized under Section 102 (a) of the Marine Protection, Research and Sanctuaries Act. Your letter requests that the National Marine Fisheries Service (NOAA Fisheries) concur with the Environmental Protection Agency and US Army Corps of Engineers, New England District, that consultations under the Endangered Species Act (ESA) and the essential fish habitat (EFH) provisions of the Magnuson - Stevens Fishery Conservation and Management Act (MSA), undertaken during the site selection of Site 69(b) as a dredged material disposal site, remain valid and appropriate should the site be designated.

Site 69(b) is located on the northern tip of a sea floor depression located roughly 7.5 nautical miles due east of Block Island, and facilitates disposal of sediments from the maintenance dredging of the Providence River Federal Navigation Project. The ESA consultations concluded that the use of site 69(b), now known as Site "W", was not likely to adversely affect any protected species under NOAA Fisheries jurisdiction. Similarly, we concurred that the impacts associated with site selection were not likely to adversely affect waters designated as EFH. While we continue to concur that the ESA and EFH conclusions and recommendations remain valid for the Site "W" designation, we also recognize that some natural as well as man induced changes may be affecting the region's habitat and resource use patterns since the initial consultations. For this reason, we recommend that the site monitoring program schedule reassessments of the EFH and ESA findings at five year intervals, or whenever significant and extraordinary changes of the resource base are observed. Please also note that a distinct and further EFH consultation must be reinitiated pursuant to 50 CFR 600.920(l) if new information becomes available that affects the basis for the present consultation. Also, new information may require additional consultation under Section 7 of the ESA. We look forward to your response regarding our recommendations and comments.

Should you or your staff wish to discuss this matter further, please contact Michael Ludwig at our Milford, Connecticut, Northeast Fisheries Science Center.

Sincerely,

for

Patricia A. Kurkul
Regional Administrator

CF: HCD; Milford, Sandy Hook
PRD, Gloucester

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

April 1, 2004

Reference:	Project	Location
	Draft EIS, dredged material disposal site	Rhode Island Sound

Linda Murphy
U.S. Environmental Protection Agency
1 Congress St., Suite 1100
Boston, MA 02114-2023

Dear Ms. Murphy:

This responds to your recent correspondence requesting information on the presence of federally-listed and/or proposed endangered or threatened species in relation to the proposed activity(ies) referenced above.

Based on information currently available to us, no federally-listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act is not required.

This concludes our review of listed species and critical habitat in the project location(s) and environs referenced above. No further Endangered Species Act coordination of this type is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

Thank you for your coordination. Please contact us at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Michael J. Amaral

Michael J. Amaral
Endangered Species Specialist
New England Field Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

July 16, 2004

John M. Fowler
Advisory Council on Historic Preservation
1100 Pennsylvania Avenue, NW, Suite 809
Old Post Office Building
Washington, DC 20004

Re: Environmental Impact Statement for the Designation of a Long-term Dredged Material Disposal Site in Rhode Island Sound

Dear Mr. Fowler:

EPA has prepared a draft Environmental Impact Statement (EIS) for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (the RIR Project). In accordance with 36 C.F.R. § 800.8(c), EPA is providing notice to the Advisory Council on Historic Preservation (ACHP) of the Agency's intent to rely upon the process and documentation required for preparation of the subject project's EIS to comply with Section 106 of the Historic Preservation Act in lieu of the procedures set forth in Sections 800.3 through 800.6 of the ACHP regulations. In accordance with 36 C.F.R. § 800.8(c)(2)(i), a copy of the draft EIS for the RIR Project is enclosed with this letter.

The RIR Project was conducted at the request of the Governor of Rhode Island to determine the feasibility of designating a long-term dredged material disposal site in the Rhode Island Region (the RIR). The RIR is defined in the draft EIS as the ocean waters offshore of Rhode Island or offshore of southeastern Massachusetts. As part of the RIR Project, the Army Corps of Engineers (the Corps) conducted a 20-year dredging needs survey. The dredging needs survey concluded that maintenance of the channels, anchorages, and marinas of the RIR required consideration of alternative disposal options for approximately 8.8 million cubic yards of material that may be dredged from harbors and navigation areas in Rhode Island and southeastern Massachusetts.

To identify potential long-term disposal sites and to assess the impacts of these potential disposals, EPA worked with the Corps to develop a draft EIS (the draft RIR EIS) for the designation of one or more long-term dredged material sites in the RIR. The draft RIR EIS was conducted in accordance with the requirements of the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq*., the Marine Protection, Research, and Sanctuaries Act, 33 U.S.C. § 1401 *et seq*., and the Clean Water Act, 33 U.S.C. § 1251 *et seq.*

The draft RIR EIS evaluated two alternative ocean disposal sites, Site E and Site W. Site E is located 15 nautical miles (nmi) southeast from Point Judith, Rhode Island and 17.7 nmi northeast of Block Island, Rhode Island. Site W is a deep water site located about 9 nmi south of Point Judith and 6.5 nmi due east of Block Island. Both of these sites are located in open water outside of Rhode Island's territorial limit.

It is important to note that Site W is also known as Site 69b, a disposal site that was thoroughly evaluated in 1999 during the EIS process concerning the selection of a dredged material disposal site for the Providence River and Harbor Maintenance Dredging Project (the Providence River EIS). As part of the Providence River EIS process, the Corps conducted an Archeological Assessment and Remote Sensing Archeological Survey (the Survey) concerning the impact of the Providence River Project on historic and prehistoric properties. A draft of the Corp's report concerning the results of the Survey was submitted to the Narragansett Tribe Historic Preservation Officer (THPO) and the Rhode Island State Historic Preservation Officer (the SHPO) for review and comment. Subsequent to the review of the draft Survey report, EPA, the THPO, and the SHPO engaged in discussions concerning the impact of the Providence River Project on historic and prehistoric properties. Tribal and SHPO comments were considered as part of the Corps's final report on the results of the Survey.

In relevant part, the final Survey report concluded, on the basis of background research and consultations concerning prehistoric and historic archeological resources and after conducting magnetometer and side scan sonar surveys, that it was unlikely that any intact, significant archeological resources or features existed in the vicinity of Site 69b. As a result, the report recommended that no further survey for historic resources be conducted for this site. Final Report, Archeological Assessment and Remote Sensing Archeological Survey, Providence River and Harbor Maintenance Dredging Project (June 30, 2000) at pp. 27, 28, 35. In a February 6, 2003 letter to the Corps, the SHPO concurred with these determinations.

The selection of Site 69b as the preferred disposal site for Providence River and Harbor dredged materials was supported by the determination that the disposal of these materials would likely have no impact upon historic or archeological resources. Providence River and Harbor Maintenance Dredging Project, Final Environmental Impact Statement (August 2001) at p. 5-9; see also 66 Fed. Reg. 44620 (August 24, 2001). A copy of the Providence River EIS is available from the Army Corps of Engineers, New England District, Concord, Massachusetts. The Corps has used Site 69b as a disposal site for Providence River and Harbor dredge materials since the spring of 2003.

Because Site W is the same site that was evaluated as part of the Providence River EIS process (Site 69b), conclusions concerning historic properties in the draft RIR EIS rely, in large part, upon the Providence River EIS analysis. In addition, as a supplement to the Providence River EIS evaluation, the Corps and EPA conducted a Historic Shipwreck Background Study, performed additional side scan sonar investigations of both alternative disposal sites, and engaged in consultations with the SHPO and the THPO. The Historic Shipwreck Background Study concluded that there is no evidence of shipwrecks within Sites E and W. Final Report, Historic Shipwreck Background Study (April 2004) at p. 6. Similarly, the side scan sonar investigations did not locate any potential surface features related to historical or cultural events in Site W. Draft, Environmental Impact Statement, Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (April 2004) at p. 3-189. In all, the supplemental analysis and consultations conducted for the draft RIR EIS confirmed the Providence River EIS determination that it is unlikely that any intact, significant archeological resources or features exist in the vicinity of Site W/69b. Id. As a result, the draft RIR EIS determined that the selection of Site W as the preferred alternative for designation of a long-term dredged material disposal site would have no effect upon historic properties. Environmental Impact Statement, Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (April 2004) at pp. 4-81, 6-11.

The draft RIR EIS public comment period commenced on April 30, 2004 and closed on June 21, 2004. EPA did not receive any comments concerning its determination that no historic properties will be affected by the proposed selection of Site W.

If you have any questions or comments, or need additional information concerning the Rhode Island Region Long-Term Dredged Material Disposal Project, please contact Olga Guza, EPA New England Project Manager, at 617-918-1542.

Sincerely,

Linda M. Murphy

Linda Murphy
Director, Office of Ecosystem Protection

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

July 19, 2004

John Brown
Tribal Historic Preservation Officer
Narragansett Indian Tribe
P.O. Box 700
Wyoming, RI 02898

Dear Mr. Brown:

Thank you for hosting the April 1, 2004 meeting concerning the draft Environmental Impact Statement (RIR EIS) for the proposed Rhode Island Region Long-Term Dredged Material Disposal Site Project at the Narragansett Tribal Headquarters. Representatives from the U.S. Army Corps of Engineers (Corps), the U.S. Environmental Protection Agency (EPA), Battelle, and the Narragansett Tribe attended the meeting. This letter is in response to several questions you raised at the meeting concerning historic properties of interest to the Narragansett Tribe.

As requested at the meeting, enclosed are copies of the draft RIR EIS and the Final Historic Shipwreck Background Study. Regarding your request for hard copies of the side scan sonar data, EPA cannot provide these because the hard copies cannot be reproduced and you need special software to read the electronic data. You also asked that EPA provide the Tribe with training on the analysis of side scan data. Although EPA does not have the expertise necessary to provide this type of training, we would be willing to meet with you at your request and bring in outside experts to explain the side scan sonar data and its interpretation.

Finally, you asked for a tour of site 69B, the disposal site currently being used by the Corps for dredged material from the Providence River and Harbor Project, and that has been proposed as the Rhode Island Region long-term dredged material disposal site. If you are still interested in such a trip, please contact Michael Keegan, the Corps' Project Manager, at (978) 318-3087.

If you have any questions or comments, or need additional information concerning the Rhode Island Region Long-Term Dredged Material Disposal Site Project, please contact Olga Guza, EPA New England Project Manager, at 617-918-1542.

Sincerely,

Melville P. Cote, Jr.

Melville P. Cote, Jr., Manager
Water Quality Unit

Enclosures

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

September 21, 2004

Grover J. Fugate
Executive Director
Coastal resources Management Council
Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

RE: Coastal Zone Management Consistency Determination

Dear Mr. Fugate:

The U.S. Environmental Protection Agency (EPA) is completing actions necessary for the proposed final designation of the Rhode Island Sound Disposal Site (RISDS) for dredge material disposal in Rhode Island sound. By this letter, we are requesting that *your* office concur with EPA's determination that the designation of the RIRDS in Rhode Island Sound is consistent with the applicable policies of the Rhode Island Coastal Management Program.

EPA has completed this federal consistency determination pursuant to Section 307 of the Coastal Zone Management Act. We have determined that the designation of RISDS is consistent with Rhode Island Coastal Management Policies (RICMP), and that any direct or indirect effects of the actual disposal of dredged material at these sites would be consistent with the RICMP based on:

1. State of Rhode Island Coastal Resources Management Program Section 300.9 Part B 2 "The Council favors offshore open-water disposal for large volumes of dredge materials, providing that environmental impacts are minimized"; and

2. A written letter from the Governor of Rhode Island (September 21, 2000) requesting EPA and the U.S. Army Corps of Engineers New England District (Corps) to determine if there is a need for a long-term ocean dredged material disposal sites as part of the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project in waters offshore of Rhode Island.

EPA, in cooperation with the Corps, the National Marine Fisheries Service, the U.S. Fish and Wildlife Services, the Rhode Island Departments of State and Environmental Management, prepared an Environmental Impact Statement (EIS) to assess the potential impacts of designation this site and alternatives to this proposed action. The Draft EIS was sent to your office for review on April 30,2004 and may also be found on our website http://www.epa.gov/region1/dredge. EPA is scheduled to release the final EIS, which includes a Response to Comments Appendix and Site Management and Monitoring plans, this October 2004, and a copy will be sent to your office for your review.

In addition, EPA has evaluated the designation of this proposed site in accordance with the requirements of the Maine Protection, Research and Sanctuaries Act, 33 U.S.C. §1401, commonly referred to as the Ocean Dumping Act. Specifically, EPA applied the five general and eleven specific statutory criteria for site designation as set forth at 40 CPR §228.5 and §228.6. After consideration of the criteria, EPA concluded that the designation of the proposed sites would not result in significant adverse impacts to the marine environment. This designation was subject to environmental review under the National Environmental Policy Act. EPA's designation of a disposal site for dredged material does not authorize the actual disposal of such material. Individual dredging projects must consider alternatives to open water disposal and must be evaluated by the Corps authorities consistent with Section 103 of the MPRSA, 33U.S.C. §141, and Section 10 of the Rivers and Harbors Act.

We would appreciate a written concurrence with this Coastal Zone Management Consistency determination from your office within 30 days of receipt of this letter, as we plan to proceed with final designation of the RISDS in the near future.

If you have any questions, please do not hesitate to contact me at 617-918-1505 or Olga Guza of my staff at 617-918-1542.

Sincerely,

Linda M. Murphy, Director
Office of Ecosystem Protection

cc:

Col Thomas L. Koning, US Army Corps of Engineers

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APPENDIX C

SITE MANAGEMENT AND MONITORING PLAN FOR THE RHODE ISLAND SOUND DISPOSAL SITE

RHODE ISLAND REGION LONG-TERM DREDGED MATERIAL DISPOSAL SITE EVALUATION PROJECT

FINAL ENVIRONMENTAL IMPACT STATEMENT

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ATTACHMENTS

Attachment A: Hypotheses Flow Charts and Summary Table
Attachment B: Scow Log Sample

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ACRONYMS AND KEYWORDS

CAD	Confined Aquatic Disposal
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
Corps-NAE	U.S. Army Corps of Engineers, New England District
CPUE	Catch Per Unit Effort
CWA	Clean Water Act (Federal Water Pollution Control Act)
CY	cubic yards
CZM	Coastal Zone Management
DAMOS	Disposal Area Monitoring System
DDT	1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane
DEIS	Draft Environmental Impact Statement
DMSMART	Dredged Material Spatial Management Record Tool
DO	dissolved oxygen
EDC	Economic Development Corporation
EIS	Environmental Impact Statement
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ESA	Endangered Species Act
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
GPS	Global Positioning System
H’	Shannon-Wiener Diversity Index
J’	Evenness Index
LORAN-C	Low Frequency Hyperbolic Radionavigation and time reference system
MCY	million cubic yards
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
MPRSA	Marine Protection, Research, and Sanctuaries Act of 1972
NAD83	North American Datum 1983
NAE	Corps New England District
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

NRC	National Research Council
OSI	Organism Sediment Index
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
ppb	parts per billion
pptr	parts per trillion
psu	Practical Salinity Unit
QA	Quality Assurance
RHA	Rivers and Harbors Act
RICRMC	Rhode Island Coastal Resources Management Council
RIDEM	Rhode Island Department of Environmental Management
RIDOA	Rhode Island Department of Administration
RIDOT	Rhode Island Department of Transportation
RIM	Regional Implementation Manual
RIPA	Rhode Island Port Authority
RIR	Rhode Island Region
RIS	Rhode Island Sound
RISDS	Rhode Island Sound Disposal Site
ROD	Record of Decision
RPD	Redox Potential Discontinuity
SAIC	Science Applications International Corporation
SMMP	Site Management and Monitoring Plan
TOC	Total Organic Carbon
TSS	Total Suspended Solids
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service (Department of the Interior)
WRDA	Water Resources Development Act of 1992 (Public Law 102-580)
wt	weight

1.0 BACKGROUND

Maintenance of adequate navigation depth in the states' marine terminals, port facilities, and private marinas is vital to the economics of Rhode Island and southeast Massachusetts (referred to as the Rhode Island Region). Both commercial and recreational industries throughout the Rhode Island Region (RIR) rely on the utility of such areas. To ensure continued use, economic viability and safety of the region's navigational channels and navigation-dependant facilities, periodic dredging must be performed to remove accumulated sediment. Maintenance dredging in the RIR has become both difficult and costly due to the absence of a designated long-term ocean disposal site in the region. In an effort to ease the burden, the Governor of Rhode Island requested that the U.S. Environmental Protection Agency (EPA), in cooperation with the U.S. Army Corps of Engineers (Corps), consider the designation of a long-term dredged material disposal site in Rhode Island Sound (pursuant with the Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. §§ 1401 *et seq.*). The EPA has selected Site W (Figure 1) in central Rhode Island Sound (RIS) as the preferred alternative to provide for the long-term needs of dredged material disposal in the Rhode Island Sound and southeastern Massachusetts regions. Site W is also the same location as Site 69B selected in the Providence River and Harbor Maintenance Dredging Project Final EIS (Corps, 2001a). Site W is hereinafter referred to as the Rhode Island Sound Disposal Site (RISDS). Dredged material from Federal and private projects of any size, that satisfy the requirements of the MPRSA and for which a permit for disposal is obtained, may be disposed of at the site (see Section 3.1). Prior to use of the site, each project must receive a permit issued by the U.S. Army Corps of Engineers (Corps) under Section 103 of the MPRSA, 33 U.S.C. §§ 1413 (hereafter cited as "MPRSA §103") with concurrence by the USEPA.

Management plans for designated ocean dredged material disposal sites are required pursuant to §102(c) of the MPRSA, as amended by §506(a) of the Water Resources Development Act (WRDA) of 1992. In accordance with MPRSA (section 103(a)) disposal activities at the site "will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." The purpose of this Site Management and Monitoring Plan (SMMP) is to synthesize prior site monitoring results and outline a management plan and monitoring program for the proposed site that complies with the requirements of MPRSA.

The SMMP serves as a framework to guide the development of future project-specific sampling and survey plans created under the monitoring program. The data gathered from the monitoring program will be routinely evaluated by EPA New England Region, the Corps of Engineers New England District (NAE), and other agencies such as the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (FWS), and state regulatory agencies (see Section 9.0), to determine whether modifications in site usage, management, testing protocols, or additional monitoring are warranted. The SMMP will be reviewed on an annual basis and will be revised and updated as necessary.

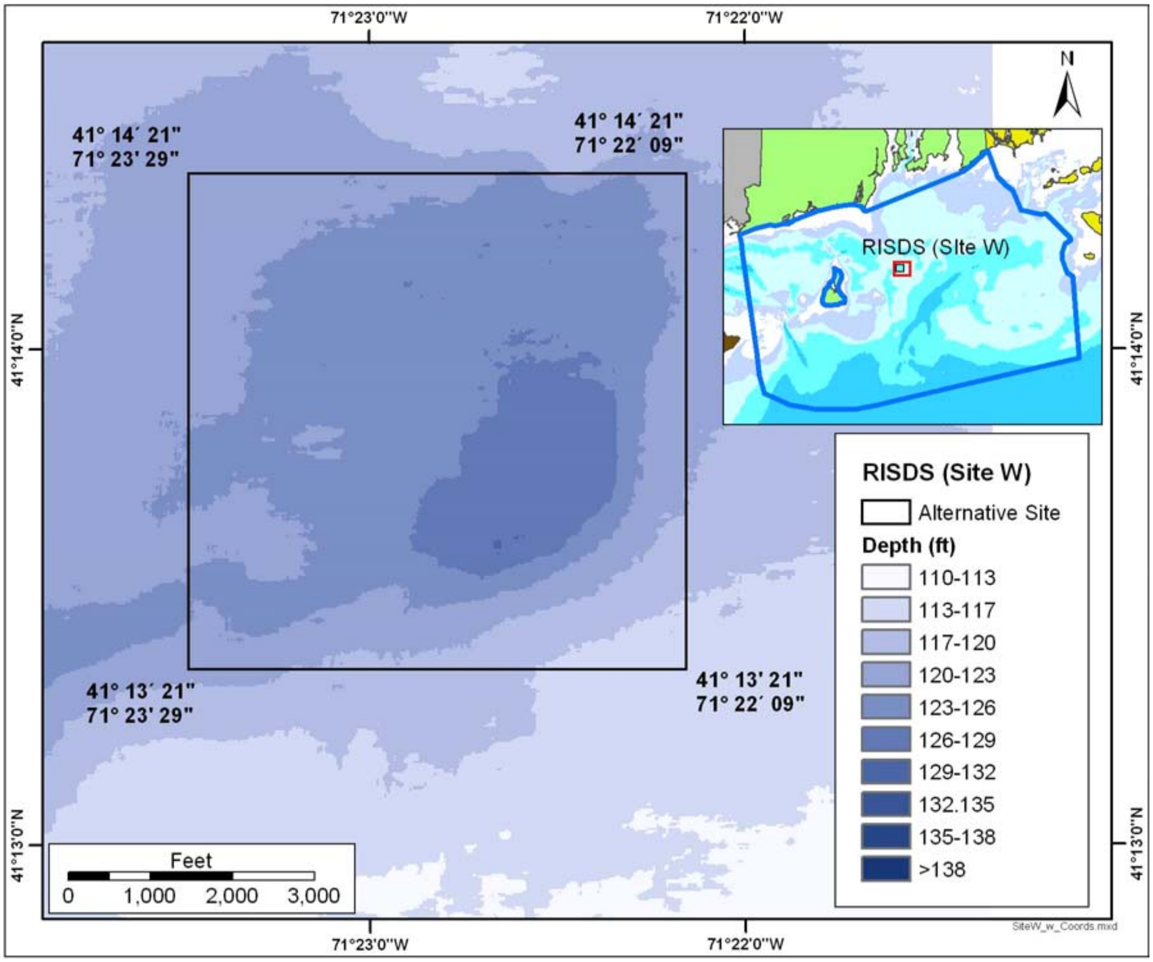

Figure 1. Location of the Rhode Island Sound Disposal Site (RISDS).

As discussed in the guidance for development of site management plans issued by EPA and the Corps ("Guidance Document for Development of Site Management Plans for Ocean Dredged Material Disposal Sites", February 1996), management of the disposal site involves: regulating the times, quantity, and physical/chemical characteristics of dredged material that is disposed at the site; establishing disposal controls, conditions, and requirements; and monitoring the site environment to verify that potential unacceptable conditions are not occurring from past or continued use of the disposal site and that permit terms are met. In addition, the plan also incorporates the six requirements for ocean disposal site management plans discussed in MPRSA § 102(c)(3), as amended. These are:

1. consideration of the quantity of the material to be disposed of at the site, and the presence, nature and bioavailability of the contaminants in the material [§102(c)(3) Section II C];
2. a baseline assessment of conditions at the site [§102(c)(3) Section III];
3. a program for monitoring the site [§102(c)(3) Section IV];

4. special management conditions or practices to be implemented at each site that are necessary for protection of the environment [§102(c)(3) Section V.A);
5. consideration of the anticipated use of the site over the long term, including the anticipated closure date for the site, if applicable, and any need for management of the site after closure [§102(c)(3) Section VI);
6. a schedule for review and revision of the plan (which shall not be reviewed and revised less frequently than 10 years after adoption of the plan, and every 10 years thereafter) [§102(c)(3) Section VII).

Dredging and disposal operations have been documented in the RIR since the 1920s. Dredging activities from the 1920s through the 1950s, were conducted as navigation projects or bridge construction work in the Mount Hope Bay and the Tiverton, Rhode Island areas, and the upper reaches of Narragansett Bay. Materials from these projects were placed at various locations in Narragansett Bay, Rhode Island. Prior to 1970, disposal activities occurred with less regulatory oversight and record keeping than today. In the late 1960s, the first disposal of dredged material in the waters of Rhode Island Sound took place at a location known commonly as the Brenton Reef Disposal Site (Saila *et al.,* 1969). The mound built by this early disposal was evaluated as Site 16 (Figure 2) in the Providence River and Harbor Maintenance Dredging Project Environmental Impact Statement (Corps, 2001a). Dredged material placed at the Brenton Reef Site originated from the Providence River and Harbor Navigation Project, several smaller projects from the Mount Hope Bay approach channels and berthing area of the New England Power Company's Brayton Point Plant (Corps, 1972), and Point Judith, Rhode Island (Pratt *et al.*, 1973). Disposal at the site was concluded by 1976.

Significant dredging in Rhode Island and southeastern Massachusetts did not occur over the next 25 years (see Section 1.1 of the DEIS, EPA, 2004). An attempt to designate a regional disposal site (Corps, 1982) and to dredge the Fall River navigation channel in Massachusetts was made in the early 1980s but failed due to the controversy over the perceived impacts of dredging and disposal (see Section 1.1 of the DEIS, EPA, 2004). More recently, the need to dredge the Providence River led to selection and approval of Site 69B (Separation Zone Site) (Figure 2) selected under the MPRSA Site Selection criteria as provided for in MPRSA Section 103.

The Record of Decision (ROD) for the Providence River and Harbor Maintenance Dredging Project was signed on March 18, 2002, and dredging was initiated in April 2003. Dredged material to be disposed of at Site 69B from this project consists primarily of material removed as a result of navigation channel maintenance (confined aquatic disposal [CAD] cell construction and maintenance material acceptable for ocean disposal) in the Providence River and determined to be acceptable for ocean disposal under the national and regional testing regulations (EPA and Corps, 1991; EPA and Corps, 2004). Site 69B is also Alternative W in the RIR Long-Term Dredged Material Disposal Site Evaluation Project EIS, now known as the Rhode Island Sound Disposal Site.

Table 1 summarizes the volumes and sources of dredged material disposed of or permitted for disposal seaward of the Territorial Sea baseline in Rhode Island Sound since 1967 and the disposal site location.

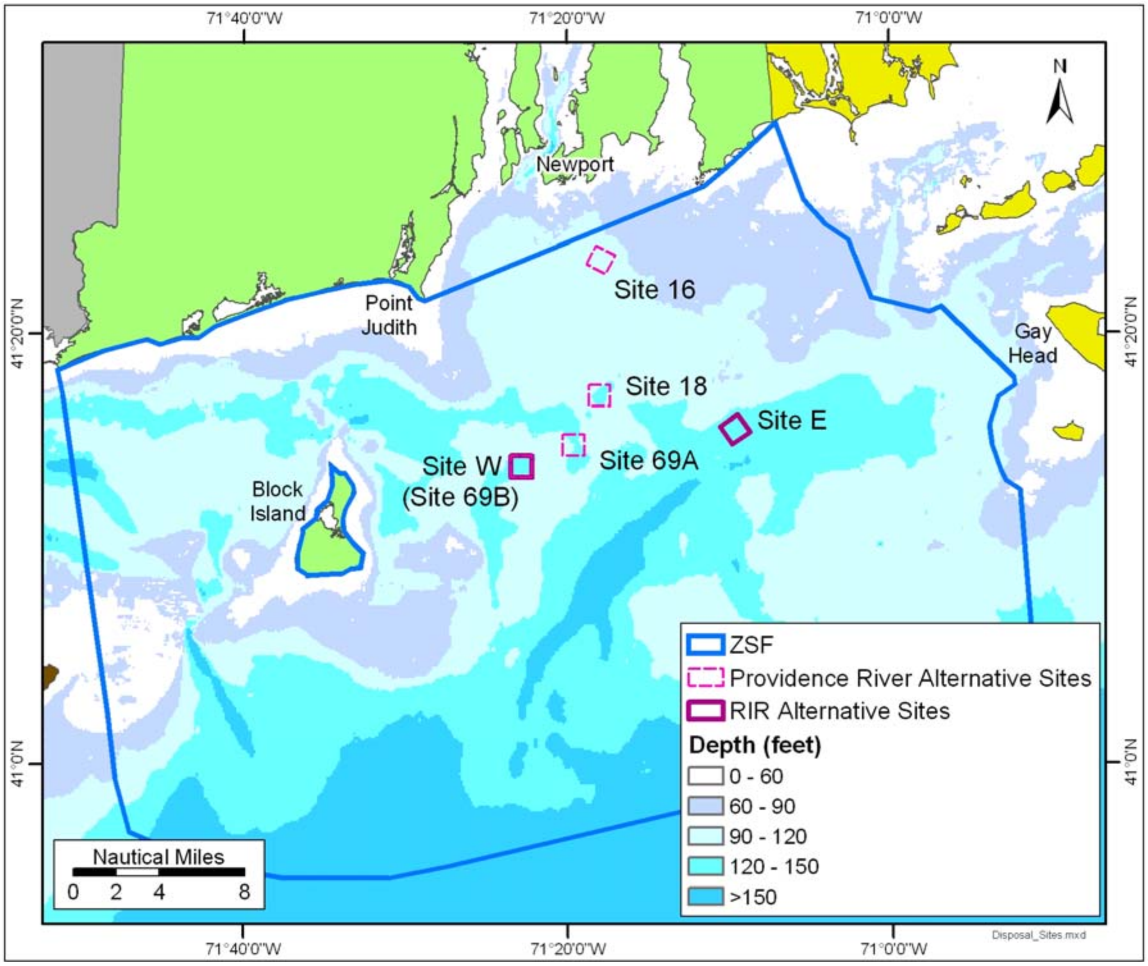

Figure 2. Open-Water Alternative Sites Evaluated Previously in the Providence River and Harbor Maintenance Dredging Project EIS and Currently in the RIR EIS.

2.0 SMMP OBJECTIVES

The intent of this SMMP is to provide a management framework and monitoring program (Section 6.0) that strives to minimize the potential for significant adverse impacts to the marine environment from dredged material disposal. To this end, the SMMP identifies actions, provisions, and practices necessary to manage the operational aspects of dredged material disposal at the RISDS. Section 40 CFR § 228.10(a) of the Ocean Dumping Regulations requires that the impact of disposal at a designated site be evaluated periodically. Section 40 CFR § 228.10(b) specifically requires consideration of the following types of potential effects when evaluating impact at a disposal site:

- Movement of materials into sanctuaries or onto beaches or shorelines [228.10(b)(1)];
- Movement of materials towards productive fishery or shellfishery areas [228.10(b)(2)];

Table 1. Disposal of Dredged Material in Rhode Island Region.

Disposal Site Location	Year(s) of Use	Volume/Type of Material	Source of Material
Site 16 (Brenton Reef)	1967 to 1970	~9 million cubic yards (MCY)[a] Dredged material[1]	Providence River and Harbor Navigation Project
Site 16 (Brenton Reef)	1970 to 1976	320,000 cubic yards (CY)[a] Dredged material[1]	New England Power Co. Brayton Point
Site 16 (Brenton Reef)	1970 to 1976	30,000 CY[a] Dredged material[1]	Point Judith, RI
Site 69B (Separation Zone Site)	2003 to 2008	5.05 MCY (authorized) Dredged material	2003 Providence River and Harbor Maintenance Dredging Project
Site 69B (Separation Zone Site)	2003 to 2008	0.55 MCY Dredged material	Private maintenance projects adjacent to Providence River and Harbor Maintenance Dredging Project

[a] Pratt, et al. 1973.
[1] Material was dredged prior to current testing requirements.

- Absence from the disposal site of pollutant-sensitive biota characteristic of the general area [228.10(b)(3)];
- Progressive, non-seasonal, changes in water quality or sediment composition at the disposal site when these changes are attributable to materials disposed of at the site [228.10(b)(4)];
- Progressive, non-seasonal, changes in composition or numbers of pelagic, demersal, or benthic biota at or near the disposal site when these changes can be attributed to the effects of materials disposed at the site [228.10(b)(5)];
- Accumulation of material constituents (including without limitation, human pathogens) in marine biota at or near the site (*i.e.,* bioaccumulation [228.10(b)(6)]).

The regulation 40 CFR Section 228.10(c) requires that a disposal site be periodically assessed based on the entire available body of pertinent data and that any identified impacts be categorized according to the overall condition of the environment of the disposal site and adjacent areas. Because knowledge and understanding of impacts resulting from dredged material disposal have advanced substantially over the past several decades, the monitoring approach defined in this SMMP focuses on those factors that provide an early indication of potential unacceptable effects and provides for further assessments should these early indicators suggest potential impact may be occurring. The plan also incorporates ongoing regional monitoring programs in the RIR that can provide additional information to inform the periodic assessment of impact, such as NMFS trawl surveys.

The specific objectives of this SMMP are:

- **Objective 1: To ensure site management practices and disposal options are sufficient to avoid significant degradation or endangerment to the environment.** Management of the disposal site involves 1) regulating the timing of disposal(s), quantity of material, and physical/chemical characteristics of dredged material placed at the site, 2) instituting disposal controls, conditions, and requirements that avoid or minimize potential impacts to the marine environment, 3) ensuring permit conditions are met, and 4) monitoring to verify that unanticipated or significant adverse effects are not occurring from use of the disposal site. The phrase "significant adverse impact" is inclusive of all significant or potentially substantial negative impacts on resources within site or its vicinity. Factors to be considered under this objective include:

    - Evaluation of compliance with MPRSA permit conditions and initiation of enforcement actions where warranted and as appropriate;
    - Provision of reasonable assurance that use of the site will not adversely affect beaches, shorelines, or productive fish and shellfish areas.

- **Objective 2: To ensure a monitoring program and data review process that evaluates whether disposal of dredged material at the site unreasonably degrades or endangers human health and welfare, the marine environment, or economic potentialities.** The factors to be evaluated under this objective include:

    - Biotic characteristics on dredged material mounds and nearby areas;
    - Progressive, non-seasonal, changes in water quality or sediment composition at the disposal site;
    - Progressive, non-seasonal, changes in composition or numbers of pelagic, demersal, or benthic biota at or near the site(s);
    - Accumulation of material constituents in marine biota near the site.

To achieve these objectives, the SMMP includes the following components:

- A baseline assessment of current conditions against which future monitoring results can be compared;
- A description of special management conditions to be applied;
- A plan for monitoring;
- A schedule for review and revision of the SMMP.

Recognizing and correcting any potential unacceptable condition before it causes any significant adverse impact to the marine environment or presents a navigational hazard to commercial and recreational water-borne vessel traffic is central to this SMMP. Therefore, the plan includes a monitoring program that uses a "leading indicator" approach to provide early evidence of unexpected responses as further described in Section 6.0. The identification of unacceptable impacts from dredged material disposal at the site will be accomplished in part through comparisons of the monitoring results to historical (*i.e.,* baseline) conditions, and in part through comparison to unimpacted nearby reference locations measured concurrently with site measurements. The timing of monitoring surveys and other activities will be governed by funding resources, the frequency of disposal at the site, and the results of previous monitoring data.

If site monitoring data demonstrates that the disposal activities are causing unacceptable impacts to the marine environment as defined under 40 CFR § Section 228.10(b), the site managers may place appropriate limitations on site usage to reduce the impacts to acceptable levels. Such responses may range from withdrawal of the site's designation to limitations on the amounts and types of dredged material permitted to be disposed or limitations on the specific disposal methods, locations, or schedule.

3.0 SITE MANAGEMENT RESPONSIBILITIES AND AUTHORITIES

The RIS Disposal Site will be jointly managed by EPA and the Corps. An Interagency Regional Dredging Team, comprised of representatives from EPA, Corps, NMFS, USFWS, and Rhode Island and Massachusetts state representatives, meets approximately every six months in Sudbury, Massachusetts to discuss management and monitoring of New England dredged material disposal sites. This team could also provide recommendations on management of the RIS Disposal Site. Other meetings may be called in response to unusual physical events or unexpected monitoring observations. During these meetings, monitoring data will be evaluated and the SMMP will be revised as necessary depending on current conditions and available site-specific and scientific information.

3.1 FEDERAL REGULATORY/STATUTORY RESPONSIBILITIES

The primary authorities that apply to the disposal of dredged material in the U.S. are the Rivers and Harbors Act of 1899 (RHA), the Water Resources Development Act of 1992 (WRDA), the Clean Water Act (CWA) and MPRSA. The RHA regulates dredging and discharge of material in navigable waters and WRDA addresses research and funding in support of specific water resource projects for various needs (*i.e.,* transportation, recreation). It also modifies other Acts, as necessary (*e.g.,* MPRSA).

Section 404 of the Clean Water Act (33 U.S.C. Section 1344) governs the disposal of fill, including dredged materials, in waters of the United States within the three mile territorial sea. This applies to discharges landward of the baseline of the territorial sea and in instances seaward of the baseline when the intent is to fill or nourish beaches. The Section 404 permit program is implemented by the Corps and covers the discharge or placement of dredged or fill material into inland waters of the U.S. RISDS does not involve inland waters, as defined; therefore, the Section 404 permitting process does not apply to disposal at this site.

Under Section 103 of MPRSA, the Corps is assigned permitting responsibility for dredged material, subject to EPA review and concurrence that the material meets applicable ocean disposal criteria. The Corps is required to use EPA designated open-water disposal sites for dredged material disposal to the maximum extent feasible. If EPA designated sites are not feasible, the Corps may select an ocean disposal site and it may be used for two, 5-year periods. Section 33 of the Code of Federal Regulations (CFR) Part 336 describes the factors to be considered in the evaluation of dredging projects that involve discharge of dredged material into waters of the United States and ocean waters (MPRSA waters).

Section 307 of the Coastal Zone Management (CZM) Act of 1972 requires that Federal agencies proposing activities within or outside the coastal zone, that affect any land or water use or natural resource of the coastal zone, ensure that those activities are conducted in a manner which is consistent to the maximum extent practicable, with the enforceable policies of approved State coastal management programs. As part of the National Environmental Policy Act (NEPA) process, EPA prepared a Federal determination of consistency with State approved Coastal Zone Management Programs.

Additionally, EPA obtained concurrence for the RIS Disposal Site from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) regarding an Endangered Species Act Section 7. The NMFS and USFWS concurrence confirmed that the selection of RISDS will not adversely affect threatened or endangered species or adversely modify critical habitat. EPA also coordinated with NMFS to ensure that essential fish habitat (EFH) issues were considered and addressed.

3.2 SURVEILLANCE, ENFORCEMENT, AND MONITORING

All dredging, dredged material transport, and disposal must be conducted in compliance with the permits issued for these activities. To ensure compliance, the MPRSA provides for both surveillance and enforcement. The Corps and EPA share surveillance and enforcement responsibilities at the disposal site. The U.S. Coast Guard may also assist with such surveillance (See 33 U.S.C. Sec 1417[c]). The permittee is responsible for ensuring compliance with all project conditions including placement of material at the correct location and within applicable site use restrictions. Both the Corps and EPA have enforcement authority under MPRSA. The EPA and the Corps will cooperate to ensure effective enforcement of permit violations.

The Corps and EPA also share responsibility for monitoring of the site. Monitoring data may be generated by the agencies or through coordination or use of data gathered under other programs. Monitoring data from other agencies will be utilized as appropriate to maximize the availability of information at the site. The Corps Disposal Area Monitoring System (DAMOS) Manager will direct the disposal of dredged material at the site. EPA will lead the evaluation of these data for potential impacts from disposal. Under MPRSA, EPA has the responsibility for determining if an unacceptable impact has occurred as a result of dredged material disposal at the site. However, such determinations will be made in consultation with other agencies and be based on available monitoring data. The Corps and EPA share responsibility for developing any necessary mitigation plan. EPA is responsible for determining any modification to site use or de-designation.

As in the past, disposal will continue to be practiced using a grid system on a case-by-case basis, in addition to a taut-wire buoy or specified coordinates, to ensure that disposal locations are known and that post-disposal monitoring is effective. On-board inspectors will be used by the Corps for all disposal activities at RISDS to ensure compliance with this policy. These inspectors will be trained and certified by the Corps specifically for the dredged material disposal program.

Prospective inspectors are required to submit their qualifications to the Corps prior to being approved for training. Every inspector must have basic knowledge of seamanship, which includes shipboard navigation equipment, buoy identification and the ability to chart location using whatever navigation equipment is available on board. Many of the existing disposal inspectors hold Master's licenses or are merchant marine academy graduates. All inspectors must have a basic understanding of the Corps Regulatory Program, especially permit and enforcement requirements. This information is provided in a Corps disposal inspector certification training session that all inspectors are required to attend and also included in an Inspector's Manual provided during the training.

Communication is an essential part of the inspector's duties. This includes coordination with the permittee, the dredging and towing contractors, and the New England District's headquarters office in all instances where problems arise. Disposal activities will not generally be performed during poor sea conditions. Inspectors have been issued specific guidance on disposal under these conditions ("Guidance for Inspectors on Open-Water Disposal of Dredged Material, Corps NAE, January 1996).

The inspector must carefully review and fully understand the specific details of the project to be inspected before embarking on a trip to the disposal site. Before leaving for the disposal site, the inspector must understand the exact location of the specified disposal point for the specific project. The inspector must also know the planned route that will be taken from the dredging area to the specified disposal point. The inspector must be alert at all times and ensure the route on charts is followed during the trip to make certain the disposal operation is accomplished as planned. Unusual events during the trip that affect the disposal of the dredged material must be reported on the scow logs. An example of this would be discharge of the material at a location other than that specified.

The inspector must complete an Inspector's Daily Report of Disposal by Scow (scow log; see Attachment A) for each and every disposal trip. The inspector must send the original of the scow log to the Corps' disposal inspection program manager within one week of the date of the disposal trip. The inspector, not the permittee, must also submit a monthly report to NAE, Regulatory Division, Policy Analysis and Technical Support Branch for each month the inspector performs disposal inspections. The monthly report includes permittee name, permit number, trip dates and estimated cubic yards discharged. At the completion of a dredging project, either final or seasonal period, the permittee must submit to the Corps' disposal inspection program manager the completion report form. The form is included with the letter authorizing the initiation or continuation of open-water disposal at the disposal site.

If any apparently illegal disposal-related activity is discovered or is about to occur, the inspector must advise the responsible party of the requirements for proper disposal, the apparent violation, and the possible legal ramifications that could ensue should the action occur. Any instances of non-compliance observed by the inspectors must be reported to the Corps within 24 hours and in writing to both the Corps and EPA within five working days of the observed violation. Both agencies will cooperate to ensure effective enforcement of all disposal requirements. Section 105 of the MPRSA gives authority to EPA to enforce permit conditions. Egregious violations of permit conditions may be referred by the Corps or EPA to the Department of Justice for criminal prosecution. Illegal disposal can lead to penalties that include revocation or suspension of the permit as well as fines of up to $50,000 and imprisonment for one year. Penalties for violations of the Ocean Dumping Act can be even more severe. The inspector is required to inform the captain of the requirements concerning disposal and to report to the Corps what occurred. This report must be made immediately from the vessel itself or as soon as possible after the event is observed.

Monitoring surveys at and near the site will be conducted periodically as available funding permits. The monitoring objective for each survey will be based on prior monitoring results and recommendations of the Interagency Regional Dredging Team , in consultation with Rhode Island Departments of Environmental Management (RIDEM), Transportation (RIDOT), and Administration (RIDOA), the Rhode Island Coastal Resources Management Council (RICRMC), the Rhode Island Port Authority (RIPA), the Economic Development Corporation (EDC), the Port of Providence, the Governor's Policy Office, the Massachusetts Office of Coastal Zone Management (CZM), the Massachusetts Division of Marine Fisheries (DMF), and the Massachusetts Department of Environmental Management (DEM).

4.0 MANAGEMENT APPROACH

Dredged material disposal at the disposal site will be authorized under MPRSA Section 103 and the site will be managed in a manner that ensures the following site management goals are met:

- Ensure and enforce compliance with permit conditions;
- Minimize loss of sediment from the disposal site;
- Minimize conflicts with other uses of the area;
- Maximize site capacity;
- Minimize environmental impact from sediments placed at the site;
- Recognize and correct conditions before unacceptable impact occurs.

The practices that will be applied to address these management goals at the disposal site include coordination among Federal and state agencies, testing of material for acceptability for disposal at the site, review of general and specific permit conditions, review of allowable disposal technologies and methods, implementation of inspection, surveillance and enforcement procedures, periodic environmental monitoring at the site and at relevant reference sites for comparative evaluation, and information management and record keeping.

4.1 MANAGEMENT PRACTICES

EPA and the Corps will jointly manage the disposal site. The effectiveness of the management approach depends on having efficient planning processes, consistent compliance and enforcement, a robust yet flexible monitoring plan, and an effective communication structure that includes timely receipt and review of information relevant to the site management goals. One component of this communication structure will be an Interagency Regional Dredging Team meeting, convened by EPA, to review the SMMP with respect to current information and conditions as well as scientific advancements.

Management of the site will include the following practices for the disposal site:

- Evaluation of the suitability of material for disposal, conducted in accordance with the applicable requirements for the specific type of project (i.e., MPRSA), is determined through the Regional Implementation Manual (RIM) (EPA and Corps, 2004);
- Specification of disposal conditions, location, and timing in permits as appropriate (e.g., to ensure that dredging windows for fisheries are met or disposal may be restricted during spring tides to ensure that water quality criteria are not exceeded outside the boundaries of the site);
- Enforcement of all permit conditions;
- Use of a grid system for the disposal of dredged material on a case by case basis
- Use and maintenance of disposal buoys at the site with disposal specified to occur at the buoy or designated coordinate;
- Positioning disposal buoys each year with the intent to create bowl-like features on the seafloor;
- Use of disposal inspectors or electronic vessel tracking or both to record all disposal events;
- Building disposal mounds to no shallower than 105 feet below mean low water;
- Conducting disposal site monitoring in a consistent, systematic manner;
- Holding technical advisory panel meetings for the monitoring program, as needed;
- Specification of de-designation (*i.e.,* closure) conditions and dates.

In addition, special management practices may exist at the site for individual projects to improve site management, anticipate future disposal requirements, or improve the conditions at the site. Examples include:

- Specification of the dredged material volume that can be placed at specific locations within the site or the total dredged material volume placed in the site;
- Modifications to the site designation or to disposal methods, locations, or time of disposal;
- Monitor mounds on a rotating basis as determined during annual planning meetings.

In addition to management practices for the disposal site and individual projects, the SMMP must also include a monitoring plan (as described in detail in Section 6.0) and a coordination/outreach component. Coordination and outreach will be continuous and include state and Federal agencies, scientific experts, and the public. To ensure communications are appropriate and timely, site management activities and monitoring findings will be communicated through many mechanisms: scientific reports, peer reviewed publications, participation in symposia, the Corps and EPA websites, public meetings, and fact sheets.

4.2 TESTING REQUIREMENTS

National guidance for determining whether dredged material is acceptable for open-water disposal is provided in the Ocean Testing Manual (Green Book; EPA and Corps, 1991). The RIM (EPA and Corps, 2004), consistent with the Green Book, provides specific testing and evaluation methods for dredged material disposal projects in New England. Any updates and revisions will take precedence at the time of notification by the agencies.

These guidance documents are consistent in their application of test procedures used to determine acceptability for MPRSA 103 projects. The testing requirements are the same regardless of statute under which the material will be managed and each project is evaluated on a project-by-project basis. However, management of the material may differ depending on the regulations under which it is disposed. All projects that propose to use RISDS for disposal of dredged material must adhere to the guidance documents or superceding versions of these documents.

4.3 DISPOSAL CONDITIONS, LOCATION, AND TIMING

The following list represents special conditions that will be applied to projects using RISDS for disposal. These conditions may be modified on a project-by-project basis, based on factual changes (*e.g.,* administrative changes in phone numbers, points of contact) or when deemed necessary as part of the individual permit review process.

1. At least ten working days in advance of the start date, the First Coast Guard District, Aids to Navigation Office (617-223-8356) shall be notified of the location and estimated duration of the dredging and disposal operations.
2. At least ten working days in advance of the start date, the Coast Guard Marine Safety Office (617-223-3000) shall be notified of the location and estimated duration of the dredging and disposal operations.
3. Every discharge of dredged material at the disposal site must be witnessed by an onboard inspector who has been trained by, and who holds a current certification from, the Corps NAE. The disposal inspector shall be contracted and paid for by the permittee. A list of currently certified inspectors can be obtained from the New England District Regulatory Division at 978-318-8292. The inspector will require that all permit conditions and other special requirements are followed as applicable.
4. For the initiation of disposal activity and any time disposal operations resume after having ceased for one month or more, the permittee or the permittee's representative must notify the Corps NAE. Notification must be made at least ten working days before the date disposal operations are expected to begin or resume by contacting the Corps Policy Analysis and Technical Support Branch at 978-318-8292. The information to be provided in this notification is: permit number, permittee name,

name and address of dredging contractor, estimated dates dredging is expected to begin and end, name of disposal inspector, name of the disposal site and estimated volume of material to be dredged. Disposal operations shall not begin or resume until the Policy Analysis and Technical Support Branch issues a letter authorizing the initiation or continuation of open-water disposal. The letter will include disposal-point coordinates to use for this specific project at that time. These coordinates may differ from those specified for other projects using the same disposal site or even from those specified earlier for this project. It is not necessary to wait ten days before starting disposal operations. Disposal operations may start as soon as this letter is issued.

5. The permittee shall ensure that a separate Corps disposal inspection report (scow log; see Attachment B) is fully completed by the inspector for every trip to the disposal site and that this report is received by the Corps NAE within one week of the trip date. The Regulatory Division telefax number is 978-318-8303. The original of this report must be mailed to: U.S. Army Corps of Engineers, Regulatory Division, Policy Analysis and Technical Support Branch, 696 Virginia Road, Concord, MA 01742-2751. For each dredging season during which work is performed, the permittee must notify the Corps upon completion of dredging for the season by completing and submitting the form that the Corps will supply for this purpose when disposal-point coordinates are specified.
6. Except when directed otherwise by the Corps DAMOS Program Manager, all disposal of dredged material shall adhere to the following: The permittee shall release the dredged material at a specified buoy or set of coordinates within the disposal site. All disposal is to occur at the buoy or specified coordinates with the scow at a complete halt. The Corps will provide buoys and the coordinates. This requirement must be followed except when doing so will create unsafe conditions because of weather or sea state, in which case disposal within 150 feet of the buoy or specified coordinates with the scow moving only fast enough to maintain safe control (generally less than one knot) is permitted. Disposal is not permitted if these requirements cannot be met due to weather or sea conditions. In that regard, special attention needs to be given to predicted conditions prior to departing for the disposal site.
7. EPA and the Corps (and/or their designated representatives) reserve all rights under applicable law to free and unlimited access to and/or inspection of (through permit conditions): 1) the dredging project site including the dredge plant, the towing vessel and scow at any time during the course of the project; 2) any and all records, including logs, reports, memoranda, notes, etc., pertaining to a specific dredging project (Federal or non-Federal); 3) towing, survey monitoring, and navigation equipment.
8. If dredged material regulated by a specific permit issued by the Corps or Federal authorization is released (due to an emergency situation to safeguard life or property at sea) in locations or in a manner not in accordance with the terms or conditions of the permit or authorization, the master/operator of the towing vessel and/or the Corps Disposal Inspector shall immediately notify the Corps of the incident, as required by

permit. In addition, both the towing contractor and the Corps-certified disposal inspector shall make a full report of the incident to the Corps and EPA within ten (10) days. The report should contain factual statements detailing the events of the emergency and an explanation of the actions that were ultimately taken.

4.4 ALLOWABLE DISPOSAL TECHNOLOGIES AND METHODS

Dredging and dredged material disposal in Rhode Island Sound has historically been accomplished using a bucket dredge to fill split hull or pocket scows for transport to the disposal site. Typically, 1,000-6,000 CY vessels are used but allowable size is not specified by EPA or the Corps. The volume of material allowed in a barge may be restricted depending upon the results of the ADDAMS Model for any given dredging project.

4.5 MODIFICATIONS TO DISPOSAL PRACTICES AND THE SITE

Based on the findings of the monitoring program (Section 6), modifications to the site use may be required. Corrective measures such as those listed below, but not limited to, may be developed by EPA New England Region and the Corps NAE.

- Stricter definition and enforcement of disposal permit conditions;
- Implementation of more conservative judgments on whether sediments proposed for dredging are suitable for open-water disposal;
- Implementation of special management practices to prevent any additional loss of sediments to the surrounding area;
- Excavation and removal of any unacceptable sediments from the disposal site (an unlikely, worst case scenario given that the permitting program should exclude such material from the site to begin with, and since excavation could make matters worse by releasing contaminants during the process);
- Closure of the site as an available dredged material disposal site (*i.e.,* to prevent any additional disposal at the site).

4.6 OTHER MANAGEMENT CONSIDERATIONS

In addition to the management practices outlined in Section 4.1, other management considerations may be determined on a project by project basis through consultation with the NMFS and the USFWS, and coordination with other state and Federal agencies. These may include the following:

- Use of marine mammal observers during disposal operations;
- Establishment of dredging windows;
- Compliance with Essential Fish Habitat (EFH) recommendations;
- Endangered Species Act (ESA) concerns.

Any changes to special permit conditions may be discussed at the Interagency Regional Dredging Team meeting.

5.0 BASELINE ASSESSMENT

MPRSA 102(c)(3)(A) as amended by WRDA 92 requires that the SMMP include a summary of baseline conditions at the site. Much of the information provided in this section is based on surveys conducted in support of the site designation DEIS (EPA, 2004) and disposal site monitoring for the Providence River and Harbor Maintenance Dredging Project. Baseline conditions are defined as the conditions existing at the time data to support the Final EIS (FEIS) were developed[1]. This section includes a general characterization of the site followed by a description of current disposal at the site including information on the dredged material disposal mounds in the site.

5.1 SITE CHARACTERIZATION

Physical, chemical, and biological environment at the site are summarized in this section.

5.1.1 Site Location

The RISDS is located in central Rhode Island Sound. The site is a 1-nmi^2 square with its center at 41˚ 13' 51"'N and 71˚ 22' 49"W (NAD 83) (see Figure 1) is located approximately 9 nmi south of Point Judith and roughly 6.5 nmi due east of Block Island. RISDS is located over a historic topographic depression, where the maximum water depth is about 130 ft. Water depths of the surrounding area are between 110 and 118 ft to the north, east, and south of the site. The southeastern portion of the site shoals more rapidly than the northern area. RISDS (also referred to as Site 69B) is currently being used as the disposal location for the Providence River and Harbor Maintenance Dredging Project.

5.1.2 Reference Areas

The baseline assessment activities conducted at RISDS as part of the Final EIS study (Section 3.0 Affected Environment) also sampled areas adjacent to the site (Area W; EPA, 2004). Seven stations located around the periphery of the site were sampled in 2001, and 10 stations located west and north of the site, were sampled in 2003 for infauna and sediment characteristics. Sediment profile images were obtained from 9 and 20 stations within these areas during 2001 and 2003, respectively. Similarly collected samples have been gathered from other sites in Rhode Island Sound (Site 18, Site 69A, Site E; see Figure 2) in 2001 or 2003.

Site 69A, with center coordinates at 41º 14' 51"N 71º 19' 36"W, will serve as a potential reference area. The precise location of the reference area could shift depending upon whether siltier or sandier material is needed for comparison. Additional reference sites may also be selected including areas adjacent to the site.

[1] This information will be updated as necessary based on any new information presented in the FEIS.

5.1.3 Physical Characteristics

Bathymetric surveys of RISDS have shown that the original site encompassed a topographic depression with water depths around the boundary of the site generally about 120 ft and depths within the depression about 130 ft. The water depth in RISDS ranges from 115 ft in the southeast corner to 128 ft in the depression. This depth range places Sites W in the depth range determined by the sediment transport model to correspond to an area of occasional sediment transport and reworking.

Multi-beam imagery data indicate that the original sea floor at RISDS (prior to April 2003), consisted of various types of sediments ranging from glacially derived till to soft, silty sand (Table 2). Sediments along the northern and eastern boundaries and in the southeast corner tended to be a mixture of fine sands, whereas the northern area has some hard-bottom areas interspersed with fine sands, which correspond to shallower depths. Very fine rippled sand occurs at the southernmost stations within the site. The rippled sand corresponds to shallower depths and higher near-bottom energy regimes, which are near or outside the 120-ft depth contour. In the deeper central portion of the site, the sediments tend toward very fine sand mixed with silt-clay and an unconsolidated soft bottom, suggesting a depositional environment in the hollow. Outside of RISDS, the sediments consist of coarse-grained glacial sediment made up of gravel, till, and coarse sand to the north (shallower depths) and softer sediment (sand and silt) to the southwest (deeper depths). The TOC content of the natural sediments is very low (<1%) throughout the site (Table 2).

Since April 2003, dredged material from the Providence River and Harbor Maintenance Dredging Project has been placed along the western boundary of the site to build a low berm that is up to two meters above the natural seafloor bathymetry (Figure 3-5 of SAIC report; Corps, 2004a) with a width of 6-200 m. This low berm is composed primarily of glacial tills, cobbles, sands, clays to silt/clays from material excavated from the CAD cells (Corps, 2004a). As the project proceeds, maintenance dredging material that is primarily fine-grained estuarine sediment, will be deposited to the east of the excavated CAD cell material and within the shallow depression in the site.

Table 2. Average Grain Size and TOC Content for Sediment Samples from RISDS and the Nearby Area.

Parameter	RISDS[1]	Adjacent Area[2]	Area West and North[3]
Gravel (%)	12	7	8
Sand (%)	75	86	63
Fines (%)	13	7	30
TOC (%)	0.4	0.2	0.5

[1] Nine sediment stations sampled in 2001; average of values shown.
[2] Seven reference stations sampled in 2001; average of values shown.
[3] Ten reference stations sampled in 2003; average of values shown.

Currents: No long-term current measurements are available from within RISDS, or from its vicinity. Short-term measurements are available from a 1-month current meter deployment in the fall of 1999 (Corps, 2001b) and a 2-month deployment in April and May 2002 (Corps, 2003a).

The dominant tidal flow directions are northwest and southeast, with the narrow ellipses indicating little flow perpendicular to the dominant flow direction. The amplitude of the tidal velocity decreases with depth (Table 3). The surface tidal amplitude was 12.7 cm/s and the near-bottom amplitude was 7 cm/s. Based on these data, only 40 percent to 50 percent of the current variance during the 2-month late-spring deployment period is attributable to the tide. The remainder is caused primarily by wind stress and atmospheric pressure gradients associated with storms.

Table 3. Tidal Ellipse Parameters for Near-bottom, Middle and Surface Currents Measured in RISDS, April–May 2002.

Layer	Major Amplitude (cm/s)	Minor Amplitude (cm/s)	Inclination (deg)	Phase (deg)	Major Axis % Tidal Variance	Minor Axis % Tidal Variance
Surface	12.7	2.0	135	25	50.4	34.8
Middle	11.2	0.9	131	29	43.1	58.7
Near-Bottom	7.0	2.4	143	5	48.8	58.6

Source: Corps, 2004b

Near-surface currents recorded at RISDS reached as high as 60 cm/s flowing toward the south. Currents this strong, however, were infrequent, with current speeds greater than 30 cm/s occurring four percent of the time. Surface currents tend to be much stronger because of the effect of the wind stress on the surface layer. Throughout the rest of the water column, the maximum currents were only 30 cm/s and occurred very infrequently. Velocities of 30 cm/s occurred two percent of the time at mid-depth and 0.2 percent of the time near the bottom. Currents greater than 20 cm/s occurred approximately 10 percent of the time at mid-depth and 0.6 percent of the time near the bottom. The mean current velocity for the station was 2.5 cm/s directed toward the west at mid-depth and 1.6 cm/s toward the west near-bottom.

Waves: No wave measurements are available at or near RISDS, but the site can be expected to experience a wave climate similar to that of Rhode Island Sound in general. However, because of differences in fetch, wave climatology may vary somewhat from the general pattern. The exposure of RISDS to winds and waves from the southwest is partly blocked by the presence of Block Island, including the island itself and its surrounding bathymetry. The results from the 10-year wave model hindcast at RISDS for storms of different frequencies or occurrence indicate that RISDS will experience wave heights of about 9 feet during storms with a frequency of occurrence of about 5 percent (Table 4).

Table 4. Wave Height and Period at RISDS for Storms of Various Frequencies of Occurrence.

Storm Frequency of Occurrence	Estimated Wave Height [1] (ft)	Estimated Wave Period (seconds)
5%	8.9	6.6
1%	13.4	9.0
0.2%	15.1	14.2

[1] Wave heights are reported as significant wave height, which is the average of the one-third highest waves.

5.1.4 Sediment Quality

Concentrations of total organic carbon (TOC) were very low (0.4 percent) in the ambient (native) surface sediments from RISDS and were correlated with grain size (Table 2). Concentrations of total polycyclic aromatic hydrocarbons (PAHs) (Table 5) correlated well with grain size and TOC content, with lower concentrations found in sandier sediments which have low TOC content. Higher concentrations were found in finer sediments having higher TOC content. Metals concentrations (Table 5) were consistent with TOC content (more TOC correlated with greater metals concentrations), but not with grain size material. Sediments from RISDS contained slightly higher concentrations of metals than sediments with smaller amounts of fine material (<15 percent fines). The correlation between metals concentrations and sediment grain size was stronger in sediments located adjacent to RISDS. For example, concentrations of some chemicals (e.g., total PAH, copper, and mercury) were higher in sediments located to the west of RISDS, which typically had higher amounts of fines and TOC. Concentrations of chemicals found in the RISDS natural sediments were well below established sediment quality benchmarks (i.e., National Oceanic and Atmospheric Administration [NOAA] Effects Range-Low [ER-L] and Effects Range-Median [ER-M] values).

The material being placed in the site from the Providence River and Harbor Maintenance Dredging Project ranges in grain size and TOC content. Typically, the sandy gravel material is low in TOC while fine-grained maintenance material will have high TOC. Data collected through September 2003 found a range of sediment type within the deposited dredged material from silty-sand to cohesive white clay and black sulfidic mud.

No toxicity tests have been conducted on original sediments from RISDS due to the low levels of contaminants.

Table 5. Summary of Metals and Total PAH Concentrations in Sediment Samples from and Near the RISDS in Rhode Island Sound.

Parameter	Surface Sediment (top 1 inch)					
	RISDS (a)		Adjacent to RISDS (n=10)		Rhode Island Sound (b)	
	Range	Mean	Range	Mean	Range	Mean
Organic Chemicals (ppb dry wt)						
Total PAH	5.62 to 25.1	18.4	14.9 to 821	235	5.05 to 407	137
Metals (ppm dry wt)						
Aluminum	7550 to 39700	25800	22200 to 50100	38800	7550 to 45600	34300
Chromium	10.9 to 36.4	24.9	ND to 54	30.4	8.59 to 43.2	26.2
Copper	2.8 to 7.69	5.16	6.3 to 52.5	18.4	2.16 to 19	8.01
Lead	2.69 to 17.5	13	12.4 to 33.3	18.8	2.69 to 21.7	15.7
Mercury	ND to 0.009	0.006	0.009 to 0.082	0.033	0.003 to 0.051	0.019
Nickel	3.87 to 14.6	8.57	ND to 16.6	10	2.94 to 14.6	8.27
Zinc	4.37 to 50	28.7	25.6 to 75.9	46.1	4.37 to 50	31.4

ND = Not detected.

5.1.5 Water Column Characteristics/Circulation

Studies conducted within RISDS in 2001 and 2002 (Corps, 2002a; Corps, 2002b; Corps, 2003a) gathered physical and chemical information about the water column (i.e., temperature, salinity, turbidity, DO), including concentrations of organic and inorganic contaminants. When compared to similar data collected elsewhere within Rhode Island Sound, the water quality at RISDS was found to be consistent with and representative of the water quality of Rhode Island Sound in general.

Within Rhode Island Sound, salinity is generally constant, ranging from approximately 31 to 33 practical salinity units (psu) with the lower values occurring in the surface waters. Surface water temperatures in the summer may range from 20 to 23 °C and can be as low 3 °C or less in the winter. During the summer, temperatures near the bottom can be several degrees cooler than those at the surface as the thermocline intensifies and deepens. Most turbidity (water clarity) measurements for Rhode Island Sound have been based on total suspended solids (TSS), expressed as or the concentration of particulate matter in the water. Measurements from 2001 and 2002 (Corps, 2002a; Corps, 2002b) were within the range of historical values (Table 6). These values, which are spatially consistent across different areas in Rhode Island Sound, indicate that the water column within the region is generally clear. Recent measurements of dissolved oxygen (DO) concentrations in surface waters within Rhode Island Sound ranged from 7.2 mg/L in October 2001 to 10.8 mg/L in December 2002 (Corps, 2002a; Corps, 2002b), well above the Rhode Island DO water quality criterion for SA waters (6.0 mg/L) (RIDEM, 2000).

DO concentrations in water near the seafloor are often lower than those in surface waters because oxygen is consumed as organic matter decays.

Table 6. Water Column Turbidity in Rhode Island Sound.

Study	TSS
Pratt and Heavers, 1975	0.1 – 7.4 mg/L
Collins, 1976	0.23 – 1.61 mg/L
Pilson and Hunt, 1989	0.33 – 3.79 mg/L
Corps, 2002a	0.51 – 1.42 mg/L
Corps, 2002b	0.28 – 1.26 mg/L

Data on water-column contaminant levels in Rhode Island Sound are limited. Organic contaminants (polychlorinated biphenyls [PCBs] and pesticides) were measured in October 2001 and May 2002 in support of this Draft EIS and were generally below method detection limits (Corps, 2002a; Corps, 2002b). For example, total PCB concentrations were less than 46 parts per trillion (pptr), and total DDTs were less than 4 pptr. Recent measurements of water-column dissolved metals concentrations in Rhode Island Sound were also low (Table 7) (Corps, 2002a; Corps, 2002b). Dissolved metal concentrations appeared similar throughout the year and throughout Rhode Island Sound. The distribution of dissolved metals within the water column varies with depth (higher in surface waters) because of the presence of the vertical salinity gradient in Rhode Island Sound during the spring and summer. When this gradient is present, surface waters are less saline than bottom waters. Because concentrations of metals tend to be higher in freshwater than in marine water, surface waters tend to have slightly greater metal concentrations than found in higher-salinity bottom waters.

Table 7. Concentrations of Dissolved Metals (parts per billion [ppb]) in Water from Rhode Island Sound.

Metal	Fall 2001[a]	Spring 2002[b]
Arsenic	0.82 - 1.21	0.97 - 1.17
Cadmium	0.029 - 0.058	0.027 - 0.029
Copper	0.24 - 0.92	0.31 - 0.39
Chromium	0.17 - 0.49	0.17 - 0.24
Mercury	0.00030 - 0.0011	0.00062 - 0.00082
Nickel	0.25 - 1.38	0.37 - 1.15
Lead	0.045 - 0.25	0.045 - 0.28
Selenium	0.038 - 0.11	0.013 - 0.045
Silver	0.014 - 0.028	0.018 - 0.037
Zinc	0.58 - 5.88	0.74 - 2.36

[a]Corps, 2002a. Sites 18, 69A, and W (= 69B).
[b]Corps, 2002b. RISDS (= 69B) only.

5.1.6 Biological Characteristics

No recent studies have specifically examined the phytoplankton or zooplankton communities at RISDS. However, RISDS is located within the open waters of Rhode Island Sound, where the primary factors controlling fluctuations in plankton communities are water temperature, nutrient abundance, water column turbulence and stratification, and the presence of predators. The available information about plankton communities in this area suggests that the plankton community at RISDS is similar to that found in the open waters of Rhode Island Sound.

Plankton Community

The phytoplankton and zooplankton populations within Rhode Island Sound fluctuate annually and seasonally. Phytoplankton species and abundance are affected by environmental factors such as water temperature, nutrient abundance, and water column turbulence and stratification. Phytoplankton populations within Rhode Island Sound are influenced by the presence of certain zooplankters and the grazing of those zooplankton on the existing phytoplankton species. Zooplankton populations are also influenced by some of these factors. Additionally, the presence of various finfish that prey upon zooplankton influences the zooplankton species that are present within Rhode Island Sound and their abundances.

Benthic Community

The benthic infaunal communities found within regional RISDS sediment and in the nearby areas during the 2001 and 2003 sediment characterization surveys were very similar (Corps, 2002c; Corps, 2003b). The number of infaunal animals within each area was moderate to relatively high, with about 32,000 individuals/m^2 found within RISDS, about 25,000 individuals/m^2 occurring within the reference area located just outside of RISDS sampled in 2001, and about 29,000 individuals/m^2 found in the area north and west of the site sampled in 2003 (Table 8). The average numbers of species found in the RISDS (2001), reference site (2001), and nearby (2003) samples were 53, 46, and 57, respectively. These sets of moderately high values were reflected in the moderately high Shannon-Wiener diversity (H') values calculated for the RISDS and nearby area samples (Table 8). Evenness values were moderate at the RISDS stations and at the nearby stations (0.6).

Two of the three most abundant species co-occurred at all three locations: the small clam *Nucula annulata* and the tube-dwelling amphipod *Ampelisca agassizi*. The relative contribution of these two taxa to the total abundance of the infauna identified to species was similar in 2001 (49 percent) to that in 2003 (48 percent). The density of *N. annulata* among all area samples was about 6,850 individuals/m^2 for samples collected in 2001 and about 8,450 individuals/m^2 for samples collected in 2003. Other numerically important species in 2001 were three polychaete worms (*Polygordius* sp. A, *Tharyx acutus*, and *Exogone hebes*) and small crustaceans such as *Byblis serrata* and *Eudorella pusilla.* In 2003, other common taxa included the crustaceans *Crassicorophium crassicorne, Eudorella pusilla*, and *Unciola irrorata*, and additional clam species (*Crenella decussata, Nucula delphinodonta*). In general, the infaunal community in RISDS was very similar to that found in the nearby area and was typical of the open-water silty-sand/sand communities found in Rhode Island Sound.

Table 8. Comparison of the Sedimentary and Biological Characteristics of RISDS (September 2001, July 2003).

Parameter	RISDS[1]	Adjacent Area[2]	Area West and North[3]
Sediment Features			
Gravel (%)	12	7	8
Sand (%)	75	86	63
Fines (%)	13	7	30
TOC (%)	0.4	0.2	0.5
SPI Features			
Grain Size (modal category)	Silty/fine sand-pebbles	Silty/fine sand	Silty/fine sand–cobble
Prism Penetration (cm)	1.4–14.3	1.1–9.9	0.2–7.6
Dominant Surface Processes	Physical/Biological	Physical	Physical
RPD Depth (cm)	0.9–2.6	1.2–3.3	1.1 – >7.1
Successional Stage	I, II-III	I, I-III	I-II, II-III
OSI	4.0–9.0	3.0–10.0	4.0–10.0
Infaunal Community Features			
Average Abundance (#/sample)	1,298 (~32,450/m^2)	989 (~24,725/m^2)	1,175 (~29,375/m^2)
Average Species (#/sample)	53	46	57
Average Diversity (*H′*)	3.4	3.4	3.7
Average Evenness (*J′*)	0.59	0.62	0.64
Ten Most Abundant Taxa[4]	*Nucula annulata* *Ampelisca agassizi* *Oligochaeta* *Tharyx acutus* *Eudorella pusilla* *Polygordius* sp. A *Byblis serrata* *Exogone hebes* *Levinsenia gracilis* *Nucula delphinodonta*	*Ampelisca agassizi* *Polygordius* sp. A *Nucula annulata* *Eudorella pusilla* *Exogone hebes* *Tharyx acutus* *Goniadella gracilis* Oligochaeta *Spiophanes bombyx* *Byblis serrata*	*Nucula annulata* *Ampelisca agassizi* *Crassicorophium crassicorne* *Eudorella pusilla* *Exogone hebes* *Unciola irrorata* *Crenella decussata* *Nucula delphinodonta* *Tharyx acutus* *Ericthonius fasciatus*

Source: Corps, 2003b
OSI = Organism-Sediment Index; RPD = Redox Potential Discontinuity
[1] Nine sediment stations sampled in 2001; average of values shown. Nine SPI stations sampled in 2001; range of values shown.
[2] Seven reference stations sampled in 2001; average of values shown. Nine SPI stations sampled in 2001; range of values shown.
[3] Ten reference stations sampled in 2003; average of values shown. Twenty SPI stations sampled in 2003; range of values shown.
[4] In order of decreasing abundance.

Cluster analyses performed combining the 2001 and 2003 data (Corps, 2003b) indicated that 8 of the 10 samples collected west and north of RISDS in 2003, were more similar to each other than to the other two samples collected in 2003 and all of the 2001 samples. This may indicate that the recent disposal of dredged material in RISDS has slightly changed the nearby infaunal community, although natural variation cannot be excluded.

SPI data were obtained from nine stations within RISDS in 2001 and from several nearby stations sampled in 2001 and 2003. Analyses of the SPI data generally indicated that habitat quality in RISDS and in the nearby area was moderately variable. Primary evidence for this conclusion was the variability in the average Organism-Sediment Index (OSI) values calculated for the site, ranging from 4.0 to 9.0 within the site, and ranging from 3.0 to 10.0 in the area near the site (Table 8). The successional stages evident in the profile images showed that the communities within RISDS and in the nearby area were similarly developed (primarily stages I and I-III or II-III). No anoxic sediments or gas voids were found in the area.

SPI data from the late fall of 2003 show similar results for areas not receiving dredged material. Within the site, evidence of disturbance on the deposited mounds and within the areas is clear. However, even these areas show recovery as *Ampelisca*, species indicative of recovering sediment, were observed on some of the recently deposited sediment.

Commercial/Recreational Fish and Shellfish Resources

The finfish resources within Rhode Island Sound are spatially and temporally variable. Fish are mobile, moving between various locations within Rhode Island Sound in search of prey or better habitat. Migrations of several species occur in relation to temperature changes. These fish may use topographic depressions preferentially during these migrations, but this possibility remains unclear.

Three trawls conducted by the National Marine Fisheries Service (NMFS) within about 4 nmi northeast of RISDS, yielded medium CPUE values (988–1,396 fish/tow). Several recent trawl surveys have yielded mixed results due to the timing of the surveys and seasonal variations in fish abundance. Several trawl surveys were conducted at RISDS during a recent evaluation of the site for the Providence River and Harbor Maintenance Dredging Project EIS. The trawls at RISDS were conducted at different times of the year (June, November, and December) than more recent tows conducted west and north of the RISDS (July 2003). The CPUE for three tows at RISDS in June 2002 ranged from 288 fish/tow to 1,322 fish/tow, with a mean CPUE of about 680 fish/tow. Fifteen species were caught at RISDS during this survey. Squid (unidentified species) comprised the largest portion of the catch (101 to >1,170/30-min tow). Little skate, spiny dogfish, Atlantic butterfish, and winter flounder were the next most abundant species. In July 2003, three trawls were conducted west or north of RISDS. CPUE values (standardized to equal 30-min tows) for the tows near RISDS ranged from 50.0 to 82.0 fish/tow, with a mean CPUE of 70.8 fish/tow. Thirteen species were caught in the trawls near RISDS. NMFS and Corps-sponsored surveys indicated that the RISDS is within a region of Rhode Island Sound that has relatively low finfish productivity. The most common species found at the site were similar to those found elsewhere in the central region of Rhode Island Sound.

Rhode Island Sound supports a valuable lobster population, which appeared to be in decline as of mid-2003. Data suggest that lobsters in the Rhode Island Sound area make seasonal movements between inshore locations within Narragansett Bay and the more northern and central reaches of Rhode Island Sound, to locations in the southern region of Rhode Island Sound and much further offshore. Six surveys conducted from 1999 to August 2003 to assess the lobster population in and around RISDS, yielded average CPUE values for the site (~7 lobster/trap) that were generally similar to or slightly less than those from other sites in Rhode Island Sound.

Four commercially harvestable shellfish species—ocean quahogs, Atlantic surf clams, sea scallops, and whelks—occur in Rhode Island Sound. Of these, the ocean quahog is the most commercially important. Ocean quahogs typically live in fine-sand sediments at depths of 30 to 480 ft and rarely occur where bottom water temperatures exceed 16 ºC. Three recent (1997, 2002, and 2003) surveys of ocean quahog populations in and near RISDS found adult (greater than 70 mm) ocean quahog densities within RISDS ranged from 0.1 individuals/m^2 in the southeastern part of the site to 1.76 individuals/m^2 just west of the site (Corps, 1998; Corps, 2003d). These are comparable to historical estimates for the general area (Fogarty, 1979). The area in and around RISDS supports an ocean quahog population that has remained fairly stable through the last two decades, but one that is not as productive as other areas of Rhode Island Sound. No surf clams, scallops, or whelks were collected during the recent dredge or infaunal surveys conducted in and near RISDS. Juvenile ocean quahogs captured during benthic grab sample surveys have been uncommon, occurring at densities of about 34 individuals/m^2 to 48 individuals/m^2 (Corps, 2002c; Corps, 2003b).

Endangered and Threatened Species

Known endangered, threatened, and "special concern" species within the Rhode Island Sound region are summarized in this section. An endangered species is one whose overall survival in a particular region or locality is in jeopardy as a result of loss or change in habitat, direct exploitation by man, predation, adverse interspecies competition, or disease. Unless an endangered species receives protective assistance, extinction may occur. Threatened or rare species are those with populations that have become notably decreased because of the development of any number of limiting factors leading to a deterioration of the environment. A species may also be considered as a species of "special concern." These may be any native species for which a welfare concern or risk of endangerment has been documented within a state. Endangered and threatened species are protected by the Federal Endangered Species Act, 16 U.S.C. §§ 1531 *et seq.* and state law, while species listed as "special concern" are protected only by state law. Sixteen federally protected species and five species of special concern may occur in or near the waters of Rhode Island Sound and are listed in Table 9.

Endangered and Threatened Marine Mammals: In general, the six Federally listed whales (Table 9) and other marine mammals are not frequently observed in Rhode Island Sound. They are also not expected to spend significant portions of time in or near RISDS. Fin whales have the greatest likelihood of occurrence in the Rhode Island Sound area. These whales feed in coastal waters along the 130- to 165-ft depth contour and therefore may occur occasionally in the southern areas of Rhode Island Sound, approximately 8-10 nautical miles south of RISDS. The other listed whales generally occur off the continental shelf or deeper waters and therefore are not expected to occur in or near Rhode Island Sound except as an occasional visitor during possible migration or along feeding routes in the summer months.

Table 9. List of Federal and State Endangered or Threatened Species in the Rhode Island Sound Region.

Species	Federal Status – NMFS[1]	Federal Status – USFWS[2]	MA status[3]	RI status[3]
Blue Whale (*Balaenoptera musculus*)	NA	Endangered	Endangered	NA
Finback Whale (*Balaenoptera physalus*)	Endangered	Endangered	Endangered	Endangered
Humpback Whale (*Megaptera novaeangliae*)	Endangered	Endangered	Endangered	Endangered
Right Whale (*Eubalaena* spp. – all species)	Endangered	Endangered	Endangered	Endangered
Sei Whale (*Balaenoptera borealis*)	NA	Endangered	Endangered	NA
Sperm Whale (*Physeter catodon*)	NA	Endangered	NA	NA
Green Turtle (*Chelonia mydas*)	Endangered	Threatened	NA	NA
Hawksbill Turtle (*Eretmochelys imbricata*)	NA	Endangered	Endangered	Endangered
Leatherback Turtle (*Dermochelys coriacea*)	Endangered	Endangered	Endangered	Endangered
Loggerhead Turtle (*Caretta caretta*)	Threatened	Threatened	Threatened	Threatened
Atlantic Kemp's Ridley Turtle (*Lepidochelys kempii*)	Endangered	Endangered	Endangered	Endangered
Bald Eagle (*Haliaeetus leucocephalus*)	NA	Threatened	Threatened	Threatened
Piping Plover (*Charadrius melodus*)	NA	Threatened	Threatened	Threatened
Roseate Tern (*Sterna dougallii dougallii*)	NA	Endangered	Endangered	Endangered
American Burying Beetle (*Nicrophorus americanus*)	NA	Endangered	NA	Endangered
Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*)	NA	Threatened	Threatened	NA
Common Loon (*Gavia immer*)	NA	NA	Species of special concern	NA
Common Tern (*Sterna hirundo*)	NA	NA	Species of special concern	NA
Arctic Tern (*Sterna paradisaea*)	NA	NA	Species of special concern	NA
Least Tern (*Sterna antillarum*)	NA	NA	Species of special concern	NA
Leach's Storm-Petrel (*Oceanodroma leucorhoa*)	NA	NA	Rare/seriously declining in MA	NA

Source: [1] NMFS, 2002; [2] USFWS, 2002; [3]http://ecos.fws.gov/ecos/reports.do

Endangered and Threatened Reptiles: Five species of turtles have migration and feeding patterns that occasionally may bring them into the area that includes RISDS (Table 9). Three of these turtle species (loggerhead, leatherback, and green turtles) are more common in the shallow, coastal areas in the summer time where they search for food. The frequency of observation decreases in the winter months when most turtles are cold-stunned by water temperatures.

Endangered and Threatened Fish: No Federally or State-listed fish species are documented as occurring in or near RISDS waters (Table 9).

Endangered and Threatened Birds: The bald eagle, roseate tern, arctic tern, and Leach's storm-petrel are the bird species most likely to feed in the open waters of Rhode Island Sound (Table 9) and therefore occasionally could occur at RISDS. The other threatened and endangered bird species (piping plovers, common loon, common tern, and least tern) are more likely to occur in the nearshore, coastal areas of Rhode Island Sound.

Endangered and Threatened Insects: The two Federally listed beetle species (Table 9) live strictly in the intertidal areas (northeastern beach tiger beetle) or in the shrubs or grasses on Block Island (American burying beetle) and are not expected in the open areas of Rhode Island Sound or RISDS.

5.1.7 Bioaccumulation and Potential Risks

The Food and Drug Administration (FDA) has set action/tolerance limits that define levels of selected contaminants in food that are safe for human consumption. Measured chemical concentrations in edible tissue from finfish, lobster, and quahogs from within Rhode Island Sound were all very low (Table 10) and were at least 10 to 100 times below FDA limits for all contaminants measured.

Table 10. Comparison of Finfish, Lobster, and Ocean Quahog Edible Tissue Contaminant Concentrations (wet weight) to Human Health Action Levels (i.e., FDA Action Levels)[1].

	Total PCB (ppb)	Total DDT (ppb)	Total Chlordane[a] (ppb)	Aldrin (ppb)	Dieldrin (ppb)	Heptachlor (ppb)	Heptachlor Epoxide (ppb)	Mercury (ppm)
FDA Limits	2000	5000	300	300	300	300	300	1
Mean Concentrations in RISDS								
Fish Fillet[1]	39.83	3.73	1.29	ND	0.39	ND	ND	0.033
Lobster Meat[2]	14.3	0.928	0.139	ND	0.338	ND	0.0302	0.159
Ocean Quahog[3]	3.33	0.524	0.226	ND	ND	ND	0.118	0.006
Mean Concentrations in Rhode Island Sound (s.d.)								
Fish Fillet[4]	42.5 (15.4)	3.3 (1.3)	1.3 (0.61)	ND	0.42(0.34)	ND	ND	0.09 (0.1)
Lobster Meat[5]	12.8 (2.6)	0.73 (0.16)	0.15 (0.02)	ND	0.29 (0.04)	ND	0.03 (0.004)	0.14 (0.02)
Ocean Quahog[6]	4.3 (0.74)	0.66 (0.15)	0.33 (0.12)	ND	ND	ND	0.13 (0.04)	0.007 (0.001)

ND = not detected at or above method detection limit.
s.d. = standard deviation
[1]Mean of winter flounder (n = 2); butterfish (n = 2); scup (n = 1); and silver hake (n = 1).
[2]N = 1 lobster meat composites values.
[3]N = 1 ocean quahog composite values.
[4]Mean of winter flounder (n = 7); butterfish (n = 7); scup (n = 3); and silver hake (n = 4).
[5]Mean calculated from n = 8 lobster meat composites values.
[6]Mean calculated from n = 6 ocean quahog composite values.
[a] Total chlordane is the sum of cis Chlordane and trans-Nonachlor, as described in FDA (1989).

In 2001, selected organisms were collected at four locations within Rhode Island Sound (Site 16, Site 18, Site 69A, and RISDS [formerly called 69B]; see Figure 2) for chemical contaminant analyses to characterize body burdens of biota within Rhode Island Sound. Chemical analyses for organic contaminants and trace metals were performed on finfish, lobster, and ocean quahog tissue collected from each site.

Contaminant concentrations measured in fish collected from Rhode Island Sound are low when compared to concentrations measured in fish from coastal waters such as Boston Harbor, Cape Cod Bay, and Long Island Sound. Tissues from scup, Atlantic butterfish, silver hake, and winter flounder were collected from four locations in Rhode Island Sound in 2001 and 2002 for contaminant analyses (Corps, 2002d; Corps, 2003c). Differences in the concentrations of organic and metals contaminants among species or between collection locations were small when observed.

Organic contaminant and mercury concentrations measured in lobster meat from Rhode Island Sound are low compared to concentrations measured in lobsters from coastal waters such as Boston Harbor, Cape Cod Bay, and the New York Bight, and similar to those in lobster meat from Long Island Sound. Concentrations of the organic contaminants in lobster tissues collected from RISDS in 2002 were similar to those at two other sites in Rhode Island Sound (Sites 18 and 69A). Mercury concentrations in lobster tissues were similar among all sites sampled.

Concentrations of organic contaminants and mercury in ocean quahog tissues collected from RISDS were generally similar to or lower than those in clams from other sites in Rhode Island Sound (Corps, 2003c).

5.2 DISPOSAL SITE HISTORY

RISDS is a 1-nmi^2 square with its center located at 41˚ 13'51"N and 71˚ 22'49"W (NAD 83) (Figure 3). The site is located approximately 9 nmi south of Point Judith and roughly 6.5 nmi due east of Block Island. RISDS is located over a historic topographic depression, where the maximum water depth is about 130 ft. Water depths of the surrounding area are between 113 and 118 ft to the north, east, and south of the site. The southeastern portion of the site shoals more rapidly than the northern area. Disposal of dredged material for the Providence River and Harbor Maintenance Dredging Project began in April 2003. Recent disposal of dredged material has decreased the bathymetry in a narrow bend along the western portion of the site to approximately 112 ft as of May 2004 (Figure 3). Mound building since 2003 has been in the western and northern thirds of the site. Some disposal occurred in other locations in the site through September 2003.

6.0 MONITORING PROGRAM

Dredged materials managed under MPRSA may be disposed at RISDS. Effective environmental monitoring programs draw on available knowledge and understanding to establish approaches and clearly define monitoring objectives that focus on the primary issues of concern. Historically, monitoring of disposal sites in New England has relied on the Corps DAMOS Program as the tool for data collection. The DAMOS program uses a tiered monitoring framework (Germano *et al.,* 1994). The monitoring program presented in this section incorporates many of the features of the DAMOS framework. The goal of the monitoring program for the disposal at RISDS is to generate information that will:

- indicate whether disposal activities are occurring in compliance with permit and site restrictions;
- support evaluation of the short-term and long-term fate of materials based on MPRSA site impact evaluation criteria;
- support assessment of potential significant adverse environmental impact from dredged material disposal at the site.

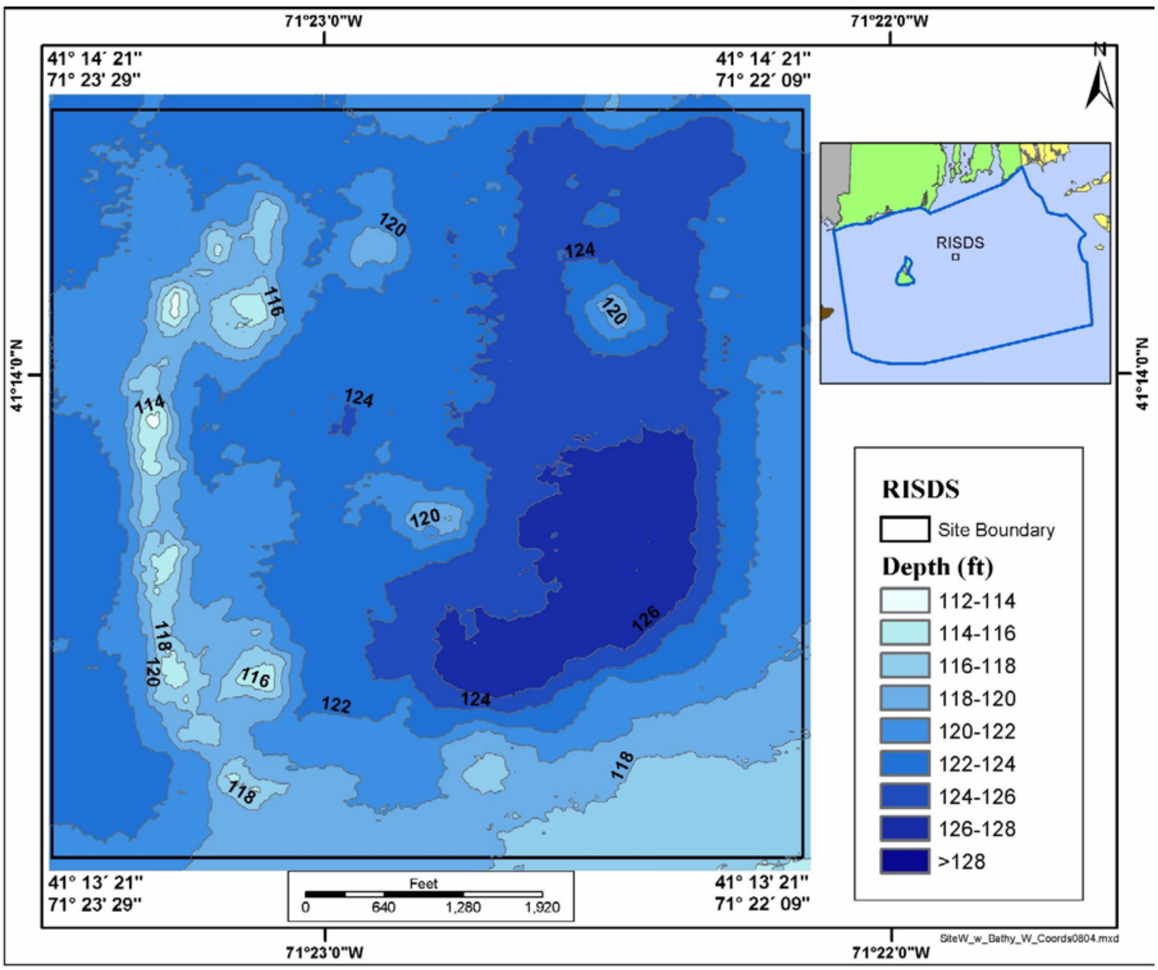

Figure 3. Location and Bathymetry of RISDS as of May 2004.

To achieve this goal, data will be developed in two areas: 1) compliance with conditions in disposal permits and authorizations and 2) environmental monitoring of the disposal site and nearby regions (as defined in Section 6.3). The latter information will be evaluated together with historic and ongoing dredged material testing data and other accessible and relevant databases (*e.g.,* Dredged Material Spatial Management and Resolution Tool [DMSMART]). These data may be provided to the EPA, Corps, and states of Rhode Island and Massachusetts at least one month prior to the Interagency Regional Dredging Team meeting. The evaluation of impacts from disposal at the site will be accomplished through a comparison of the conditions at the disposal mound(s) to historical conditions (*e.g.,* changes in historic mound height and footprint) or to unimpacted nearby reference stations. The meeting participants may use this information and the monitoring data gathered in the previous year to assess the potential impact and assist in plan monitoring surveys. EPA and the Corps will coordinate to implement the appropriate action (e.g., field surveys, additional investigations, or management actions [or subset of actions]) within the tiered Monitoring Program and to define appropriate actions to mitigate unacceptable situations.

This monitoring plan provides a general framework for the monitoring program and guides future sampling efforts at the disposal site. Specific details about those efforts (*e.g.,* sampling design, statistical comparisons) will be developed in project-specific survey plans considered during the annual agency meeting. Similarly, the schedule for the monitoring surveys will be governed by the frequency of disposal at the site, results of previous monitoring surveys, and funding resources. The data gathered under this monitoring plan will be evaluated on an ongoing basis to determine whether modifications to the site usage or designation are warranted.

Section 6.1 describes the organization of the monitoring program and summarizes the measurement program, schedule, and results that would lead to implementing additional studies. Sections 6.2 and 6.3 respectively, provide general information quality assurance requirements and a summary of the primary data collection tools.

6.1 ORGANIZATION OF MONITORING PROGRAM

The monitoring program is organized into two parts: compliance monitoring and environmental monitoring. Compliance information includes data relevant to the conditions in permits and authorizations and will be gathered separately from the environmental data.

The environmental monitoring program for the disposal site is developed around four fundamental premises that establish the overall monitoring approach from a data acquisition perspective as well as the temporal and spatial scales of the measurement program:

- Testing information from projects previously authorized to use the site for dredged material disposal can provide key information about the expected quality of material that has been placed in the site;
- Lack of benthic infaunal community recovery on recently created mounds provides an early indication of potential significant adverse impact;

- Some aspects of the impact evaluation required under MPRSA Section 102(c)(3) can be accomplished using data from regional monitoring programs (*e.g.,* fisheries impact);
- Measurement of certain conditions in the site can be performed at a lower frequency (*e.g.,* long-term mound stability) or only in response to major environmental disturbances such as the passage of major storms.

The first premise requires that historic and ongoing dredged material testing results be available. The remaining premises require various types and scales of monitoring to ensure dredged material disposal at the site is not unduly impacting the marine environment. Thus, the monitoring program is further organized around five management focus areas that are derived from the six types of potential effects required for evaluation under MPRSA [40 CFR § 228.10(b)] as described in Section 2:

- **Management Focus 1: Movement of dredged material.** This focus combines the requirements under 40 CFR 228.10(b)(1) (Movement of materials into sanctuaries, or onto beaches or shorelines) and 40 CFR 228.10(b)(2) (Movement of materials towards productive fishery or shellfishery areas) into one focus;
- **Management Focus 2: Absence of pollutant-sensitive biota.** Addresses 40 CFR 228.10(b)(3) (Absence from the disposal site of pollutant-sensitive biota characteristic of the general area);
- **Management Focus 3: Changes in water quality.** Addresses 40 CFR 228.10(b)(4) (progressive, non-seasonal, changes in water quality or sediment composition at the disposal site when these changes are attributable to materials disposed of at the site);
- **Management Focus 4: Changes in composition or numbers of biota.** Addresses 40 CFR 228.10(b)(5) (Progressive, non-seasonal, changes in composition or numbers of pelagic, demersal, or benthic biota at or near the disposal site when these changes can be attributed to the effects of materials disposed at the site);
- **Management Focus 5: Accumulation of material constituents in biota.** Addresses 40 CFR 228.10(b)(6) (Accumulation of material constituents [including without limitation, human pathogens] in marine biota at or near the site [*i.e.,* bioaccumulation]).

A tiered approach, based on a series of null hypotheses[2], is used to monitor compliance and address concerns under each Management Focus. Tier 1 evaluates a series of hypotheses addressing "leading indicators" that provide early evidence of unacceptable environmental responses or conditions. Examples include documentation of whether recolonization is proceeding as expected or whether mounds are deposited as planned and that no post-deposition movement is occurring. Should the hypotheses under Tier 1 be falsified, the findings would be

[2] A null hypothesis, H_0, represents a theory that has been put forward, either because it is believed to be true or because it is to be used as a basis for argument, but has not been proved. The null hypothesis is often the reverse of what the experimenter actually believes.

evaluated and decisions to conduct Tier 2 activities made. The specific condition that will initiate Tier 2 or Tier 3 monitoring will be decided between EPA and the Corps. Based on the type of event/action that has occurred, EPA and the Corps, with advice from other state and federal agencies, will work to implement the appropriate management practice with the Monitoring Program.

The measurement program under Tier 1 focuses on both individual dredged material mounds and the overall site conditions. New mound construction will be evaluated within one to two years of completion and the entire site will be evaluated as needed. While specific monitoring activities are defined under each Tier, the actual monitoring conducted in a given year must be consistent with budgetary constraints. Thus, prioritization of monitoring by organizational focus and findings of the monitoring program must be done annually during the Agency planning meeting.

Tiers 2 and 3 provide for progressively more detailed and focused studies to confirm or explain unexpected or potentially significant adverse conditions identified under Tier 1. For example, if Tier 1 monitoring under Management Focus 2, indicates that the benthic community was not recovering on recently deposited sediments, successive Tiers would enable examination of potential causes by incorporating additional investigation of sediment characteristics and quality. However, if the results from the Tier 1 data do not suggest impact, Tier 2 activities would not be invoked.

The following sections describe the monitoring approach that will be applied to each management focus. Each subsection provides the following:

- Intent of the data gathered under the focus area;
- Statement of relevant questions and hypotheses to be addressed within each tier;
- Summary of the measurement approach and tools to be used under each successive Tier.

Attachment A provides flow charts that summarize the tiered approach for each management focus (as questions) and a table that summarizes each of the hypotheses and the leading indicators that would require action.

6.1.1 Compliance Monitoring

Compliance monitoring includes evaluation of information and data relevant to the conditions in permits and authorizations and will be gathered separately from the environmental data. The hypothesis that will be addressed is:

H_0 0-1: Disposal operations are not consistent with requirements of issued permits/authorizations.

This hypothesis will be evaluated by review of the disposal inspectors report and any variances identified will be discussed by the EPA and the Corps on a project-specific basis to determine the potential magnitude of effect and the appropriate action.

6.1.2 Management Focus 1: Movement of the Dredged Material

This management focus addresses two concerns relative to the disposal of dredged material at RISDS. The first is site management and compliance. The second is movement of the material after disposal. The questions that will be addressed include:

- Is the material deposited at the correct location?
- Are mounds constructed consistent with the site designation?
- Are mounds stable and dredged material retained within the disposal site?

The latter question directly addresses management concerns about material moving into sanctuaries, or onto beaches or shorelines and towards productive fishery or shellfishery areas.

Tier 1

The site designation specifies that RISDS is a non-dispersive site; therefore significant movement of materials out of the site is not expected. Loss of mound material could mean that the material is being lost inappropriately and may potentially impact areas outside of the site, if transported beyond the site's boundary. For the purpose of Tier 1, this question is addressed through two hypotheses.

H_0 1-1: Changes in elevation for any mound are not greater than 1.0 feet (0.3 meter) over an area greater than 50 by 50 meters:

This hypothesis will be tested by determining the dimensions of disposal mounds created in a given dredging season and performing periodic monitoring of the mound using precision bathymetry techniques (see Section 6.3). The bathymetric baseline data for new or modified mounds will be collected after one year of consolidation. Bathymetric surveys of mounds (historic and recently completed) and the entire site will also be performed periodically. Information on mound size and height will be compared with previous data to determine if loss of material has occurred. Further study of the characteristic of the mound and surrounding area will be conducted under Tier 2, if large scale (50 by 50 meter) mound changes of more than 1.0 feet (0.3 meters) within any five year interval.

H_0 1-2: Major storms (greater than 10 year return frequency) do not result in erosion and loss of material from disposal mounds at RISDS.

This hypothesis tests whether storms that produce waves greater than 16 feet height with a period of 9.5 seconds have eroded mounds. Previous studies and sediment erosion modeling conducted during the site designation process suggest that a storm having a ten year return probability may cause a small amount of erosion on the mounds that approach the mound height restrictions (32 meters [105 feet] below mean low water) and potentially transport material from deposited mounds. However, storms of greater magnitude may interact with recently deposited sediments or sediments that are below the limiting erosion depth and result in movement of material from the mounds.

This hypothesis will be tested by determining the dimensions of disposal mounds within two months following the passage of storms with a ten-year return frequency. Dimensions will be determined using precision bathymetry techniques (Section 6.3.1). The decision to conduct post-storm surveys will be made jointly by the site managers. If a mound changes in height by more than 1.0 feet (0.3 meters) from the previous survey, the site and surrounding area will be examined as defined under Tier 2.

Tier 2

Significant loss of material from the deposited mound may result in changes to sediment quality (See Section 6.3.4) either within or beyond the site boundaries. Change in bathymetry and sediment quality immediately outside of the site would be indicative of potential unacceptable transport. Tier 2 investigates whether significant erosion of mound height determined under Tier 1 results in the relocation of material outside of the site boundaries.

H_0 1-3: Material lost from disposal mounds at RISDS does not increase the (a) bathymetry more than 0.5 feet (15 cm) over an area larger than 50 by 50 meters and (b) the organism sediment index is not significantly lower than the reference site in bathymetrically changed areas.

This hypothesis will be tested by determining changes in bathymetry and sediment characteristics within 1 kilometer (0.6 miles) beyond the site boundary. The survey design will take into account the expected direction of transport based on the predominant current direction and velocity (*e.g.,* it may not be necessary to survey the entire area within 1 kilometer [0.6 miles] of the site).

Precision bathymetry (Section 6.3.1) will be used to define substantive changes in bathymetry and topography (greater than 0.5 foot [15 centimeters]). Sediment profile imagery may also be used to evaluate changes in sediment characteristics (see Section 6.3.2). The sediment profile imagery can be used to observe layers of material too thin to detect by precision bathymetric methods and can also be used to evaluate if the benthic community in the sediments has been disturbed or is under stress (as defined in Management Focus 2, Tier 2) relative to the reference sites. Comparison of sediment profile imagery data from areas of concern to reference areas will be used to determine whether the transported material has a potential significant adverse biological effect.

Changes in bathymetry across the mound apex or apron of more than 1.0 feet (0.3 meters) or development of large areas of predominately muddy sediments not previously documented may be an indication of substantial transport of material from the site. If such changes are documented, Tier 3 characterization of sediment quality or further characterization of benthic communities may be required.

Tier 3

The premise of this Tier is that significant transport of material beyond the site boundary could affect the benthic productivity of the area. Therefore, characterization of sediment quality may be required.

H_0 1-4: Material transported beyond the RISDS boundaries does not result in significant decreases in sediment quality.

Sediment chemistry, toxicity, and benthic community structure will be measured at representative locations (determined through interagency coordination) from the area where the benthic community is depressed and at the RISDS reference sites to test this hypothesis (see Section 6.3.5).

Chemical and toxicity testing and analysis will be conducted using methods required by the RIM (EPA and Corps, 2004) or subsequent approved documents. Benthic community sampling and analysis methods will be the same as those conducted during site designation studies. Statistical comparisons and numbers of samples will be determined during project-specific survey planning.

Data from the area of concern will be compared statistically to data collected concurrently from the RISDS reference sites to determine if the quality of transported material is unacceptable. The decision of unacceptable conditions will be based on all three measures (*i.e.,* sediment quality, benthic community analysis, and toxicity).

6.1.3 Management Focus 2: Absence from the Disposal Site of Pollutant-Sensitive Biota Characteristic of the General Area

The premise underlying this management focus is that the infaunal community on disposal mounds recovers rapidly[3] after disposal ceases. Therefore, the absence of or slower-than-expected recovery of the benthic infaunal community indicates a potential biological impact at the mound and by implication the ability of the site to support higher trophic levels. The long history of disposal site monitoring in New England has resulted in an excellent understanding of the rate at which benthic infauna recover from disturbances such as those caused by dredged material disposal as well as the types of communities that are expected to recolonize the mounds (SAIC 2002; Murray and Saffert, 1999; Morris, 1998; Charles and Tufts, 1997; Wiley *et al.,* 1996; Williams, 1995; Wiley, 1995; Wiley and Charles, 1995; SAIC, 1995; Wiley, 1994; Germano *et al.,* 1994; Germano *et al.,* 1993; SAIC, 1990; SAIC, 1988; SAIC, 1987; SAIC, 1985; Morton *et al.,* 1984; Scott *et al.,* 1984; Scott *et al.,* 1983; Morton and Paquett, 1983; Arimoto and Feng, 1984; Morton *et al.,* 1982; Morton and Stewart, 1982; SAIC, 1982; Morton, 1980; SAIC 1980). Thus, the questions that the monitoring program addresses are directed at determining if benthic recovery is proceeding as expected and if pollutant sensitive organisms are growing on the mounds. For Tier 1, these questions include:

- Do opportunistic species return to the mound within a growing season?
- Are the infaunal assemblages consistent with similar nearby sediments or expected recovery stage?
- Are benthic communities and populations similar to surrounding sediments?

[3] Rapidly in this context means up to three (or more) years depending on a variety of factors that influence recolonization in coastal waters.

If these questions are answered in the affirmative, the biological community on the mounds is recovering as expected and significant adverse impact from the disposal operations is not demonstrated. If the questions are answered in the negative, investigation into potential causes is conducted under Tier 2.

Tier 1

This tier focuses on the biological recovery of the mound surface by sampling for specific, opportunistic, benthic infaunal species and the recolonization stage relative to nearby sediments.

H_0 2-1: Stage 2 or 3 assemblages (deposit-feeding taxa) are not present on the disposal mound one year after cessation of disposal operations.

This hypothesis will be tested with sediment profile imaging on the disposal mounds created in a given dredging season and by periodic imaging of older mounds (see Section 6.3.2). This evaluation includes estimates of grain size classes, which is a key variable affecting the types of organisms observed in the images. The initial sediment profile imaging survey should be conducted within 12 to 16 months after mound completion. Evaluation of selected historic (inactive) mounds and imaging of the RISDS reference stations will be incorporated into each survey of active mounds. Sampling of historic mounds can be sequenced across years depending on budgets and the conclusions of the previous data review at the annual agency coordination meeting.

Significant adverse impact will be determined from comparison of the sediment profile imagery data on the active and historic mounds to that of the reference stations. If the comparison of the mound data to the reference areas is consistent with the expected successional sequence, the biological community on the mounds would be considered to be recovering as expected and significant adverse impact from the disposal operations not demonstrated. If there is significant departure from the successional expectation in the sediment profile imagery data between the mounds and reference site, and the grain size information from the images or reference condition cannot explain the difference, further investigation into the potential causes of the difference is conducted under Tier 2.

Tier 2

This Tier is executed if differences in the benthic recolonization data on a dredged material mound cannot be explained by differences or changes in grain size. The hypotheses are designed to determine if the observations made under Tier 1 are localized (mound specific) or regional and to determine the affect of different sediment grain size distributions on the biological observations.

H_0 2-2: The absence of opportunistic species and Stage 2 or 3 assemblages is not confined to the disposal mounds.

H_0 2-3: The range in sediment grain-sizes on the disposal mound is not different from the ambient seafloor.

These hypotheses examine whether or not the differences observed in Tier 1 extend beyond the disposal mounds and whether the grain size distribution within and outside the site can explain the biological observations. If diminished recolonization (successional) stage data is widespread and substantial movement of material is not observed under Tier 1 or 2 of Management Focus 1 or if poor water quality conditions (*e.g.,* sustained low dissolved oxygen levels) are known to have occurred in the region (Management Focus 3), assignment of the dredged material disposal as the cause is questionable. However, if the differences are widespread and cannot be attributed to other factors, an investigation of cause would be initiated under Tier 3 of this Management focus.

These hypotheses will be tested with sediment profile imaging (see Section 6.3.2). The sediment profile image survey will be designed to sample representative conditions in the site and extend systematically to areas at least 1 kilometer (0.6 miles) beyond the site boundaries.

The full suite of information developed from the sediment profile images will be used to evaluate the similarity or differences of the areas sampled. This evaluation includes estimates of grain size classes, which is a key variable affecting the types of organisms observed in the images. The data will be used to address the above hypotheses. If the results find the effect is widespread and that grain size distributions can not explain the biological observations, additional cause effect studies defined under Tier 3 may be conducted.

Tier 3

Tier 3 is conducted if the benthic recolonization data developed under Tier 2 indicate that potential impacts are widespread (*i.e.,* encompass areas within and beyond the site boundaries). This Tier attempts to determine if the Tier 2 findings are the result of contaminants in the sediments or sediment toxicity. Tier 3 studies will only be conducted after a review and concurrence by the agencies managing the site.

H_0 2-4: The toxicity of sediment from the disposal site is not significantly greater than the reference sites.

H_0 2-5: The benthic community composition and abundance is not equal to that at reference sites.

Sampling and analysis of the sediments for benthic infaunal enumerations and community analysis will be conducted to evaluate the status of the infaunal community and compare the community to measures of sediment quality (see Section 6.3.2 and Section 6.3.5). Sediment chemistry and toxicity will be measured at representative locations from within the deposited material and at the RISDS references sites (see Section 6.3.4).

Chemical and toxicity measures will be conducted as defined in the RIM (EPA and Corps, 2004) or subsequent approved documents. Data from the area of concern will be compared statistically to data collected concurrently from the RISDS reference sites to determine if the quality of transported material is unacceptable. The number of stations to include in the testing may be determined at the annual meeting. The decision of unacceptable conditions will be based on all three measures.

6.1.4 Management Focus 3: Changes in Water Quality

The premise underlying this management focus is that water quality in central Rhode Island Sound is affected by many different sources and that dredged material placed at the site exerts minimal oxygen demand on the water column. Moreover, dredged material plume studies indicate the cloud of particles resulting from dredged material disposal has a very short duration in the water column and turbidity levels reach ambient levels within minutes to hours. This fact, coupled with required testing that ensures residual material meets water quality criteria within an initial mixing period (within four hours within the site and always outside the site) before the material can be accepted at the site, minimizes any long-term, cumulative impact to the water column. Therefore, it is expected that significant short-term adverse effects are unlikely to result from the disposal operations. Relevant questions for water quality include:

- Is short-term water quality in RISDS different during disposal operations than in areas outside the site?
- Does dredged material disposal have a substantive impact on long-term water quality measures such as dissolved oxygen?

As discussed under Management Focus 1 and 2, dredged material placed at RISDS must pass the requirements of the RIM (EPA and Corps, 2004) or subsequent approved manuals, for disposal at RISDS. Potential water impacts are examined through the permitting process. Thus, short-term water quality impacts are not expected. Ample evidence exists, as documented in the DEIS (EPA, 2004), that dredged material disposal poses minimal potential to impact water quality in the short time scales that residual material remains in the water column. Although not a concern for most projects, some projects may be required to prove that they are not exceeding Limiting Permissible Concentration (LPC) criteria at the site boundary during dredged material disposal. Thus, a measurement program to document whether short-term changes in water quality during disposal operations (H_o3-0) occurs is not proposed under Tier 1 but may be required as part of a disposal permit.

H_0 3-0: The LPC is not exceeded at the site boundary for four hours after a dredged material disposal event.

Tier 1

Under this tier, it is assumed that water quality at RISDS and the surrounding region is not degraded by the disposal of dredged material. Measurements under this Tier will be triggered if information developed under Management Focus Area 2, suggests that RISDS is the cause of poor water quality and is causing wide-spread benthic impacts in central Rhode Island Sound.

H_0 3-1: Water quality at RISDS is not significantly less than nearby reference areas.

This hypothesis will be tested through water quality surveys designed to evaluate short-term gradients in water quality during disposal operations. If significant sustained short-term changes are found, further evaluation of the relationship to dredged material disposal will be undertaken (Tier 2) after discussion by the managing agencies.

Tier 2

Specific hypotheses cannot be defined for this Tier at this time and will be developed through interagency coordination at such time the Tier is deemed necessary. However, they may include special studies that determine the sediment oxygen demand to evaluate the contribution of the site to spatial and temporal dissolved oxygen trends in the water column. Such studies would compare the sediment oxygen demand levels in sediments within and outside the site including the RISDS reference locations. Special plume tracking studies may also be mounted to examine the specific effects of individual dredged material plumes on water quality during the disposal season.

Tier 3

No specific hypothesis can be determined at this time. Specific hypotheses will be developed as needed through interagency coordination.

6.1.5 Management Focus 4: Changes in Composition or Numbers of Pelagic, Demersal, or Benthic Biota at or Near the Disposal Site

This management focus addresses regional changes in species composition and abundance. Two areas of study are considered: finfish and macrobenthic organisms such as lobster. As discussed in the DEIS (EPA, 2004), significant short-term adverse effects to these communities are unlikely to result from the disposal operations. Long-term impacts to fish and shellfish populations in Rhode Island Sound are also unlikely, but are more difficult to predict. However, these populations are regularly monitored by NMFS and the State of Rhode Island through their fish trawl surveys. These surveys are anticipated to provide sufficient data to develop information necessary to determine if the dredged material disposal at RISDS is affecting the fish and lobster populations in Rhode Island Sound. Relevant questions include:

- Is the composition of the pelagic and demersal fish community unacceptably affected by disposal operations at the site?
- Is the composition of macro benthic biota unacceptably affected by disposal operations at the site?

Tier 1

H_0 4-1: Disposal of dredged material has no significant long-term impact on fish/shellfish populations or abundance.

This hypothesis will be addressed with data developed under the National Marine Fisheries Service (NMFS), Massachusetts Division of Marine Fisheries (MADMF), University of Rhode Island- Graduate School of Oceanography (URI-GSO) and Rhode Island Division of Fish and Wildlife (RIDFW) fish trawl surveys. These data are collected on a yearly basis under a stratified random sampling design. Data from the vicinity of the site will be compared with data obtained from other similar areas (depth, sediment type, etc.) in the central Rhode Island Sound to determine if there are significant spatial differences that could be related to dredged material disposal at RISDS.

H_0 4-2: Dredged material disposal operations have no significant direct impact on threatened and endangered species.

The need to test this hypothesis during Tier 1 monitoring will be determined annually or based on site use activity. Methodologies may include the placement of marine mammal observers on tugs or hopper dredges.

Tier 2

If the data reviewed under Tier 1 suggest that dredged material disposal at RISDS is potentially having an unacceptable adverse affect on the fish or shellfish populations, special studies to evaluate the distribution of these species in and near the site will be developed. These studies would address the distribution and composition of the fish and macrobenthic organism species within the site and in areas contiguous to the site boundaries. Control areas with similar habitat and depths to those found at RISDS would be identified and sampled to provide a control on the sample design. Specific study questions and sampling design will be developed and approved by the agencies managing RISDS before any study is conducted.

If studies under Tier 2 demonstrate a link between reduced fish or shellfish abundance and dredged material disposal at RISDS, additional studies to determine cause will be implemented under Tier 3.

Tier 3

Studies conducted under this tier may include evaluation of the availability of prey species in the site and surrounding areas and evaluation of bioaccumulation of chemicals in the fish and macro benthic species. Studies of prey species may include evaluation of the successional stage, infaunal community analysis (as described in Section 6.3) or bioaccumulation studies similar to those defined under Section 6.1.5 below. Specific study questions and sampling design will be developed and approved by the agencies managing RISDS before any study is conducted.

6.1.6 Management Focus 5: Accumulation of Material Constituents in Marine Biota at or Near the Site

The intent of this management focus is to evaluate whether significant potential for bioaccumulation results from disposal of dredged material at RISDS. The basic premise of this management focus is that testing of sediments for open water disposal eliminates material that poses an unacceptable risk to the marine environment from disposal at RISDS. Moreover, because bioaccumulation of contaminants is a phenomena, it may not result in the impairment or death of organisms in and of itself. However, because bioaccumulation may result in transfer and possible biomagnification of certain chemicals throughout the food chain, which may pose potential unacceptable risks to marine organisms and humans that are not addressed through the evaluation of benthic community recovery, measurements for potential bioaccumulation are precautionary and prudent.

Such bioaccumulation data can serve two purposes. The first is to help understand whether transfer of chemicals from sediments to organisms could be contributing to a significant adverse biological response (*e.g.,* failure of a benthic infaunal community to thrive). The second is to estimate potential risks posed from bioaccumulation of contaminants at the site. The challenge in the monitoring program is how to best develop the information. Two questions are relevant under this Management Focus:

- Are risk levels from sediments placed at RISDS low?
- Does the bioaccumulation potential from the deposited sediments remain low after deposition?

There are several ways to address these questions. The first question is best addressed by continuing to test potential projects for potential risk (as currently practiced in the region) and by compiling test results into a readily available database. Addressing the second question involves periodically evaluating bioaccumulation potential for sediments at and near the disposal site. Methods for developing this information can range from estimating bioaccumulation potential using bioaccumulation models, to measuring the levels of contaminants in organisms collected from a site, to conducting controlled laboratory bioaccumulation studies with test organisms. These approaches are used in a tiered manner to address bioaccumulation concerns at RISDS.

If either of these questions is answered in the negative, significant adverse impact from the disposal operations may be present. Question 1 will be addressed through evaluation of the testing data submitted as part of the permit application and approval process. Question 2 is addressed under the Tiered approach below.

Tier 1

The premise of this Tier is that bioaccumulation potential at RISDS, and thus risk, does not increase after the sediments are deposited.

H_0 5-1: Bioaccumulation potential of sediments collected from RISDS is not significantly greater than the range of bulk chemical values measured in permitted projects.

This hypothesis will be tested by periodically collecting sediments from within RISDS and its reference areas and measuring the level of contaminants in the sediments. If statistically significant increases in sediment chemistry above permitted dredged material project data are found, theoretical bioaccumulation calculations will be performed. These may be performed in association with any sampling for sediment chemical analysis (*i.e.,* Tier 3 of Management

Focus 4). Such surveys should be designed to address other relevant management evaluations. If such sample collections are not performed within any five-year interval, a survey may be planned and conducted as a precautionary evaluation.

If the bioaccumulation modeling indicates a significant increase in potential bioaccumulation relative to baseline conditions or reference areas more specific studies that directly measure bioaccumulation may be conducted under Tier 2.

Tier 2

Direct evidence of bioaccumulation from sediments placed at RISDS may be obtained by comparing bioaccumulation in organisms collected from within and near (reference stations) the disposal site. The study may include collection of representative infaunal organisms from these locations and comparing the level of chemicals in their tissues or testing sediments under controlled laboratory conditions (*i.e.,* bioaccumulation bioassays) or both.

The specific study questions and sampling design will be developed and approved by the agencies managing RISDS before any study is conducted.

If significant increases in bioaccumulation are determined to exist in the sediments from the site, ecological and human health risk models may be run to examine the significance of the increase. If risks increase significantly, studies described under Tier 3 would be implemented.

Tier 3

This Tier tests for transfer of bioaccumulated compounds at the site into higher trophic levels.

H_0 5-2: Bioaccumulation of material constituents in higher tropic levels that reside at or near the site does not result from disposal of dredged material at RISDS.

Proving the source of contaminants measured in higher trophic level species is a difficult and complex task. Therefore, careful experimental design is required to make a cause effect link to the sediments deposited at RISDS. The specific study design will be developed and approved by the agencies managing RISDS before any study is conducted.

6.2 QUALITY ASSURANCE

An important part of any monitoring program is a quality assurance (QA) regime to ensure that the monitoring data are reliable. Quality assurance has been described consisting of two elements:

- Quality Control - activities taken to ensure that the data collected are of adequate quality given the study objectives and the specific hypothesis to be tested, and include standardized sample collection and processing protocols and technician training (National Research Council [NRC], 1990).

- Quality Assessment - activities implemented to quantify the effectiveness of the quality control procedures, and include repetitive measurements, interchange of technicians and equipment, use of independent methods to verify findings, exchange of samples among laboratories and use of standard reference materials, among others (NRC, 1990).

Relevant laboratories are required to submit Quality Assurance (QA) sheets with all analyses on a project-specific basis (see the Ocean Testing Manual [Green Book; EPA and Corps, 1991] and the RIM [EPA and Corps, 2004] for further details).

6.3 MONITORING TECHNOLOGIES AND TECHNIQUES

This section describes equipment and approaches typically used to evaluate dredged material disposal sites in the northeast United States. Use of consistent techniques increases comparability with future and historic data; however, monitoring methods used at RISDS are not limited to these technologies. New technology and approaches may be used as appropriate to the issues and questions that must be addressed. The applications of equipment and survey approach must be tailored to each individual monitoring situation, as warranted.

6.3.1 Mound Erosion

Loss of deposited dredged material (erosion) at the site will be investigated using bathymetry (SAIC, 1985). Typically, this methodology applies a minimum area bounded by rectangular dimensions of approximately 800 meters to 1,200 meters centered around a disposal buoy and aligned with the major axis of the tidal ellipse at the site will be surveyed. Today's survey techniques and equipment have matured to the place that comparative surveys can detect changes in the bathymetry of mounds of approximately 6 inches (15 cm) over areas of 50 by 50m. Side scan sonar and sediment profile imaging systems (Rhoads and Germano, 1982; Germano *et al.*, 1994) may also be used and are useful for defining broad areas where grain size may have changed or identify thin layers of dredged material, respectively (Rhoads, 1994). Specific survey requirements and application of these measurement tools will be defined for each tier and situation investigated. Evidence of mound erosion will need to be evaluated carefully to distinguish between actual erosion and mound consolidation.

6.3.2 Biological Monitoring

Benthic recovery at disposal mounds will be measured by sediment profile imagery (Germano and Rhoads, 1982; 1994). Stations will center on the disposal buoy and sampled in a star pattern at 100 meter intervals (if more than one area is used in the year then these additional areas will be surveyed in a similar manner). In addition, stations at each of the reference sites will be obtained. At each station three photos will be taken with the sediment profile imaging camera. Image analyses will provide the following information:

- Sediment grain size;
- Relative sediment water content;

- Sediment surface boundary roughness;
- Sea floor disturbance;
- Apparent Redox Potential Discontinuity (RPD);
- Depth of camera penetration;
- Sediment methane;
- Infaunal successional stage;
- Organism-Sediment Index (OSI).

6.3.3 Water Quality

Should site specific monitoring be required for water quality monitoring, methodologies will be developed.

6.3.4 Sediment Quality

Grab samples of the sediments will be collected and analyzed for grain size, total organic carbon, and selected contaminants such as trace metals (*e.g.,* mercury, lead, zinc, arsenic, iron, cadmium, copper), total PCBs, total PAH, and pesticides (EPA/Corps, 2004). The number of stations and locations will be defined during survey planning and will be sufficient to enable characterization of within and among station variability. A minimum of two replicate samples should be obtained from each station sampled including each of the reference stations.

Toxicity tests will be selected from those used to evaluate dredge material proposed for disposal at RISDS (EPA/Corps, 2004). The number of stations and locations will be defined during survey planning and will be sufficient to enable characterization of within and among station variability. A minimum of two replicate samples should be subjected to testing and include each of the reference stations.

6.3.5 Living Resources

Data from the NMFS Trawl Survey will be obtained and analyzed to determine whether the diversity and abundance of recreational and commercial fish in the vicinity of RISDS differs from other similar areas (depth, sediment type, *etc*.) of Rhode Island Sound.

6.3.6 Bioaccumulation Measurements

Measurement of bioaccumulation will include collection of representative benthic infaunal species within the site and at reference locations. At least two types of organisms (filter feeders and sediment feeders) will be obtained and genus level species aggregated into field replicates. Sufficient biomass to enable quantifications of bioaccumulatable compounds will be obtained from grab samples (or other appropriate sample collections device). Tissue will be prepared and analyzed using methods consistent with EPA/Corps (2004). The number of stations and locations will be defined during survey planning and will be sufficient to enable characterization of within and among station variability. Between three and five replicate samples should be obtained from each station sampled including each of the reference stations.

Laboratory based bioaccumulation testing will follow the requirements outlined in EPA/Corps (2004).

7.0 ANTICIPATED SITE USE AND QUANTITY AND QUALITY OF MATERIAL TO BE DISPOSED

MPRSA 102(c)(3)(D) and (E) requires that the SMMP include consideration of the quantity of the material to be placed in the site, and the presence, nature, and bioavailability of the contaminants in the material as well as the anticipated use of the site over the long term. RISDS is designated to receive dredged material only. No other material may be placed in the site.

The 2002 dredging needs survey of Rhode Island Sound (Corps, 2002e) identified anticipated dredging volumes for each harbor in the Sound over the next 20 years. Based on the dredging needs study, the projected dredged material volume for Rhode Island and southeastern Massachusetts is approximately 9 million cubic yards (Table 1-1; EPA, 2004). These projected dredging volumes include a mix of large and small Federal navigation projects and many small private dredging projects (marinas, boatyards, and harbors, and a few large private projects), which is consistent with the pattern of dredging in Rhode Island Sound over the past 20 years. Sediments projected for disposal are expected to come primarily from maintenance dredging projects. This estimate does not include the 2003 Providence River and Harbor Maintenance Project disposal at Site 69B (Separation Zone Site) that began in early 2003 which consists of approximately 5.6 MCY of clean CAD material and suitable maintenance material. Of the 9 MCY estimated to be dredged over the next 20 years, approximately 3.7 MCY is expected from maintenance of Federal projects and approximately 5.1 MCY from non-Federal facilities. Of the Federal maintenance material, approximately 1 MCY is expected from further maintenance of the Providence River. The sediment properties are expected to be variable although the predominant sediment type is likely to be silty material (silts, organic silts, sandy silts, etc.).

All dredged material projects using RISDS for disposal must be either permitted or authorized under MPRSA (see Section 3.0). The quality of the material will be determined on a project specific basis under the testing requirements necessary to meet open-water disposal requirements of MPRSA 103. The quality of MPRSA material will be consistent with EPA's Ocean Dumping Regulations (40 CFR Part 227), as implemented under the EPA and Corps RIM (EPA and Corps, 2004). Any updates to the RIM will be in force when approved by the EPA and Corps.

A specific closure date for RISDS has not been assigned as of the date of this SMMP. The potential capacity of RISDS (approximately 20 MCY) is far in excess of the potential site use over the next 20 years (approximately 9 MCY); thus, developing a closure plan at this time is not critical. However, the 20 MCY site capacity for RISDS is only an estimate and was calculated as the volume between the seafloor and 105-ft depth, assuming a rectangular mound occupying 1 nmi^2 and having a shoulder slope of 1:20. The capacity of the site will be evaluated at least every three years, and no legal limit exists on the amount of material that can be placed at the site. At the time that site closure appears likely in the next decade, plans should be made to (1) manage sediment placement to achieve any preferred bathymetric profile, and (2) survey the overall sediment chemical distributions to cover any site areas exhibiting relatively greater contaminant concentrations during the final years of site use.

8.0 REVIEW AND REVISION OF THIS PLAN

MPRSA 102 (c)(3)(F) requires that the SMMP include a schedule for review and revision of the SMMP, which shall not be reviewed and revised less frequently than 10 years after adoption of the plan, and every 10 years thereafter. The EPA, the Corps, and other federal and state agencies have agreed to review this plan yearly as part of the annual agency planning meeting agenda (Section 3.2). A formal review and revision of this SMMP will take place every 5 years beginning from the date of designation unless the frequency is modified during the annual agency planning meeting. Reassessment of the EFH and endangered species issues will also be conducted on a 5 year basis with NMFS.

9.0 COORDINATION/OUTREACH

To ensure a disposal program that minimizes impacts to the marine environment, the following management practices will continue to be implemented at RISDS as a matter of policy. First and foremost, all proposed dredging projects will be reviewed for suitability for ocean disposal by both the Corps and EPA.

The Interagency Regional Dredging Team, composed of representatives from EPA, Corps, NMFS, USFWS, and Rhode Island and Massachusetts state representatives, meets approximately every six months in Sudbury, Massachusetts to discuss management and monitoring of New England dredged material disposal sites.

To assess compliance with applicable permit conditions and to track overall site usage, permittees will be required to provide written documentation of disposal activities to the Corps during disposal operations and after dredging is complete. Disposal permits and authorizations will include standardized requirements for this reporting to include the source of the dredged material, the amount of the material disposed, the rate of disposal, the date, time and coordinates of disposal.

The Corps will provide EPA with summary information on each project at two stages of the dredging and disposal process. A Summary Information Sheet will be provided when dredging operations begin, and a Summary Report will be submitted when dredging operations have been completed.

The EPA and the Corps will continue to inform and involve the public regarding the monitoring program and results. For example, the DAMOS Program holds periodic symposia (typically every three years) to report results and seek comments on the program. In addition, DAMOS monitoring results are published in an ongoing series of technical reports that are mailed to interested people and organizations and also distributed at various public meetings and via the internet. The Corps also has prepared and distributed several Information Bulletins and brochures. To better meet this need, a series of presentations on different aspects of the dredging and disposal process has been prepared. In addition, site related reports can be reviewed at both the Corps Technical Library and the EPA regional library:

U.S. EPA (New England)
Regional Library
One Congress St., 11th Floor
Boston, MA 02144
Hours: Monday-Friday 8:00-5:00

U.S.ACE
NAE Technical Library
696 Virginia Road
Concord, MA 01742
Hours: Monday-Friday 7:30-4:00

Any party interested in being added to the DAMOS mailing list should mail the appropriate information to the Corps at:

U.S. Army Corps of Engineers, New England District
Regulatory Division
Marine Analysis Section
696 Virginia Road
Concord, MA 01742

10.0 FUNDING

The costs involved in site management and monitoring will be shared between EPA Region I and the Corps NAE and are subject to the availability of funds. This SMMP will be in place until modified or the site is de-designated and closed.

These recommendations do not necessarily reflect program and budgeting priorities of the Federal government in the formulation of EPA's national Water Quality program or the Corps national Civil Works water resources program. Consequently, any recommendations for specific activities or annual programs in support of efforts in Rhode Island Sound may be modified at higher levels within the Executive Branch before they are used to support funding level recommendations. Requests for funding are also subject to review and modification by Congress in its deliberations on the Federal budget and appropriations for individual programs. Similarly, state agency programs will depend solely on funds allocated to the programs by those agencies or other supporting agencies.

REFERENCES

Arimoto, R. and S.Y. Feng. 1984. DAMOS Mussel Watch Program: Histological Studies of Mussels from Dredged Material Disposal Sites. DAMOS Contribution No. 20. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 25 pp.

Charles, J. and G.J. Tufts. 1997. Monitoring Cruise at the Western Long Island Sound Disposal Site, August 1993. DAMOS Contribution No. 114. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 33 pp.

Collins, B.P. 1976. Suspended material transport: Narragansett Bay area, Rhode Island. *Estuarine and Coastal Marine Science*. 4:33-46.

Corps. 1972. Fall River Harbor, Massachusetts and Rhode Island, Improvement Dredging Design Memorandum. U.S. Army Corps of Engineers, New England Division. Waltham, MA.

Corps. 1982. Draft Environmental Impact Statement, Improvement Dredging, Fall River Harbor, Massachusetts and Rhode Island. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps. 1996. Guidance for Inspectors on Open-Water Disposal of Dredged Material. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps. 1998. Shellfish Sampling and Site Characterization, Narragansett Bay and Rhode Island Sound Proposed Disposal Sites. In: Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement, Appendix C-6. Prepared under Contract No. DACW33-96-D-0005, Delivery Order No. 14 by Battelle for the U.S. Army Corps of Engineers. January 1998.

Corps. 2001a. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 37 by Battelle for the U.S. Army Corps of Engineers, New England Division, Concord, MA.

Corps. 2001b. Letter Report: Evaluation of Existing Physical Oceanographic Data. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2002a. Fall 2001 Water Column Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. August 2002.

Corps. 2002b. Spring 2002 Water Column Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No.

DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2002.

Corps. 2002c. Fall 2001 Infauna Characterization Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. September 2002.

Corps. 2002d. Fall 2001 Finfish Characterization Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2002e. Task 12F Dredging Needs Study. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No.2 by Battelle and the Maguire Group Inc. for the U.S. Army Corps of Engineers. November 2002.

Corps. 2003a. Final Survey Report for Winter 2002 Physical Oceanography Data Collection Survey. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

Corps. 2003b. Benthic Infauna Data for Area E and Area W, July 2003. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02 by Battelle for the U.S. Army Corps of Engineers. November 2003.

Corps. 2003c. Summer 2003 Finfish Survey and Data Report. Rhode Island Region Long-term Dredged Material Disposal Site Evaluation Project. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. December 2003.

Corps. 2003d. Summer 2003 Quahog Survey and Data Report. Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared under contract DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers. October 2003.

Corps. 2004a. Monitoring Surveys of the Rhode Island Sound Disposal Site Summer 2003.t. Contribution 155. Disposal Area Monitoring System (DAMOS) Report. Prepared for the U.S. Army Corps of Engineers. 81 pp. August 2004.

Corps. 2004b. Fall 1999 and Spring 2002 Physical Oceanographic Data Report. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 2 by Battelle for the U.S. Army Corps of Engineers.

EPA and Corps. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual. EPA Report No. EPA-503-8-91/001. Available http://www.epa.gov/OWOW/

oceans/gbook/index.html. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection and Department of the Army, U.S. Army Corps of Engineers, Washington, DC.

EPA and Corps. 1996. Guidance Document for Development of Site Management Plans for Ocean Dredged Material Disposal Sites. February 1996.

EPA and Corps. 2004. Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters. Prepared by USEPA Region 1, New England, Boston, MA and the U.S. Army Corps of Engineers, New England District, Concord, MA.

EPA. 2004. Public Draft Environmental Impact Statement, Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Prepared by USEPA Region 1, New England, Boston, MA; the U.S. Army Corps of Engineers, New England District, Concord, MA; and Battelle. April 2004.

FDA. 1989. Compliance Policy Guide-Section 575.100: Pesticide Residues in Food and Feed-Enforcement Criteria (CPG 7141.01) [Online]. Available http://www.fda.gov/ora/compliance_ref/cpg/cpgfod/cpg575-100.html

Fogarty, M.J. 1979. Assessment of the ocean quahog, *Arctica islandica*, resource in Rhode Island Sound and south of Martha's Vineyard, MA. RIDEM, Division of Fisheries and Wildlife.

Germano, J.D., J. Parker, and R.W. Williams. 1993. Monitoring Cruise at the Western Long Island Sound Disposal Site, July 1990. DAMOS Contribution No. 85. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 67 pp.

Germano, J.D., D.C. Rhoads, and J.D. Lunz. 1994. An Integrated, Tiered Approach to Monitoring and Management of Dredged Material Disposal Sites in the New England Region. DAMOS Contribution No. 87. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 81 pp.

Morris, J.T. 1998. Monitoring Cruise at the Western Long Island Sound Disposal Site, July 1996. DAMOS Contribution 119. U.S. Army Corps of Engineers, New England District, Concord, MA.

Morton, R.W. 1980a. "Capping" Procedures as an Alternative Technique to Isolate Contaminated Dredge Material in the Marine Environment. DAMOS Contribution No. 11. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 26 pp.

Morton, R.W. 1980b. Management and Monitoring of Dredge Spoil Disposal and Capping Procedures in Central Long Island Sound. DAMOS Contribution No. 8. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 56 pp.

Morton, R.W., L.L. Stewart, and G.D. Paquette. 1982. Baseline Survey of the Proposed WLIS III Dredged Material Disposal Site, January, 1982. DAMOS Contribution No. 19. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Morton, R.W. and L.L. Stewart. 1982. Interim Survey of Western Long Island Sound III Disposal Site. DAMOS Contribution No. 18. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 21 pp.

Morton, R.W., J.H. Parker, and W.H. Richmond (Eds.). 1984. Disposal Area Monitoring System (DAMOS) Annual Report, Summary of Program Results, 1981-1984. DAMOS Contribution No. 46. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Morton, R.W. and G.D. Paquette. 1983. Summary of Measurements made at the WLIS III Disposal Site. DAMOS Contribution No. 27. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 60 pp.

Murray, P.M. and H.L. Saffert. 1999. Monitoring Cruises at the Western Long Island Sound Disposal Site, September 1997 and March 1998. Contribution No. 125 (SAIC Report No. 441). Disposal Area Monitoring System (DAMOS) Report. U.S. Army Corps of Engineers, New England District, Concord, MA.

NMFS (National Marine Fisheries Service). 2002. Letter to U.S. Army Corps of Engineers regarding federally listed threatened or endangered species. December 31, 2002.

NRC (National Research Council). 1990. Managing Troubled Waters. Washington, D.C., National Academy Press. 125 p.

Pilson, M.E.Q. and C.D. Hunt. 1989. Water Quality Survey of Narragansett Bay, A Summary of Results from SINBADD 1985-1986. Technical Report No. NBP-89-22. Prepared for RIDEM. Providence, RI.

Pratt, S.D., S.B. Saila and M.P. Sissenwine. 1973. Study and Report on Environmental Effects of Dredged Material Rhode Island Sound – Phase III. SR-3. University of Rhode Island, Kingston, RI.

Pratt, S.D. and R.M. Heavers. 1975. Background Turbidity Conditions of Rhode Island Sound and Buzzards Bay. Report No. SR-5 Marine Experiment Station, Graduate School of Oceanography, University of Rhode Island.

RIDEM. 2000. State of Rhode Island and Providence Plantations Department of Environmental Management Water Quality Regulation: Regulation EVM 112-88.97-1, Amended June 23, 2000. 34 pp.

Rhoads, D.C. 1994. Analysis of the Contribution of Dredged Material to Sediment and Contaminant Fluxes in Long Island Sound. DAMOS Contribution No. 88. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 32 pp.

Rhoads, D.C. and J.D. Germano. 1982. Characterization of organism-sediment relations using sediment profile imaging: An efficient method of Remote Ecological Monitoring of The Seafloor (REMOTS® System). Mar. Ecol. Prog. Ser. 8:115-128.

SAIC. 1980. Stamford-New Haven Disposal Operation Monitoring Survey Report. DAMOS Contribution No. 7. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 41 pp.

SAIC. 1982. Disposal Area Monitoring System Annual Report, 1980 Volume I: Physical Measurements, Volume II: Biological Observations, Volume III: Visual Observations. DAMOS Contribution No. 17. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

SAIC. 1985. Standard Operating Procedure Manual for DAMOS Monitoring Activities, Volume I and Volume II. DAMOS Contribution No. 48. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

SAIC. 1987. Monitoring Surveys at the Western Long Island Sound Disposal Site August and October 1985. DAMOS Contribution No. 55. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 45 pp.

SAIC. 1988. Seasonal Monitoring Cruise at the Western Long Island Sound Disposal Site, August 1986. DAMOS Contribution No. 61. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 20 pp.

SAIC. 1990a. Monitoring Cruise at the Western Long Island Sound Disposal Site, July 1988. DAMOS Contribution No. 76. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 68 pp.

SAIC. 1990b. Monitoring Cruise at the Western Long Island Sound Disposal Site, November 1987. DAMOS Contribution No. 74. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 90 pp.

SAIC. 1995. Sediment Capping of Subaqueous Dredged Material Disposal Mounds: An Overview of the New England Experience 1979-1993. DAMOS Contribution No. 95. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 101 pp.

SAIC. 2002a. Monitoring Cruise at the Western Long Island Sound Disposal Site, June 2001. DAMOS Contribution 138. U.S. Army Corps of Engineers, New England District, Concord, MA.

SAIC. 2002b. Central Long Island Sound Disposal Site Synthesis, 1999-2000. DAMOS Contribution 139. U.S. Army Corps of Engineers, New England District, Concord, MA.

Saila, S.B., T.T. Polgar, and B.A. Rogers. 1969. Results of Studies Related to Dredged Sediment Dumping in Rhode Island Sound: Phase I. Report No. SR-1. 36 pp.

Scott, K.J. and G.D. Paquette. 1983. Post Disposal Survey of the WLIS III Disposal Site, August-September, 1983. DAMOS Contribution No. 35. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 46 pp.

Scott, K.J., G.D. Paquette, D.C. Rhoads, and J.D. Germano. 1984. Baseline and Post Disposal Surveys at the WLIS III "B" Disposal Site. DAMOS Contribution No. 44. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 40 pp.

USFWS (U.S. Fish and Wildlife Service). 2003. Letter to U.S. Army Corps of Engineers regarding federally listed threatened or endangered species. January 10, 2003.

Wiley, M.B. 1994. DAMOS Capping Model Verification. DAMOS Contribution No. 89. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 45 pp.

Wiley, M.B. 1995. Deep Water Capping. DAMOS Contribution No. 98. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 35 pp.

Wiley, M.B. and J.B. Charles. 1995. Monitoring Cruise at the Massachusetts Bay Disposal Site, March 31-April 4, 1992. DAMOS Contribution No. 100. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 23 pp.

Wiley, M.B., J. Charles, C. Eller, and R. Williams. 1996. DAMOS Summary Report, 1985-1990. DAMOS Contribution No. 109. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 117 pp.

Williams, R.W. 1995. Monitoring Cruise at the Western Long Island Sound Disposal Site, July 1991. DAMOS Contribution No. 99. U.S. Army Corps of Engineers, New England Division, Waltham, MA, 45 pp.

Attachment A

Hypotheses Flowcharts and Summary Table

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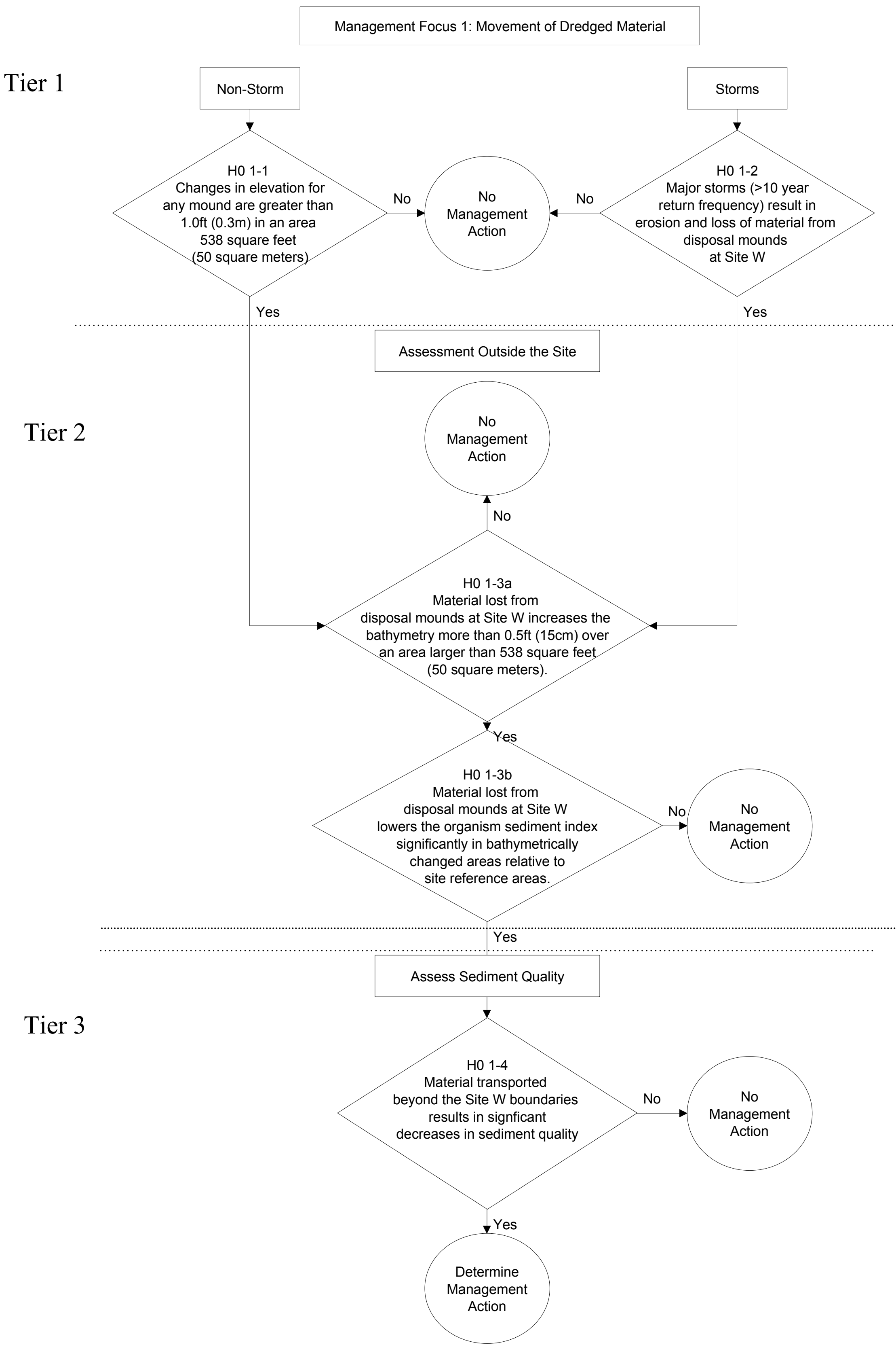
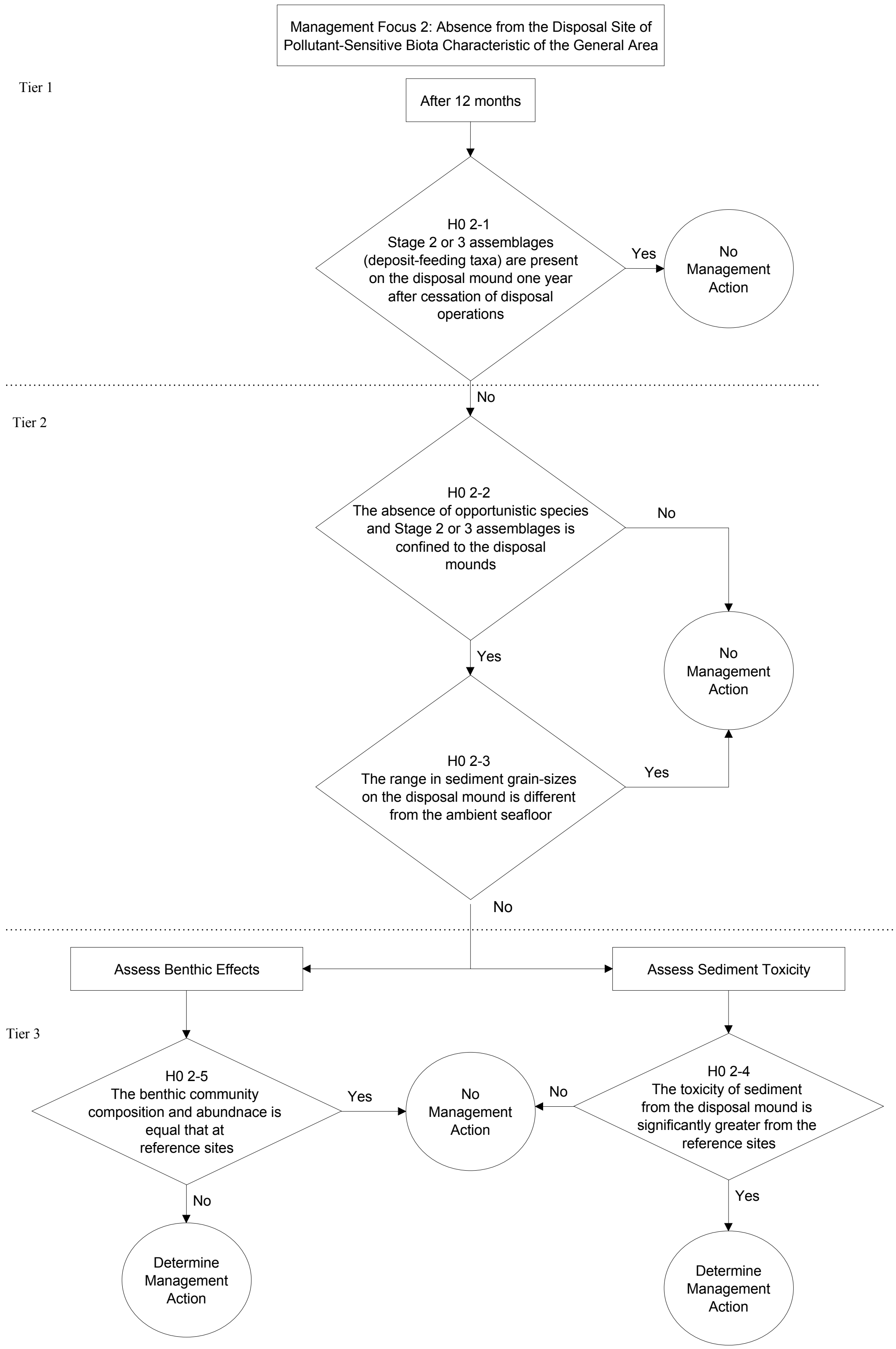
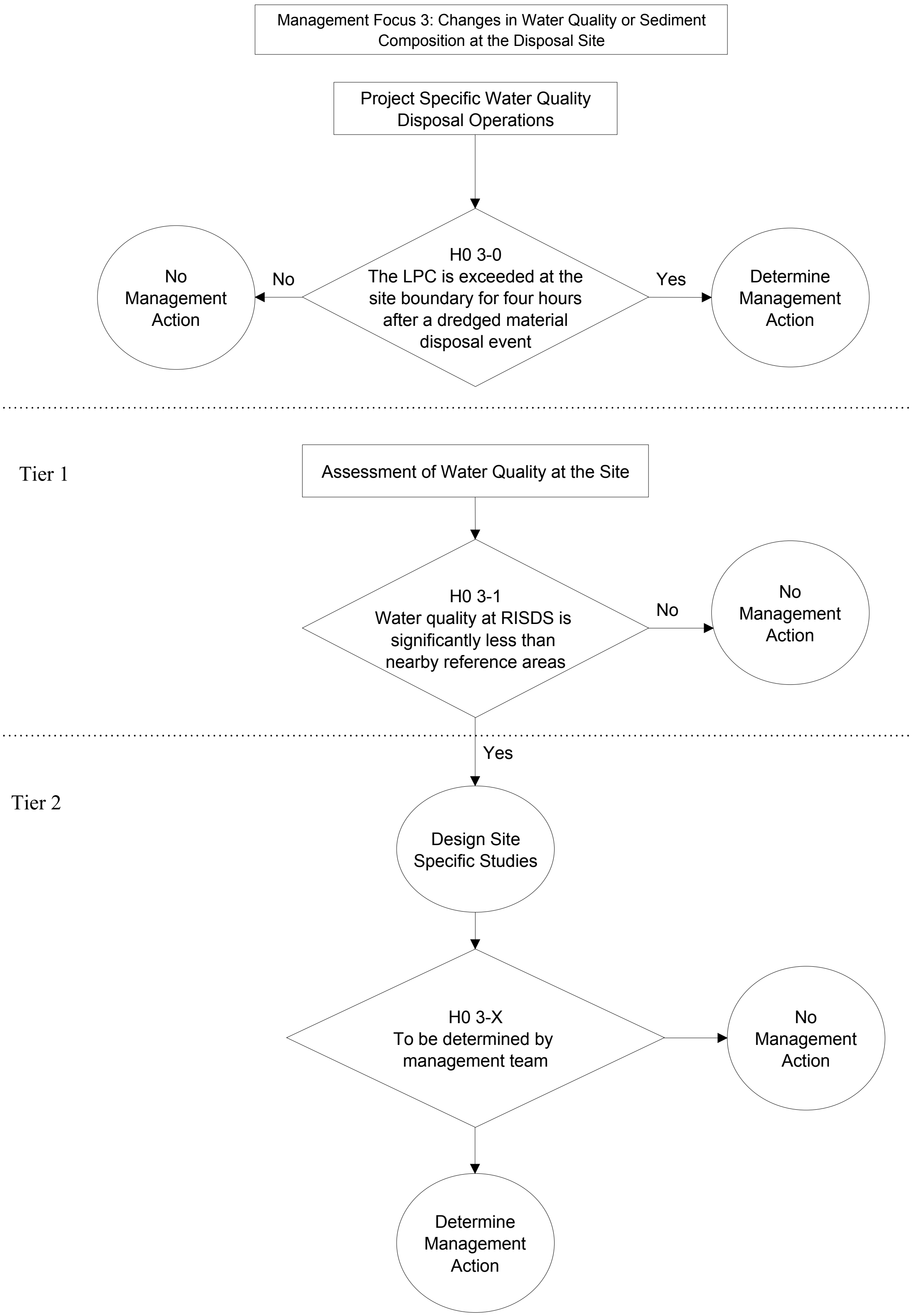
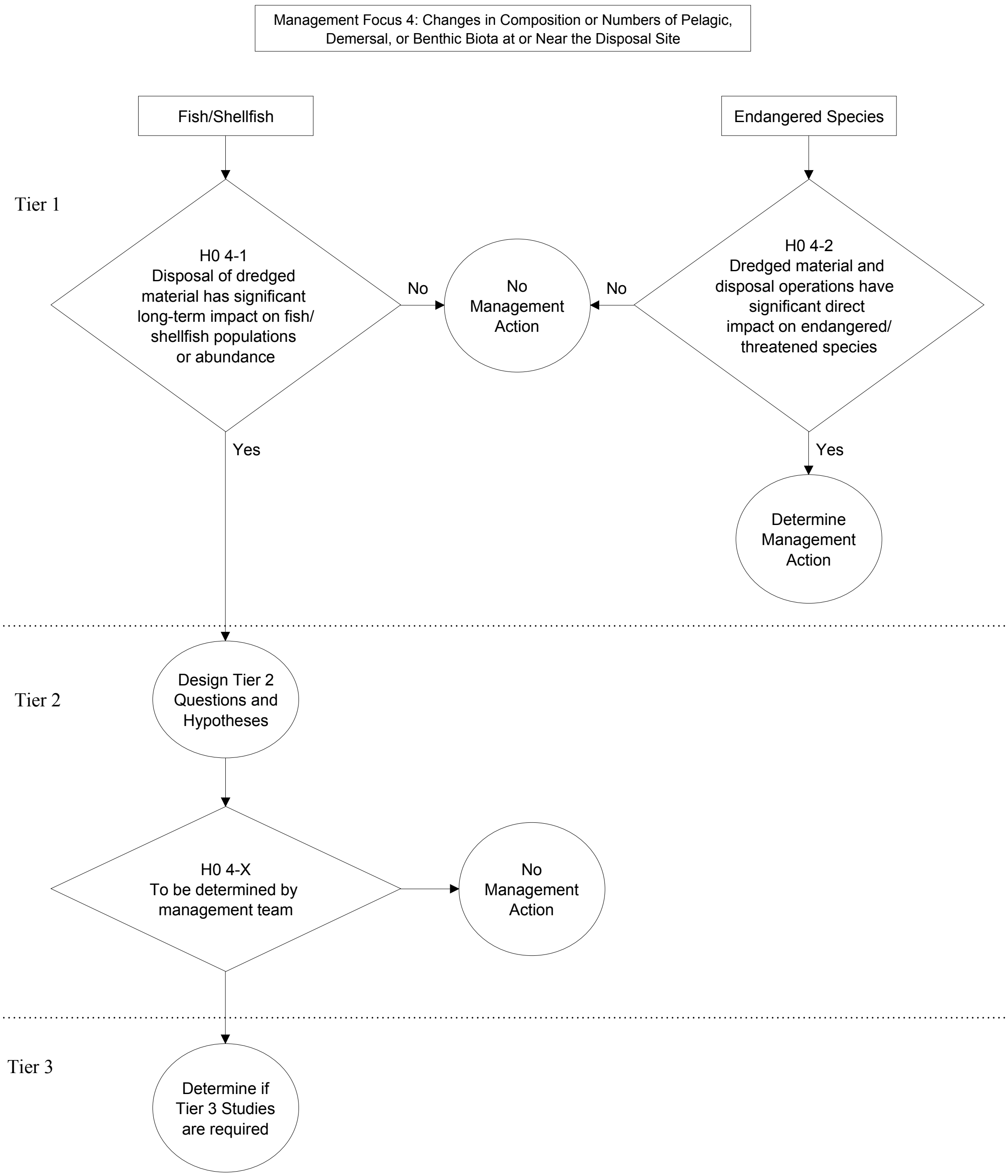
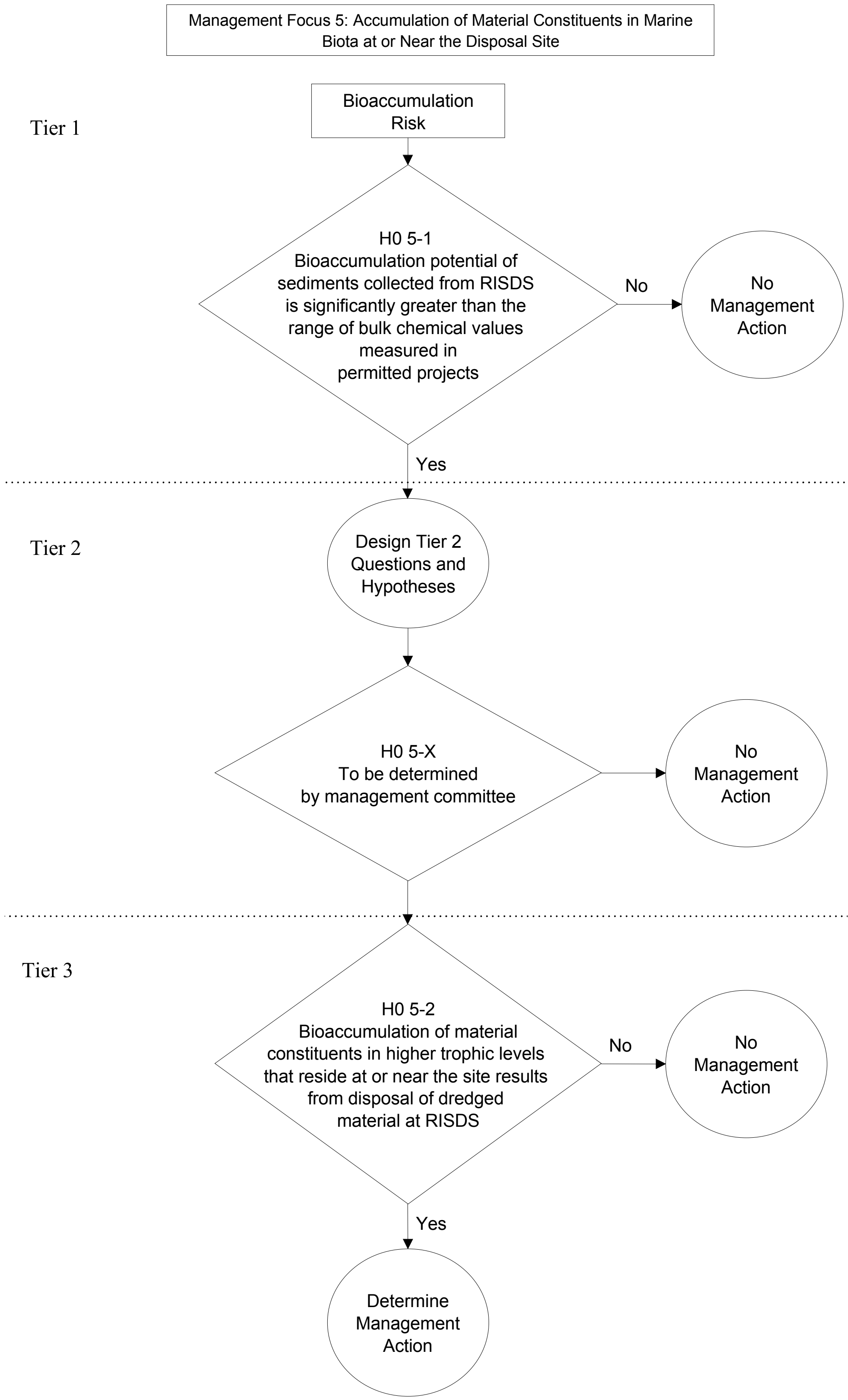

Management Focus 1: Movement of Dredged Material
Tier 1
Non-Storm
Storms
H0 1-1
Changes in elevation for any mound are greater than 1.0ft (0.3m) in an area 538 square feet (50 square meters)
No
No Management Action
No
H0 1-2
Major storms (>10 year return frequency) result in erosion and loss of material from disposal mounds at Site W
Yes
Yes
Assessment Outside the Site
Tier 2
No Management Action
No
H0 1-3a
Material lost from disposal mounds at Site W increases the bathymetry more than 0.5ft (15cm) over an area larger than 538 square feet (50 square meters).
Yes
H0 1-3b
Material lost from disposal mounds at Site W lowers the organism sediment index significantly in bathymetrically changed areas relative to site reference areas.
No
No Management Action
Yes
Assess Sediment Quality
Tier 3
H0 1-4
Material transported beyond the Site W boundaries results in signficant decreases in sediment quality
No
No Management Action
Yes
Determine Management Action


Management Focus 2: Absence from the Disposal Site of Pollutant-Sensitive Biota Characteristic of the General Area
Tier 1
After 12 months
H0 2-1
Stage 2 or 3 assemblages (deposit-feeding taxa) are present on the disposal mound one year after cessation of disposal operations
Yes
No Management Action
No
Tier 2
H0 2-2
The absence of opportunistic species and Stage 2 or 3 assemblages is confined to the disposal mounds
No
Yes
No Management Action
H0 2-3
The range in sediment grain-sizes on the disposal mound is different from the ambient seafloor
Yes
No
Assess Benthic Effects
Assess Sediment Toxicity
Tier 3
H0 2-5
The benthic community composition and abundnace is equal that at reference sites
Yes
No Management Action
No
H0 2-4
The toxicity of sediment from the disposal mound is significantly greater from the reference sites
No
Yes
Determine Management Action
Determine Management Action


Management Focus 3: Changes in Water Quality or Sediment Composition at the Disposal Site
Project Specific Water Quality Disposal Operations
H0 3-0
The LPC is exceeded at the site boundary for four hours after a dredged material disposal event
No
No Management Action
Yes
Determine Management Action
Tier 1
Assessment of Water Quality at the Site
H0 3-1
Water quality at RISDS is significantly less than nearby reference areas
No
No Management Action
Yes
Tier 2
Design Site Specific Studies
H0 3-X
To be determined by management team
No Management Action
Determine Management Action


Management Focus 4: Changes in Composition or Numbers of Pelagic, Demersal, or Benthic Biota at or Near the Disposal Site
Fish/Shellfish
Endangered Species
Tier 1
H0 4-1
Disposal of dredged material has significant long-term impact on fish/ shellfish populations or abundance
No
No Management Action
No
H0 4-2
Dredged material and disposal operations have significant direct impact on endangered/ threatened species
Yes
Yes
Determine Management Action
Tier 2
Design Tier 2 Questions and Hypotheses
H0 4-X
To be determined by management team
No Management Action
Tier 3
Determine if Tier 3 Studies are required


Management Focus 5: Accumulation of Material Constituents in Marine Biota at or Near the Disposal Site
Tier 1
Bioaccumulation Risk
H0 5-1 Bioaccumulation potential of sediments collected from RISDS is significantly greater than the range of bulk chemical values measured in permitted projects
No
No Management Action
Yes
Tier 2
Design Tier 2 Questions and Hypotheses
H0 5-X To be determined by management committee
No Management Action
Tier 3
H0 5-2 Bioaccumulation of material constituents in higher trophic levels that reside at or near the site results from disposal of dredged material at RISDS
No
No Management Action
Yes
Determine Management Action

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Attachment B

Scow Log Sample

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INSPECTOR'S DAILY REPORT OF DISPOSAL BY SCOW

NOTE: Dredged material volume stated below is approximate and shall not be used for measurement and/or payment.

Permittee ______________________ Disposal Area ______________________
Permit/Contract No. ______________________ Date ______________________
Project ______________________ Towboat ______________________
Dredging Contractor ______________________ Owner ______________________

Trip No.	Scow No.	Started From Place	Started From Time	Disposal Time	Returned To Place	Returned To Time	Round Trip Time	Trip Dist.	Lat/Long Coordinates* Specified	Lat/Long Coordinates* Actual	Dist./Dir. From Buoy

Trip No.	No. of Pockets Loaded	No. of Pockets Dumped	Reason Pocket Not Dumped	Disposal Depth	Disposal Speed	Weather	Sea Conditions/ Visibility	Approx. Volume (CY)	Scow Draft

Comments:

*Check the datum used ___NAD27 ___NAD83. Also note any factors that may affect reliability of navigation instrument and readouts.

Time On	Time Off	Hours On Duty
Total Hours On Duty		

Reviewed By: Permittee's Representative or, for Corps Projects, Corps' Resident Engineer or Field Inspector

To the District Engineer, U.S. Army Engineer District, New England, Concord, Massachusetts:
I certify that I informed the tug captain of the conditions of the U..S. Army Corps of Engineers permit or contract regarding the distance from the buoy and the speed of the scow during the release of the dredged material. I also informed the captain that failure to comply with these conditions would constitute a violation of the permit and would be reported to the Corps. I certify that this report is correct and that I am not an employee of the dredging or towing firm, or the permittee, nor have I been employed by any of them at any time during the past six months. The approximate volume of dredged material stated on this report is only an estimate. It was made either by me, the dredging or towing contractor, or the Corps of Engineers Resident Engineer of Field Inspector. I do not certify that it correctly states the volume of material dredged.

______________________ ______________________
Signature of Disposal Inspector (Certification No.)

Print Name Here ______________________

R:\complnce\marie\2002scowrprt.doc Revised June 2002. Previous versions are obsolete and shall not be used.

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APPENDIX D

RESPONSE TO COMMENTS
ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT

RHODE ISLAND REGION LONG-TERM DREDGED MATERIAL DISPOSAL SITE EVALUATION PROJECT

FINAL ENVIRONMENTAL IMPACT STATEMENT

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Table 1. Comment Letters and Public Hearing Comments on the DEIS for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. 1

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) and the Corps of Engineers (Corps) completed a Draft Environmental Impact Statement (DEIS) evaluating the designation of one or more long-term ocean dredged material disposal sites in waters offshore of Rhode Island in April 2004. Written comments on the DEIS were solicited by the EPA and accepted until June 21, 2004. Two public hearings were held, to solicit comments on the DEIS, on June 15, 2004 at the Lighthouse Inn of Galilee in Narragansett, RI. Hearing proceedings were recorded by Justice Hill Reporting (Sterling, Massachusetts).

A total of seven commenters responded during the DEIS review period. The comment letters, e-mails, and the public hearing transcripts were reviewed by the project team. Comments within each document were identified, given a unique code and number, marked, and grouped according to the content of the comment. Each comment letter was given a code based on the author's last name (Table 1). Public hearing comments were given a code beginning with "PH", followed by the commenter's last name (e.g., PH-BROWN). The specific comments identified within each letter and from the public hearing transcript have been marked with a line (e.g., | placed in the margin of the document) and assigned a sequential number. After reviewing the comments, EPA and the Corps developed responses to each group of comments. The following document lists the responses to comments received. Copies of the original comment letters and public hearing transcript are included in Section 3 and can be located using the page numbers listed in Table 1.

Table 1. Comment Letters and Public Hearing Comments on the DEIS for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project.

Name	Affiliation	Letter Code	Page Number
Christopher Brown	Rhode Island Commercial Fishermen's Association	PH-BROWN	55
Bruce Knight	F/V Catherine and Gloria	PH-KNIGHT	53 – 54
Vernon Lang	U.S. Fish and Wildlife Service	LANG	8 – 11
Gregory Norris	Nautical Data Branch, NOAA	NORRIS	12
Donald Pryor	Brown University	PRYOR	13
Robert Shields	Friends of Oceanography	PH-SHIELDS	54
John Torgan	Save the Bay	PH-TORGAN	41 – 42

2.0 RESPONSES

Comments LANG-1, LANG-3, LANG-7, and PH-KNIGHT-2: The commenters felt that the designation of a long-term disposal site (Site W, which is also the selected Site 69B) was premature when the currently selected site (Site 69B) would remain in effect until 2013. They also stated that a long-term site should not be designated until the short- and long-term effects of current disposal at Site 69B were monitored to determine if they are fully compatible and consistent with the general and specific criteria of the applicable statutes and regulations, including 228.10(a). Specifically, Mr. Lang noted as examples on page 3-76 of the DEIS, that drift of dredge material to the north and west of Site W has been detected. He also noted that on page 3-69 the recovery or healing process for Site 16 (former Brenton Reef dredged material disposal site) to become similar with natural background conditions took about 30 years.

This project was initiated at the written request on the Governor of Rhode Island in September 2000. There was a concern that the navigational needs of the region were not being met due to the lack of viable disposal options. In addition, there was also a concern that additional disposal sites, other than Site 69B, could be selected for disposal of dredged material. There are several advantages, including environmental reasons, to a designated long-term disposal site, rather than a selected site (i.e., the current Site 69B). As described on pages 1-12 and 1-13 of the DEIS, the site designation process evaluates the cumulative impacts of placing dredged material from the RIR at the proposed site. In contrast, the site selection process requires only project-specific and individual action review of the environmental consequences at the disposal site associated with its use and not an evaluation of cumulative impacts of all potential projects. An EPA-designated site must also have a Site Monitoring and Management Plan (SMMP), whereas a selected site is not required to have an SMMP. Moreover, the EPA designation process evaluates dredging needs over long planning horizons, while the site selection process evaluates each proposed dredging project on a project-specific basis. The DEIS concludes that designating a single long-term site would limit the ocean floor footprint that would be disturbed, whereas having additional sites selected would potentially impact more of the ocean bottom.

EPA agrees that monitoring of the site is important. EPA and the Corps are currently conducting monitoring at Site 69B[1], and any post-disposal data collected to date has been incorporated into the Final EIS (FEIS). Monitoring conducted to date indicates that no significant impacts have occurred due to disposal activities at the site.

In response to Mr. Lang's specific comments, page 3-76 of the DEIS does state that sediments collected north and west of Site W in 2003 had a much higher fine fraction. Extensive surveys by EPA and the Corps in the summer of 2003 did not find a general movement or drift of dredged material into this area. However, there is no indication at this time that this difference is significant or negative. The evaluation of benthic recovery at Site 16 presented in the DEIS is an estimation of the recovery of the area 30 years after disposal ceased. Post-disposal monitoring was conducted for the first time at Site 16 in 2001. The site may have recovered before then,

[1] Corps. 2004. Monitoring Surveys of the Rhode Island Sound Disposal Site Summer 2003. Contribution 155. Disposal Area Monitoring System (DAMOS) Report. 81 pp. August 2004.

but, as stated on p 3-69, "the time scale cannot be defined adequately" because of a lack of monitoring data during that time.

Comment LANG-2: "The issue of sediment compatibility at Site 69B, now Site W, was raised by the Service late in the FEIS process for the Providence Harbor Dredging Project. Consequently, the issue did not receive a lengthy study and evaluation phase prior to the Corps Record of Decision. The following paragraphs from our March 30, and September 19, 2001 letters describe the issues involved..."

As the commenter indicates, the subject of sediment compatibility at Site 69B was a project-specific comment that was submitted in response to the U.S. Fish and Wildlife Service's review of the Providence River and Harbor Maintenance Dredging Project EIS. Additional information was not provided by the commenter to assist us in determining what the commenter was referring to with regards to sediment compatibility concerning the DEIS for the Rhode Island Region (RIR) Long-Term Dredged Material Disposal Site Evaluation Project. We assumed that the concern was whether an evaluation of the potential impact of dredged material with different physical characteristics was made as part of this project. The RIR EIS did evaluate all types of dredged material that could potentially be disposed of at the proposed site and analyzed their potential impact to fish and shellfish resources in the area. This analysis showed no significant adverse impacts to biological resources through the disposal of dredged material from the RIR (see Section 4.3 in the FEIS).

Comments LANG-4 and LANG-6: The commenter stated that the present DEIS relies extensively on outdated baseline data used by the Corps to designate Site 69B as opposed to baseline surveys that specifically address the needs in 228.2(b), 228.6(a)(9), 228.9, 228.10, and 228.13.

The commenter incorrectly assumed that this DEIS relied on surveys conducted as part of the Providence River and Harbor Maintenance Dredging Project EIS and that no other surveys were conducted. The DEIS contains references and information from numerous baseline studies that were conducted in 2001 – 2003 in support of the RIR EIS. These surveys included: bathymetry, physical oceanography, water quality, side scan sonar, sediment profile imaging, benthic infauna, sediment chemistry, finfish trawls and chemistry, lobster trawls and chemistry, and shellfish tows and chemistry. A complete listing of surveys conducted is provided in Section 9 of the DEIS. Information from these surveys is used and referenced throughout Sections 3 and 4 of the DEIS to establish a baseline for assessing potential environmental impacts. Survey plans, survey reports, and data reports were prepared for each of the baseline surveys and approved by EPA and the Corps. As part of the public review process, these data reports were also made available to the public at two repositories and were posted on the project web page (http://www.epa.gov/ne/eco/ridredge/index.html). The availability of this information was published in the Project Public Notice of Availability.

Comment LANG-5: "On page 4-1, Section 4.0, of the DEIS, a statement is made that monitoring requirements pursuant to 40 CFR 228.10 are not required for the site designation process. However, in Section 4.1, also on page 4-1, the first sentence states that dredge material disposal at designated sites must be evaluated periodically as required by 40 CFR 228.10. These statements

seem to be inconsistent, and particularly so in the present situation where disposal has occurred and a new designation is proposed."

Page 4-1, Section 4.0, states that the criteria in 40 CFR Section 228.10 to identify impacts during and after disposal are not part of the designation process; not that monitoring is not required. Site monitoring is required after the site designation process has occurred and a site has been designated. The language in Section 4.0 of the FEIS will be clarified to make this distinction.

Comment NORRIS-1: "Two of the four geographic coordinates provided in the proposed rule for the RISDS (published in the Federal Register) appear to be out of sequence. In order to plot as a square, coordinate #3 and coordinate #4 should be transposed for the final rule. Unchanged, the current sequence of coordinates will produce an odd "Z-shaped" linear figure."

The four geographic coordinates provided in the proposed rule were listed to mark the four corners of the RISDS, in no particular order. The final rule will be changed to list the coordinates in a clockwise rotation, starting with the northwest corner. The sentence in the final rule will be changed to read: "The coordinates (North American Datum 1983: NAD 83) for the proposed RISDS site, clockwise from the northwest corner, are as follows: 41°14'21. N, 71°23'29. W; 41°14'21. N, 71°22'09. W; 41°13'21. N, 71°22'09. W; 41°13'21. N, 71°23'29.W."

Comment PRYOR-1: "The Proposed Rulemaking indicates that there is to be no disposal site capacity volume restriction (p. 20 under specific criteria #4). Clearly the analysis in the DEIS and supporting materials does not support this. The rulemaking should limit capacity to 8.8 MCY or less. If additional demands should arise (such as an additional large project similar to Quonset or aggregate demand greater than expected), another analysis of disposal sites should be conducted as well as analysis of dredging needs and cumulative impacts."

The analysis in the DEIS calculated that the preferred alternative has an estimated physical consolidated capacity of ~20 MCY[2]. The evaluation of impacts conducted in the DEIS was performed assuming that up to 20 MCY would be disposed of at the proposed site. The current disposal from the Providence River and Harbor Maintenance dredging project (~5.5 MCY) was also taken into consideration. The estimated dredging need, based on the responses to the dredging needs survey, is 8.8 MCY, with a likelihood of additional needs in the future. The capacity of the disposal site should not be limited to the current estimate of dredging needs.

The following sentence will be added to the final rule: "The estimated capacity of the site, as designated by the specified boundaries, is ~20 million cubic yards."

Comment PH-TORGAN-1: The reviewer commented that the dredging needs survey in the purpose and needs section is different from the one that appears in the DEIS, and that the dredging need survey volumes should be updated for the purposes of this project (i.e., exclude the Quonset container port project, which is no longer being pursued as an EIS and the Providence River and Harbor Maintenance Dredging Project, which is underway and near completion).

---

[2] Mound capacity was calculated as the volume between the seafloor and 105-ft depth, assuming a rectangular mound and a shoulder slope of 1:20.

The dredging needs in the purpose and needs section and in the DEIS are consistent. Quonset is not included in the 8.8 MCY dredging needs estimate. Table 1-1 in FEIS will be modified for clarity by removing Quonset from the table and adding it as a footnote. Though the existing Providence River maintenance dredging volumes are not included in RIR dredging needs estimate, future Providence River maintenance dredging is included in the 20-year estimate.

Comment PH-TORGAN-2: "…I appreciate the efforts of EPA and the Corps and the cooperating agencies to keep Save the Bay, the organization I'm representing, apprised of this project; participated in the working group; and it has been my impression that the public process on this has been inclusive and complete; that the scientific basis for these determinations has been thorough and professional, and we felt that we have had our comments adequately considered throughout the process; and that the science is, what we have seen so far, fundamentally sound."

The project team appreciates your comment.

Comment PH-TORGAN-3: The commenter stated that Save the Bay have not received any comments from their membership or public around Narragansett Bay about this EIS or these proceedings. The only calls he has received were from residents in Block Island and representatives of municipal organizations on Block Island. The commenter suggested contacting and soliciting input and comments from the Town of New Shoreham. He wanted to be sure that the affected parties have the opportunity to provide input into this process; and that if an adequate number of comments were not received, he suggested extending the public comment period or holding an additional hearing.

The project team made every effort to make this an open public process. We officially started the process with a notice in the Federal Register and Scoping Meetings held in Westport, MA, Narragansett, RI in 2001. Between August 2001 and January 2002, three meetings were held with fishermen from the region to specifically address concerns of the fishing and lobster industry. Based on the issues and concerns identified a the scoping and fishermen meetings, a series of seven Working Group meetings were conducted at the University of Rhode Island (URI) Coastal Institute (CI) between September 2002 and November 2003. Complete meeting minutes were posted on the CI web site (www.ci.uri.edu/projects/dd). The public involvement process is described in detail in Section 7 of the DEIS.

At each meeting, sign-in sheets were distributed to collect the names and addresses of those in attendance. All attendees were added to the project mailing list so that they could be provided future project information. All libraries located in a coastal community in the State of Rhode Island, including the Island Free Library on Block Island, received a copy of the DEIS, along with the Public Notice of Availability and the draft Rulemaking. Notices of Public Availability of the DEIS were mailed to each person on the project mailing list, including the town hall and the harbor master of New Shoreham. In addition, the DEIS, as well as reports of various surveys, investigations, and analyses, was posted on the project website (http://www.epa.gov/ne/eco/ridredge/index.html), which was published in local papers. Newspaper ads were also placed in area papers announcing the RIR public hearings.

Comment PH-TORGAN-4: The reviewer expressed concern related to how the designation of a long-term ocean disposal site could impact the dredging policy and process in the State of Rhode Island. For example, he stated that designation of an inwater disposal site for a long-term basis may remove some of the incentive for private or public applicants to consider beneficial use of dredged material, or it may erode the feasibility of beneficial use options. He noted that this DEIS did not consider beneficial use as an alternative, given the volume of the survey. His other concern was that projects that may not ordinarily be able to consider open water disposal as a feasible option will now be able to do so and some of the incentive to think of more creative and conservative strategies for dredging management may be removed.

The designation of a long-term ocean disposal site only gives the project proponents one among several disposal options for consideration in the project analysis. State of Rhode Island regulations require an analysis of all available disposal options be made in determining the preferred disposal alternative, with beneficial use as the most preferred alternative. If disposal does occur at an open ocean site, MPRSA regulations must be followed. These regulations and the Corps' policy also require an analysis of all available options and encourage beneficial use as the preferred solution.

Comment PH-KNIGHT-1: "As a representative of the Rhode Island Commercial Fishermen's Association, I went to the first public hearing at CCRI's Knight Campus to request an additional public hearing in the South County area. I read a statement and brought a petition for additional public hearings with over 100 signatures. Our request for a second public hearing was granted and held on September 26th, at URI Bay campus. Six members of the RICFA read statements about our concerns of using 69B as the Providence River dump site. We were promised written answers to our concerns in one month. We have received the Corps of Engineers response to comments in June 2002. We were basically told our concerns had no merit. 69B, as the Providence River dump site, was a done deal."

Mr. Knight's comment pertains to the Providence River and Harbor Maintenance Dredging Project process and is not relevant to this project.

Comment PH-KNIGHT-3: "I represented the RICFA at the Rhode Island DOT's public hearing for the disposal of the Jamestown Bridge debris. I negotiated successfully the steel to be recycled and three inshore sites to be taken off the table. The Black Point site was in trap waters and a dragging area. That left two dump sites, 69A and Block Island Sound. The DOT refused to take Block Island Sound off the table, even though it was in a drag bottom and a major area of income for the fleet. I told the DOT time after time that Rhode Island was blessed with a tremendous amount of natural underwater structure, and there was no need for artificial reefs. In December 2003, I thought we had an agreement with the DOT that 69A and the gravel berm on the north and west side of 69B would be used as the disposal site. This fell through when the Army Corps of Engineers decided that one site was ocean disposal and not ocean reef."

The discussion does not relate to the designation of disposal sites or the actions of this project.

Comment PH-KNIGHT-4: "As I thought of my statement for this public hearing on a choice of site W or E, I thought keeping it simple and just endorsing Site W. Well, that would make me an advocate of something I fought tooth and nail against just three years ago. The manipulations of the Army Corps of Engineers has been a wonder to see. When something sinks beneath the surface of

the water, it is out of sight and out of mind. We sit here now, June 2004, with one active dump site, 69B, or Site W. Two dump sites to go active in 2005, 69A, and an inshore site to be named, and the possibility of Site E becoming the long-term dump site. Amazing. The first week of June 2004 saw a meeting between the Army Corps of Engineers, DEM, CRMC and the DOT on a suitable inshore site for the Jamestown Bridge debris. This was a meeting even the RIDOT admitted should have occurred two years ago. The arrogance and ruthlessness of the Army corps of Engineers was something to behold. I suspect the trouble the Army Corps of Engineers has had in courts throughout the United States comes from this attitude. Personally, I hope this will put my -- an end to my dealings with the Army Corps of Engineers. It's nothing pleasant."

The DEIS has identified the designation of one disposal site, Site W, as the preferred alternative. The DEIS does not include nor recommend designation of additional sites inshore or offshore.

Comment PH-SHIELDS-1: The commenter expressed his concern that the designation of a long-term ocean disposal site would enable the transport of large liquefied natural gas (LNG) tankers into urban areas where existing or proposed LNG plants are located, including Providence, Fall River, and Brayton Point.

Designation of an ocean disposal site is not related to the transport of LNG tankers described by the commenter. A designated long-term ocean disposal site would provide a disposal option for any material dredged to allow the movement of LNG tankers. However, development of LNG tankers would require a NEPA document that evaluates potential impacts and would require its own series of permits.

Comment PH-BROWN-1: "I would like to take a minute and express that the entire commercial industry in the State of Rhode Island is pretty much opposed to the expansionist tactics employed by the Army Corps into making Rhode Island not the Ocean State any longer, but maybe the ocean dump site state. It seems the potential for huge tracks of our now currently healthy environment to turn into wasteland, and hopefully, you know, they will come around and benefit the next generation of people who use the ocean to make a living maybe 20 or 30 years down the road. It's an awful gamble. We don't care for it."

EPA acknowledges receipt of your comment.

Comment PH-BROWN-2: "And as far as our exclusion from determining the dump Site E goes, I would like to point out that at no point in time were we, as an organization, myself as a 30-year commercial fisherman, having made roughly 30,000 sets with my net within 10 miles of Block Island, ever one time consulted with regards to the development of a site in an area in which I make my living. The standards that we, as commercial fishermen, today are held to with regard to respect for the environment and ecosystem destruction and all the likes is -- is pretty amazing that the same government that is sponsoring this kind of activity is holding my feet to the fire as hard and close as they are. It's -- it's amazing."

As part of the public process, three meetings were held with fishermen from the region between August 2001 and January 2002 to specifically address concerns of the fishing and lobster industry (see Section 7.1.2 of the FEIS). Representatives of the Rhode Island Commercial Fishermen's Association participated in these meetings, as well as the scoping and Working

Group meetings that were conducted as part of the project. Information gathered at the Working Group and fishermen meetings were used to identify evaluation factors and fishing areas that were considered in the initial screening process, which identified Site W and Site E as potential disposal sites. The DEIS evaluated both sites and their potential impacts, and recommends only Site W as the preferred alternative. The DEIS does not include nor recommend designation of additional sites inshore or offshore.

3.0 ORIGINAL COMMENT LETTERS RECEIVED AND PUBLIC HEARING TRANSCRIPTS

LANG

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

June 17, 2004

Ms. Olga Guza
U.S. Environmental Protection Agency
New England Region
One Congress St., Ste 1100, CWQ
Boston, MA 02114-2023

Dear Ms. Guza:

This is in response to the April 30, 2004 letter from Linda Murphy, Director, Office of Ecosystem Protection, requesting comments on the draft environmental statement and rule for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project.

The proposed action would essentially confer long-term dredged material disposal site status to Site 69B, designated in 2001 by the Corps as a short-term disposal site. At the time of this short-term designation, the Service raised a number of issues that we believe warranted further study and evaluation. These issues generally relate to project need, sediment compatibility, and baseline surveys.

In our view, the draft statement does not provide a convincing case for moving forward with long-term site designation when the short-term designation would remain in effect until 2013. 1
While project proponents may have a point about seizing upon the opportunity of the moment, the more rational, time-tested approach would be to carefully monitor Site 69B to determine if the short- and long-term effects of disposal are fully compatible and consistent with the general and specific criteria of the applicable statutes and regulations.

The issue of sediment compatibility at Site 69B, now Site W, was raised by the Service late in 2
the FEIS process for the Providence Harbor Dredging Project. Consequently, the issue did not receive a lengthy study and evaluation phase prior to the Corps Record of Decision. The following paragraphs from our March 30, and September 19, 2001 letters describe the issues involved:

Sediment Compatibility [March 30, 2001 letter]

A statement is made on page 4-140 that all open water disposal sites evaluated in the FEIS are compatible with the dredge material in the Providence River navigation channel. This line of reasoning is followed in Chapter 7 even though the information contained in the erosion testing reports and imported into Chapter 7 indicates that the Providence River maintenance dredge material is significantly different from other dredge materials studied by a number of researchers (pg. 7-9). The description of the dredge material on pg. 7-8 is a somewhat selective description, since it omits information on pages 1 and 2 of Chapter 6 in the draft report, Dredged Material Fate Modeling of Proposed Providence River Confined Aquatic Disposal (CAD) Cells and Ocean Dredged Material Disposal Site (ODMDS). On pages 1 and 2 of Chapter 6 in the above report, the material is described as follows: "The material has a high clay content and has a consistency more like a gelatinous ooze rather than a sandy material. Core samples taken at various locations in the proposed dredging area indicate a low bulk density (approximately 1.3 gm/cm^3) even at 1 meter below the sediment water interface. This lack of significant consolidation is indicative of a high clay content, which will retain a large amount of pore water." During our February 1, 2001 meeting, the author of Chapter 6 in the above report, Joseph Gailani, made the following comment about this highly unusual dredge material: "I could stick my arm into the sediments and when I removed my arm from the sediments, the shape of my arm indentation in the dredge material would remain for a few minutes while the sediments slowly flowed back together." 2 (cont.)

None of the sediments evaluated at any of the alternative open water disposal sites have been shown to have characteristics similar to those in the Providence River navigation channel. The cohesiveness; high water content; low bulk density; presence of smectite clays; resistance to consolidation; tendency for gel formation, e.g., gelatinous ooze; resistance to erosion; and perhaps other factors produce maintenance dredge sediments with unique characteristics. In particular, normal dredge materials have a critical sheer stress (e.g., a measure of the force required to erode or move sediments) of 1 pascal or less, while the critical sheer stress of the Providence River dredge material is significantly higher at 6 pascals indicating highly cohesive characteristics.

Compatibility issues at open water disposal sites could arise with benthic recolonization of the dredge material. It is noteworthy that the in situ samples up to 1 meter in depth from the Providence channel showed little evidence of consolidation. Sediments deeper than 1 meter did show evidence of consolidation taking place, but these sediments still have high water content. Given that these materials have been in place for up to 30 years since the channel was last dredged, it appears that consolidation will be a slow process, particularly for those sediments that end up being in deposits less than 1 meter thick at the disposal site. These characteristics of the dredge material raise questions about recolonization by the pre-disposal era endemic benthic community at the various open water disposal sites. Some species and/or life stages such as lobster, hard clams, ocean quahogs, or other species may find the disposal mound unsuitable. Benthic recolonization may be limited to pioneer and opportunistic species that utilize the surface layers much like the present situation in the Providence channel. Given the gelatinous ooze consistency of the dredge material, bottom trawls may have difficulty or may be prevented from fishing the disposal site because of gear entanglement. In either case, these would constitute loss of existing uses. Accordingly, the Corps needs to undertake a more rigorous evaluation of these compatibility issues. Reliance on grain size similarities is not sufficient, neither is reliance on monitoring studies from disposal mounds in Long Island Sound, unless the Corps can demonstrate that those dredged sediments also had a consistency like a gelatinous ooze and critical sheer stress values in the range of 6 pascals. 2 (cont.)

Sediment Compatibility [September 19, 2001 letter]

The FEIS does not provide any new information to address the sediment compatibility issues identified during interagency discussions this past winter and in my March 30, 2001 memorandum. While it may be accurate to say that these are relatively new issues in the context of this EIS process, they nonetheless are significant issues because of their potential for long-term or even permanent effects at the disposal site. The unique characteristics of the Providence River dredge materials discussed in Appendix P (cohesiveness, high water content, low bulk density, presence of smectite clays, resistance to consolidation, tendency for gel formation and resistance to erosion) could significantly alter conditions at Site 69b or other sites in Rhode Island Sound and perhaps at the alternative open water sites in Narragansett Bay. I remain concerned that benthic recolonization could be limited to species that utilize the surface layers of the sediment much like the ambient conditions in the navigation channel. This would cause a long-term adverse ecological change at the disposal site where a diverse, climax benthic community presently exists. Secondly, the consistency of the dredge material may physically limit or prohibit certain commercial and recreational fishery uses at the site such as bottom trawling or lobstering. In combination, these effects would constitute loss of existing uses and interference with fishing, ecological functions and other legitimate uses in contravention of ocean dumping regulations, 40 CFR 228.6(a)(8).

Accordingly, we believe EPA should refrain from moving forward with an FEIS and site designation at this time. Instead, we recommend that EPA adopt an environmentally-friendly and conservative posture involving extensive monitoring of Site 69B to determine if the short- and long-term use of the site is acceptable as discussed above. 3

The remaining carryover issue from the Site 69B designation process to the present project is the issue of baseline data collection. The issue was characterized by the Service as follows: 4

Baseline Survey [September 19, 2001 letter]

During the course of the Providence Harbor EIS process, the Service recommended in correspondence dated June 24 and October 12 1994, March 5, 1997, October 20, 1998 and February 22, 1999, that the Corps collect site specific temporal and spatial data on the living resources at the short list of reasonable alternative disposal sites. The FEIS essentially relies on existing resource information to describe the ecology and water quality of the reasonable sites with some limited data collection such as the Remots Images of the sediment/water interface to characterize the benthic community structure and a lobster survey. The lack of spatial and temporal data on the species, communities and populations that use Site 69b

environs raises questions regarding compliance with applicable site selection, designation and monitoring criteria in the ocean dumping regulations 40 CFR 228. One of the purposes of the 4
baseline survey [228.2(b), 228.6(a)(9)] is to adequately characterize the ecology and water (cont.)
quality of a site prior to use such that a subsequent monitoring program (228.9, 228.13) can evaluate the impact of disposal on the marine environment by referencing the monitoring results to a set of baseline conditions. Another purpose of the baseline survey is to form the basis of the disposal site designation study which is intended to support the environmental assessment of the site for disposal and use in any required EA/EIS.

On page 4-1, Section 4.0, of the DEIS, a statement is made that monitoring requirements pursuant to 40 CFR 228.10 are not required for the site designation process. However, in 5
Section 4.1, also on page 4-1, the first sentence states that dredge material disposal at designated sites must be evaluated periodically as required by 40 CFR 228.10. These statements seem to be inconsistent, and particularly so in the present situation where disposal has occurred and a new designation is proposed. The larger issue relates to the fact that the present DEIS relies on what is now outdated data used by the Corps to designate Site 69B. In 6
essence, both the Corps and now the EPA environmental documents rely extensively on existing data sources as opposed to baseline surveys that specifically address the needs in 228.2(b), 228.6(a)(9), 228.9, 228.10, and 228.13. One of the positive environmental benefits of postponing further action on the FEIS and final long-term site designation is that it would provide the time interval necessary to collect data and conduct long-term monitoring to comply 7
with 228.10(a) and the other citations above. We note with interest on page 3-76 that drift of dredge material to the north and west of Site W has been detected. We also note on page 3-69 that the recovery or healing process for Site 16 to become similar with natural background conditions took about 30 years. These are additional reasons to adopt an environmentally conservative posture and hold further site designation steps in abeyance.

Questions may be directed to me at 603-223-2541 or email vernon_lang@fws.gov.

Sincerely yours,

Vernon B. Lang
Assistant Supervisor
New England Field Office

NORRIS

Gregory Norris
<Gregory.Norris@
noaa.gov>

To: Olga Guza/R1/USEPA/US@EPA
cc:
Subject: RI Sound Disposal Site

05/11/04 11:15
AM

Two of the four geographic coordinates provided in the proposed rule for the RISDS (published in the Federal Register) appear to be out of sequence. In order to plot as a square, coordinate #3 and coordinate #4 should be transposed for the final rule. Unchanged, the current sequence of coordinates will produce an odd "Z-shaped" linear figure. 1

Greg Norris
Nautical Data Branch, NOAA
(301)713-2737,ext 127

PRYOR

Donald Pryor
<Donald_Pryor@brown.edu>

06/21/04 04:45 PM

To: Group R1_RISEIS@EPA
cc:
Subject: Designation of the RI Region Dredged Material Disposal Site in RI Sound

Please regard the following as formal comments on the DEIS and Proposed Rulemaking concerning the Designation of the RI Region Dredged Material Disposal Site in RI Sound.

The Proposed Rulemaking indicates that there is to be no disposal site capacity volume restriction (p. 20 under specific criteria #4). Clearly the analysis in the DEIS and supporting materials does not support this. The rulemaking should limit capacity to 8.8 MCY or less. If additional demands should arise (such as an additional large project similar to Quonset or aggregate demand greater than expected), another analysis of disposal sites should be conducted as well as analysis of dredging needs and cumulative impacts. 1

As just one indication of the need to include a capacity in the rulemaking, consider the following: According to the DEIS (p. 4-73), the total capacity of site W before any disposal activity is approximately 20 MCY. (That fact alone calls of a finite capacity to be recognized. Realization of that capacity without deposits projecting above the 105 ft depth used in the analysis will be very difficult, if possible.) Site 69B, within site W, is projected to receive approximately 5 MCY from the Providence River project by 2005, leaving approximately 15 MCY capacity. Table ES-1 shows dredging needs of just less than 8.8 MCY. That table shows that, if dredged materials from Quonset were to be added, the total would be almost 17.6 MCY. The DEIS indicates that this volume exceeds the capacity of the possible disposal site.

Thank you for your consideration.

Donald Pryor

PH

June 15, 2004

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U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

Joint EPA/USACE Public Hearing held at the Lighthouse Inn of Galilee, Rhode Island, on June 15, 2004, at 1:00 p.m. and 7:00 p.m., concerning:

Draft Environmental Impact Statement
Rhode Island Long-Term Dredged Material Disposal Site Evaluation Project

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REPORTER: MARIANNE KUSA-RYLL, RMR
JUSTICE HILL REPORTING
252 JUSTICE HILL ROAD, P.O. BOX 610
STERLING, MASSACHUSETTS 01564-0610
TELEPHONE: (978) 422-8777 FAX (978) 422-7799

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P R O C E E D I N G S

MODERATOR ROSENBERG: Once again, good afternoon. I am Larry Rosenberg. I am Chief of Public Affairs for the United States Army Corps of Engineers in New England, and I would like to welcome you to this public hearing held in conjunction with the Draft Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project, which was released on the -- by the government on April 30th.

This hearing is being held in accordance with the National Environmental Policy Act for the sole purpose of listening to you.

Before we begin, I would like to thank you for getting involved in this environmental review process. You see, we're here to listen to your comments, understand your concerns, and provide you an opportunity to go on the record, should you care to do so. This hearing is yours.

Our Hearing Officer today is Mel Cote, Manager of the Water Quality Unit of the Office of Ecosystem Protection of the Environmental

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Protection Agency, New England Region, that is headquartered in Boston, Massachusetts.

Other Federal representatives with me today are from the EPA, Olga Guza, the EPA's Project Manager, and Ann Rodney, a team member on this project.

From the Corps is Michael Keegan, the Corps of Engineer's Project Manager, and Kathy Rogers, the Army Corps's Environmental Team Member. And, of course, the staff of the Public Affairs Office, who you met as you entered this facility.

Should you need copies of the public notice, it appeared in the Federal Register. The hearing procedure or other pertinent information, it is all available at the registration table.

The agenda today is: Following this introduction, Mel Cote will address the hearing. It will be followed by the Corps of Engineers' Project Manager, Mike Keegan, who will provide a brief project history, and an overview of the Corps' role, and then discuss the public meeting that will follow this hearing.

Mike will then introduce Dr. Carlton Hunt from Battelle, contractor to the Corps, who

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will make a 30-minute or so presentation on the EIS processes and the recommendations. I will then open this hearing to public comment, utilizing the hearing protocol.

I should point out that the draft EIS has made a preliminary recommendation, and that no final decision has been made, until your comments and concerns are heard and addressed.

The public comment period for this Draft Environmental Impact Statement started on April 30th, and will close on June 21st. We encourage you to submit your comments for our consideration in this development for the final EIS decision document.

Before we begin, I would like to remind you the importance of filling out those cards that were available at the door. The cards serve two purposes. First, they let us know that you're interested in this project so we can keep you informed by adding you to the project mailing list.

Second, they provide me a list of those who will speak today. So if you did not complete a card, but wish to speak or receive future information regarding this project, please fill out

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a card. And once again, it's available at the registration desk.

One additional comment. We are here to receive your comments, not to enter into any discussion of those comments, or to reach any conclusions. Any questions you have should be directed to the record and not to the individuals on the panel. Once the public hearing is closed, and that includes the break, we will open a public meeting where you will have an opportunity to ask any questions, and be provided the answers by representatives of the EPA or the Corps of Engineers, and others associated with this project.

Thank you very much.

Ladies and gentlemen, our Hearing Officer, Mel Cote.

MR. COTE: Thanks, Larry.

And good afternoon, everyone. As Larry mentioned, my name is Mel Cote. I am the Manager of the Water Quality Unit in the U.S. Environmental Protection Agency's New England Regional Office, and there are a couple other representatives with EPA I wanted to acknowledge who are here today. Walter Berry, from our Office of Research and

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Development Lab here in Narragansett; and Doug Pabst from our EPA Region 2 Office, both who have been involved in the support of this project over the past several years.

Thanks for coming to this public hearing on the Draft Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Whether it's the voice of support for or concerns about, the Federal action proposed in this Draft EIS are simply to learn more about the project. We welcome your participation.

On April 30th, EPA published a Federal Register notice and issued a press release announcing the availability of the Draft EIS for public comment until June 21st, next Monday. We posted the Draft EIS and the link to supporting documents on our web site, and based on responses to an inquiry that we sent to a large mailing list of agencies, organizations and individuals, we mailed either a Notice of Availability or directions on how to access the Draft EIS, or an executive summary of the document, or the complete document to interested parties. This is consistent

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with our ongoing efforts throughout the site designation process to provide the public with ample opportunity to get information about the project, and to give us their feedback, and that's why we are here today, to listen to and record any comments that you may have on the Draft EIS.

Now, the EPA and the U.S. Army Corps of Engineers jointly regulate dredged material disposal under federal authorities provided under section 404 of the Clean Water Act, and section 103 of the Marine Protection, Research and Sanctuaries Act, or the Ocean Dumping Act. I will use the shorter name throughout the rest of my address. Section 404 of the Clean Water Act applies to dredged material disposal in state waters, while disposal in Federal waters is subject to the rigorous sediment testing and disposal site designation criteria, and site management and monitoring plan requirements, of the Ocean Dumping Act. Since this project is in Federal waters, only the Ocean Dumping Act applies. In administering these programs, we work closely with other Federal resource management agencies like the National Marine Fisheries Service and U.S. Fish and Wildlife

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Service, Indian tribes and state environmental agencies to ensure proper coordination and consistency with statutory and regulatory requirements, and environmental standards.

The Ocean Dumping Act authorizes the Corps to select sites for short-term use, and EPA to designate sites for long-term use. In 2001, the Corps, in cooperation with EPA, exercised its Ocean Dumping Act authority to select a dredged material disposal site for the Providence River and Harbor Maintenance Dredging Project, which is known as Site 69B, and disposal operations from that project began in April 2003. That site selection was supported by an Environmental Impact Statement that evaluated several options for the disposal of Providence Harbor and River sediments. The Ocean Dumping Act limits the availability of Corps-selected sites for disposal activity to two five-year periods. The first fire-year period begins with the first disposal activity - in this case, April 2003 - and the second five-year begins with the first disposal activity commencing after completion of the first five-year period. Thus, the Corps can select disposal sites only for

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short-term, limited use; whereas, Congress authorized EPA to undertake long-term site designations, subject to ongoing monitoring requirements to ensure that the sites remain environmentally sound.

Periodic dredging and, therefore, dredged material disposal are essential for ensuring safe navigation and facilitating marine commerce. EPA believes it's preferable from an environmental perspective to dispose of dredged material in only a few discrete locations so that it can be more easily managed and monitored to protect the marine environment. In the course of selecting Site 69B for the Providence River project, it was acknowledged that the short-term availability of that site was insufficient to meet the long-term dredging needs of the Rhode Island region. With a continuing need for dredged material disposal, and the impending expiration of the short-term site selection for the Providence River dredging project, the Corps was faced with the prospect of having to continue to select new disposal sites that could only be used for a maximum of two five-year periods. In the

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long-term, this could result in the proliferation of disposal sites in the Rhode Island region. And that is why we are here today.

In September 2000, EPA and the Corps received a request from the Governor of Rhode Island to evaluate the designation of one or more long-term open water dredged material disposal sites, citing the difficulties that navigational facilities were experiencing due to a backlog of maintenance dredging activities. This backlog stemmed from the lack of environmentally acceptable and cost-effective disposal options available to the navigation community. Subsequent dredging needs surveys conducted by the Corps and EPA confirmed the need for a long-term disposal option.

The two agencies agreed to fulfill this request and also agreed that, consistent with past present -- past practice in designating disposal sites, we would follow EPA's "Statement of Policy for Voluntary Preparation of National Environmental Policy Act (NEPA) Documents," and would prepare an environmental impact statement to evaluate different dredged material disposal options. EPA and the Corps have tried to prepare this Draft EIS

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to be consistent with EPA's NEPA-implementing regulations as well as those promulgated by the Council on Environmental Quality for additional guidance.

So the two primary Federal laws under which we are conducting this site designation process are the Marine Protection, Research and Sanctuaries Act, which among other things, establishes criteria to identify a suitable location for disposal sites; and the National Environmental Policy Act, which requires federal agencies to establish clear purpose and need for a proposed federal action, evaluate various alternative approaches to meet that need, and choose the best, or the least environmentally damaging, yet practicable alternative. Both statutes require public participation in the decision-making process.

Although EPA is the agency that is authorized by the Ocean Dumping Act to designate dredged material disposal sites, the Corps is participating in the development of EIS as a cooperating agency, because it has knowledge concerning the needs of the dredging program, as

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well as technical expertise in assessing the environmental effects of dredging and dredged material disposal. The Corps is also providing technical and financial support in the development of the EIS, but all final decisions regarding -- regarding any site designations will be made by EPA. To take advantage of expertise held by other entities and to ensure compliance with all applicable legal requirements, EPA also is closely coordinating this effort with other federal agencies, as I mentioned, the National Marine Fisheries Service and Fish and Wildlife Service, Indian tribal governments, state environmental and coastal zoning management agencies and local governments, some of which are participating as cooperating agencies. EPA and the Corps also have conducted extensive public participation activities, including numerous workshops and informational meetings to explain the process and disseminate technical findings, and to solicit feedback from the public to help guide the process.

We are here today to present information on the Draft EIS that evaluates long-term disposal options for the Rhode Island

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region and to solicit feedback on this document and the Federal action it proposes in the form of oral or written comments. We encourage and welcome your oral and written comments, but we will not be responding to them during the public hearing portion of today's proceedings. As Larry has explained, there will be a question and answer session dealing with the public meeting immediately following this formal hearing. The comments we receive will be given equal consideration upon completion of the public comment period for the purposes of finalizing the EIS and issuing final rulemaking. The final EIS will include responses to all the comments that we receive. EPA and the Corps anticipate releasing the final environmental impact statement in December this year, and if recommended by the EIS, issuing a final rule that will officially designate the site in early 2005.

For accuracy of the record, your written comments should be sent to Olga Guza, Project Manager for EPA, at the EPA New England Regional Office and they will be accepted until close of business next Monday, June 21st.

Thank you again for your participation

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in this public hearing and for your interest in the issue of dredged material management in the Rhode Island region.

MODERATOR ROSENBERG: Ladies and gentlemen, the Corps of Engineers Project Manager, Mike Keegan.

MR. KEEGAN: Good afternoon.

As Larry indicated, I'm Mike Keegan. I am the Corps of Engineers Project Manager for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. The purpose of this project is to evaluate the feasibility of designating a long-term disposal site to assist both public and private navigational facilities in meeting maintenance requirements to ensure safety, and to meet the navigational needs of commercial and private shipping, fishing and recreation vessels.

The Corps of Engineers currently has 18 navigation projects in the State of Rhode Island and 17 in Southeastern Massachusetts. These projects we required to maintain a safe navigable depth for vessels ranging from large cargo carriers to recreational boats. Some of this material

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dredged from the harbor is clean and suitable for use as renourishment on beaches of the area, when they are available. Other material is not compatible for renourishment, because it has a different grain size than the beach material.

Fairly recently, the Corps completed an Environmental Impact Statement that selected an ocean disposal site in Rhode Island Sound for the disposal of material from the Providence River Harbor to restore the federal channel to its authorized depth, and eliminate the impacts that shoaling has caused on the channel to commercial shipping. This material must, according to federal law, undergo a series of rigorous physical, chemical and biological testing to prove its suitability for placement in the Sound.

Although this selected site, called 69B, is currently available to meet some of the short-term maintenance requirements in the Rhode Island region, other navigation facilities in the region have experienced a tremendous backlog in the dredging needs to meet, because of limited environmentally accepted and cost-effective disposal options. It was because the amount of

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time that was needed to conduct the Providence EIS that the state believed it was prudent to attempt to address the long-term needs of the area that caused the Governor of Rhode Island to write a letter to both the Corps of Engineers and the US Environmental Protection Agency requesting that we evaluate the feasibility of designation of a long-term disposal site.

As Mel has mentioned, EPA is the agency that has the authority to designate a long-term disposal site. However, since the Corps has extensive knowledge of dredging needs, has a history on expertise of assessing the dredging and disposal and its affects on the environment, EPA requested that the Corps become a cooperating agency in the conduct of this evaluation project. Both agencies agree that updated information needed to be acquired that could supplement historic information, as well as data that was collected as part of the Providence Project. Both agencies also recognized the need to involve the public in every aspect of this project.

In addition to conducting an extensive literature review to collect all available

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information on the project area, we have conducted various field efforts to collect information on physical oceanography, fish, lobster, shellfish populations and tissue analysis. Benthic information was collected and sediment analysis was performed. In order to determine the current and future dredging needs, we sent a survey to 450 navigation facilities in Rhode Island and in Massachusetts to collect information on the immediate and future dredging needs for both maintenance and for expansion of current facilities.

An investigation into the economic importance of navigation-dependent facilities in Rhode Island and Southeastern Massachusetts was conducted, and we found that those industries contributed 56,000 jobs and 3.4 billion annually to the economy. We had three meetings with local fishermen to find out where they fished, which areas should be avoided in considering the location of an alternative disposal site, and to determine if there was a location that a disposal alternative should be considered.

While the field investigations were

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being conducted, economic analysis and dredging needs work was being initiated. The project team worked with the University of Rhode Island Coastal Institute here in Narragansett to establish a working group. This working group would assist us in developing a screening criteria, and to help us focus our evaluation efforts. The working group is comprised of representatives of Federal, tribal, state and local agencies, representatives of lobster, shellfish, fishing organizations, representatives of the shipping industry, local universities, and other organizations that both had an interest and an expertise on the project. The coastal institute acted as facilitators to assist the working group in identifying screening criteria that they felt should be included in the initial screening of the project area to eliminate areas where dredging sites should not be considered because of impacts to fisheries, shellfish or other navigational and safety concerns. Later in the hearing, a presentation will be made by Carlton Hunt that will walk you through this screening process and that criteria considered.

Throughout this project we have

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attempted to present information as it's developed to receive input back from the public and help us focus our efforts. It is important that we receive your input here today. As Larry will explain shortly, the hearing process is somewhat of a one-way communication. You provide input. We record your comments and listen to your thoughts. It's not designed to be a question and answer process. That could be both frustrating to you and to our project team. For that reason, following the public formal session we will conduct a public meeting where you can ask questions, and we'll answer all your questions as best we can.

I want to thank you for your involvement in the project, both in the past, and for the taking the time to come here today. We have been able to get to this stage, because of the assistance of the public and the people who have been on the working group. Local knowledge has been an important component in our evaluation process. I look forward to hearing your comments today. I encourage you to also provide us any additional comments you think of by the 21st to EPA.

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Now, for the presentation of the screening process, I am going to ask Dr. Carlton Hunt from Battelle to come up and give us the PowerPoint presentation. Afterwards, if you would like, a lot of the information for the screening is on placards in the back, and when we get to the public session, we'll be able to explain any other questions you may have.

Carlton.

MR. HUNT: Thank you, Mike.

You heard the process. I'm going to show you a little bit of results of process, if you can hear me. Again, I am Carlton Hunt, and I am under contract with the Corps of Engineers in support of this project.

The objective today, and we have heard a little bit of, it's basically to summarize the process; secondly, to review the pertinent laws that regulate this activity, and the regulations to review the purpose and need. We're going to see some data to show why the need is there, to overview the screening process, summarize the evaluation of the environmental and socioeconomic impacts that the EIS address, and then present the

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preferred alternative, and talk a bit about the next steps.

The process began, as we've heard, in 2000, 2001, with the request to evaluate a long-term disposal site in Rhode Island Sound, or for the Rhode Island region. The Notice of Intent went out. Scoping studies were held. A variety of work group meetings were held, as you heard. There were field efforts that were conducted as well, a lot of mini literature searches to find data and information in the region that we were of interest.

We are in this 45-day comment period. As you heard also, we will finish the EIS once the comments are received, and comments are addressed and responses prepared, and changes to the document that may need to be made are incorporated.

The laws you have heard about, basically the Rivers and Harbor Act of 1899, Marine Protection Research and Sanctuaries Act, which sets the criteria for, and requirements for site designation, the type of material that can go into the ocean at these locations, and the authorization process.

The Clean Water Act oftentimes is

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brought forward. In this case, we're outside of the three mile state limit for this designation process; therefore, that act does not come into force.

The purpose of the EIS, very explicitly, was to evaluate one or more ocean sites for potential designation as a long-term disposal site for dredged material for the Rhode Island region. On the screen you can see the area that we began our study. You can see the Rhode Island/ Southeastern Massachusetts region. You've heard why it was initiated, and why the need is there from the government people in the state, as well as nationally.

How do we get from this purpose to this need identification to an actual designation?

First of all, we need to document the need.

Second, we needed to figure out where we could put this material at a large scale, spacial scale, that is the Zone of Siting Feasibility. We need to -- needed to identify within that zone a candidate locations that we could further evaluate in an EIS/NEPA process. We

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also needed to define the alternatives that would be carried forward.

Once that was done, then the evaluation takes place and the EIS, describing in detail the affected environment, both at a large scale, as well as a site specific location scale, the consequences of disposal at any one of these locations, and then to select the preferred alternative.

I will also indicate that a no action alternative is required in NEPA, and that was conducted. In this case, no action would be not to be designate a site.

The dredging needs came about through the survey that was mentioned previously. In that survey, the universe of navigation-dependent facilities was identified. A survey form was put out asking what their dredging needs were, both from a maintenance perspective, as well as new and improved dredging. The chart on the screen shows you the volumes that were estimated. I will point you to the -- on the screen there are Federal project volumes, as well as non-Federal project. The value that we worked with within EIS was

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8.7 million cubic yards over a 20 year life span planning horizon. There is other information applied. Those projects are not being carried forward, to our knowledge; and therefore, our planning horizon dealt with the known survey return. In that survey, approximately 30 percent of the people that were surveyed returned information.

That information was put into a geographic information base, and it was developed into dredging centers to document the areas where the most dredged needed to occur and where smaller amounts of dredging needed to occur. This chart simply shows the location, both in Rhode Island and Southeastern Massachusetts, that were incorporated into this study.

And as you can see, along the Rhode Island area particularly, there are three areas that there are large volumes anticipated over the next 20 years. Similarly, up in the Buzzards Bay area in Massachusetts, there are some large volume areas.

There are a number of other smaller volume areas. One thing I will say is that the

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dredging needs does not consider -- we excluded from the consideration any known dredging activities that contribute dredged material for beneficial use.

For example, beach nourishment. There are a number of projects in the area that those sediments do go for beach nourishment, so this material is -- that we include in the number is dredge material that would not necessarily be for beneficial use.

Once that was determined to go forward, if there was no need documented, then we would have stopped the process. The fact that there was a need demonstrated means that we move forward.

We needed to get into the Zone of Siting Feasibility and the boundaries. There are documents, guidance in place, both nationally and internationally, as to what you need to consider. The five major things that one considers are: The political boundaries, navigation restrictions, type of disposal equipment, cost of transporting the material, and distance to the continental shelf. That becomes important, because in the criteria for site designation, there is one criteria that

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suggests that disposal should occur off the continental shelf, and that should be considered.

The other factors that were considered are whether or not it's safe, it's safe and practicable to transport material. That is a consideration.

Safety is paramount. When you get into the open ocean, as you know, storms can blow up, and you can have situations develop where people are put at risk; and therefore, safety is a prime consideration.

And then also, we did map into this process where the material would come from, as I showed you in the previous slide.

This slide shows the -- what we also did was then around each center where there was dredging going to occur, we drew a 20 nautical mile distance. That is a haul distance that we thought was a practical distance. We then put concentric circles around each of those sites to figure out how far off shore we should be. We factored in all the locations to include Block Island, as well as the Vineyard and other areas in Southeastern Massachusetts.

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That process led to the -- on the right, you see a screen that shows a blue line extending from the Rhode Island/Connecticut border to the Sound, and also it's east of New York State waters. It extends off shore approximately 25 nautical miles. It then extends to the east to a location off of Southeastern Massachusetts, and it extends back into the Southeastern Massachusetts area.

This region is a Zone of Siting Feasibility where we thought we might be able to find locations into which the dredged material could be placed.

Once that was done, we had to do a process to find what specific areas that we could do -- locate these in and identify the specific alternative sites. That effort focused on the five general and 11 specific site designation criteria that are included in the MPRSA.

Part of the process, as you heard earlier, was to identify factors that support those criteria, what kind of information would we need in order to, in fact, make a judgment. Those include such issues as sediment characteristics and

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sediment quality, water quality, the biological resources that might be affected, rare threatened and endangered species, contaminant bioaccumulation potential from the material, socioeconomic impacts, air quality and noise associated with the proposed activities, and then the geological setting and the physical oceanography. Those are all factors that we work with through the Rhode Island work group to define and provide some specificity.

How did we get the data?

We performed a literature review where there was no information; that data gaps were filled by surveys. A variety of survey types were conducted. We will describe briefly some of those a little later in this presentation. That information was put into a spacial geographic EIS layers to show the overlay and show the correspondence amongst the various information that we gathered, and then what we did was prioritize the MPR state criteria into a Tier 1 exclusionary approach, that this was not reasonable -- on the basis of that criteria, could not be reasonable to put a dredged material disposal site.

After that was done, we did a second

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tier where we began to focus in on specific areas, and again followed a process of defining exclusionary, those that would require some discussion and those that would be in an acceptable location. And I'm going to provide not all the information, but just some representative information.

The Zone of Siting Feasibility ruled out areas beyond the continental shelf, primarily for safety and cost reasons. An area of concern is whether or not material placed in the ocean would erode and be dispersed throughout the ocean. The concept behind this particular site is to retain the material within the site. Therefore, erosion due to waves and winds and current action were an important factor.

Areas of conflicting uses, if you have anchorages, you don't necessarily want to have a dredged material disposal site located in that anchorage, because anchors could resuspend that material, and also interfere with the actual activity.

Reserves and science areas, for obvious reasons, I think you do not want to go into a

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science area that is being studied and cause a perturbation by putting dredged material.

Beaches and amenities are to be considered observation areas. Conservation areas are considered exclusionary. Areas where there are active military use, also, would be exclusionary. And then historic or culturally-important features in the ocean; for example, a known shipwreck that has historic importance, or in the case of tribes, if there were culturally important areas that might be buried.

And then the last thing is threatened and endanger species, critical habitat, which are known in the Zone of Siting Feasibility that we looked at.

This figure shows the -- basically the depth contours, the darker blue area. The darker it is, the deeper the water. Overlaying on top of that is a transparent layer. That is the area where we considered erosion was too high a potential to locate a site. And you can see south of Rhode Island, Southeast Massachusetts, an area around Block Island and to the east at Cox's Ledge. It's too shallow to put a disposal site there, so

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those areas were excluded.

Just from a shipwreck perspective, this is type of data that we gathered, and we are to understand that there are vessels and shipwrecks. Some folks died on those; therefore, those are recreational activities that we did not want to interfere with.

And then these are utilities. There are a number of telephone and telecommunications lines that are through -- run through the area, and those areas are locations that we wanted to exclude. We put a buffer zone around each of those. That's why they look so wide on this particular feature.

The squares that you see are also military use areas; and to the east, I'll point out no-man's land, which also is -- not only is it military use, but it's also a reserve.

What we did is black out those areas, and what you see in the blue, the black is what is no longer feasible to put a site in. The blue is where we considered further in Tier 2. That consideration looked at minimizing impact of fishing and fish habitats. It also looked at

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shellfish resources. It looked at living resources, from the spawning nursery, passage perspective. It looked at navigation lanes, not locations within navigation lanes of varied routes. All that would interfere with normal navigation in the area.

We also addressed a number of other things that the regulations include that are unexploded ordinance, use of historic dump sites or disposal sites, benthic habitat types and also cultural resources.

This is just an example of the fishing information that we pulled together from a large variety of sources. The hatching and gray area -- modeled areas are areas that have been identified by fishermen or other people as being important places where they -- where fishing activities occur. You will particularly note in this deep channel area and the southern part of the feasibility zone, fishermen had pointed out that that is an important area for them, as well as other areas around Block Island Sound. All of that information was then factored in to -- from a fishing perspective.

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This particular chart shows some very -- 20-year-old data that indicates where ocean quahog are, in fact, abundant. The red means high abundance, and the blue means there's a low abundance. And so there are a number of areas that -- of historic data set would suggest that we would want to avoid, because we wouldn't want to cover that resource.

This screening shows the navigation, varying routes, and also the navigation channels coming into both Narragansett Bay and Buzzards Bay.

When you screen out those, the black is a clear screen out. We didn't want it to be in there. The gray suggested we should not be in that location. So just on the basis of Tier 2 screening, we found very few areas that were left.

The small blue areas in -- if we only did Tier 2 screening, the small blue areas in Block Island Sound might be available to us. And then there were two or three other locations in the eastern part of the zone, as well as one location between the inbound and outbound navigation lines to Narragansett.

When you combine the two screening

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layers together, there are very few locations where we could, in fact, locate or potentially locate a dredged material disposal site. Highlighted in red on the screen are the two areas, not the sites, but two areas that were carried further into the EIS, in terms of determining a specific one square nautical mile location for comparing as an alternative in the EIS.

There are some areas that were -- were not considered further, the small blue area to the east side, and then down in this deeper channel area, south of Block Island Sound. Those are considered -- not considered further because of location with respect to fisheries resources.

These are -- this is a zoom in on those specific areas. The eastern area is this oblong area that in yellow is where we studied further. And we also expanded the study zone around Site 69B, the light pink of 69B. The purple areas, new areas that we studied further as a potential to see if we could change the configuration of that particular location.

Because Site E had very little data available on it, a series of surveys were mounted a

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year ago to look at the dymmetry, to look at the bottom pipes. We used a site scan sonar. We looked with a magnetometer for potential cultural resources. We looked at erosion potential through looking through current data, tidal data. We did a series of sediment studies using a -- what is called a sediment profile imaging technique, that looks at both some physical characteristics of the sediments, as well as biological characteristics, and the rapid assessment technique that allows us to map large areas very quickly. We, in addition, looked at specific species that are through traditional benthic graph samples.

Chemistry was conducted both grain size, physical properties, as well as collected metals as representative of potential areas where there might or might not be high contaminant levels. We did finfish and trawl surveys. We also did a quahog survey, and we also looked at lobster resources in those -- that specific area, in order to get a balanced set of data to compare what was Area E and Area W, and to focus in on the specific one square nautical mile footprint.

Not to spend time, but you can look by

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the color differences. This is Area E, and you can see the sediment profile imagery. There is a number of color changes. All of those color changes are somewhat related to the grain size type, so we were able to look at a large number of locations and try to determine where best to locate the site within this area.

That was done through a process of comparing the data that we had generated. The squares that are shown on this particular figure show the specific locations that we tried to figure out were the best, the one nautical mile square footprint, the best location that we could come up with. In the process, Area 3 site, or Location 3 on this site was chosen, and to carry forward with the EIS it's in a relatively sandy area. It's away from rough bottom areas where there are higher lobster populations, so we tried to avoid that lobster resource that's known to be out in that region. It also avoided areas where trawling occurs. Trawling occurs generally to the south of this location.

Area W is the largest square we did the slide scan survey. That is what is shown on this

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particular figure. The area that we moved to, in terms of carrying forward into the EIS, is the green square. That green square delineates the current 69B location.

This map shows the two sites in relationship to each other within Rhode Island Sound. And those, in fact, were the areas that we carried forward. And to include, as I said earlier, the no action alternative, we assessed impacts of each alternative of putting material in those sites. We made the judgment as to whether that would be an impact, no impact. We qualified the impact by speaking to minor impacts, and I will speak a little bit more about what minor impacts mean, or minimum impact.

The EIS that you have in front of you, or hopefully had time to read, or gotten through most of it, is 10 chapters.

Chapter 1 talks about purpose and need.

Chapter 2 talks about the alternatives that were carried forward.

Chapter 3 is a very large chapter that talks about the affected environment, what is its physical conditions, what are its physical

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traditions, what are the biological resources, what are the biological organisms that are there, what's the chemical condition of the sediments. A whole suite of sets of information about this area.

Chapter 4 does the judgment call, in terms of which of the alternatives are to be carried forward. It looks at the consequences of placing material there.

Chapters 5 through 8 basically are information that is required as part of NEPA to complete the EIS.

One more word. The appendices that are there, it's required that the agencies provide a site management and monitoring plan for any designated site in that major appendix. It's in there, if the site management monitoring plan that is proposed. That is as important as the EIS, in terms of looking at -- reviewing this document.

This chart, I won't spend a lot of time on. The highlighted areas are those where we felt there would be some level of impact. If it's not highlighted, then our judgment call was no impact. And for sediment and erosion, both Site E and F, for example, had some small potential for erosion.

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The currents are -- exist in the area, so you can get some small minor potential.

Sediment quality, there is a minor impact for both of those, simply because of the material we put out there. It might be slightly different than the native material that is located in the site. It's primarily a grain size situation. The testing eliminates material that would be toxic, or potentially bioaccumulate through the regional testing.

The benthos is considered to have a minor impact, primarily because when you put material, you will disrupt the bottom. You may cover a few organisms, but it's reasonably well documented in the literature and the other reports that the benthic community in these locations does recover. You get a stage sequence coming through of rapidly colonizing organisms that over time those organisms in that benthic community become like the surrounding environment with grain sizes similar. So, therefore, minor impact is a short-term impact. There is recovery.

The same thing with lobster, fish and other invertebrates. The judgment is is that when

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you place material in the ocean, you may have an immediate short-term impact, but by and large over time those impacts go away; and, in fact, there is no long-term effects on those resources.

Shipping and navigation, particularly important, is taking no action on this. We have some long-term impacts in terms of the ability to move goods and services into Rhode Island, or into Southeastern Massachusetts.

Importantly, as I said earlier, use of previous disposal sites is called out in the regulations, and because Site E is a location for dredged material, and has never been placed, it's considered to be an impact, because we would be increasing the area of potential disturbance within this region and, therefore, not a desirable condition. However, for Site W, it's considered no impact, because it is, in fact, an ongoing disposal location.

Cumulative impacts for the same reason is long-term cumulative, what might happen through all activities that occur in Rhode Island Sound. Designating E was considered to be not -- would have an impact and, therefore, not desirable.

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This is the preferred alternative. It shows the benthic. The red colors on this particular shot or slide or shallower depths that have developed as a result of the ongoing disposal in the location. I believe this figure is as of early 2004.

The judgment call in the EIS was the preferred alternative is Site W, and the reasons are lower likelihood of sediment transport in that particular location, the greater likelihood of meeting water quality criteria. The currents and the configuration of this site are such that one can manage, or we can manage any potential for any water quality effects.

The other reason for selecting it is it reduces regional economic impacts by adding this long-term disposal site designated. And the last piece is that it is an active disposal site.

My last slide is to simply the next steps. What you have already heard this morning will be to receive the comments, review and respond to those, publish the final EIS that addresses any of the issues that are raised in that process, the final rulemaking and complete the designation

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process.

And I'm going to turn the hearing, I think, back over to Larry. Thank you for your time.

(Pause.)

MODERATOR ROSENBERG: Thank you, Carlton.

Ladies and gentlemen, it is crucial to this public process that your voice is heard, and we're here to listen, to listen to your comments, to understanding your concerns, and to provide you an opportunity to put your thoughts on the record, should you care to do so.

Any information you provide today is important and will assist both the EPA and the Corps in evaluating and developing the course of action that the agencies will jointly recommend in the future. And I would like to thank you in advance for taking the time to provide us your views.

This hearing will be conducted in a manner so that all who desire to express their views will be given an opportunity to so. To preserve the right of all to express their views, I

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ask that there be no interruptions. When you came in, copies of the Public Notice of availability and the procedures to be followed at this hearing were available. If you did not receive these, they are available at the desk as you walk in.

I will not read either of the procedures or the notice of the availability, but they will be entered into this record.

A transcript of this hearing is being prepared, and a record will remain open, and written comments may be submitted today, or by mail by 5:00 p.m. on June 21, 2004. All comments receive equal consideration.

If you know of anyone who cannot attend, but who desires to provide written comments, they should do so, and should forward those comments to Olga Guza at the EPA's New England Region office in Boston, Massachusetts.

Lastly, I would like to reemphasize that the government has made no final decisions with regards to this project. It is our responsibility to fully evaluate all the information available, including your input, prior to developing the recommendation in the final EIS.

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MR. COTE: If there is no objection from the Hearing Officer, I will now dispense with the reading of the Public Notice of Availability, and have it entered into this record.

MR. COTE: No objection, Larry.

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Public Notice of Availability
Draft Environmental Impact Statement (DEIS) for Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project
April 30, 2004

The Draft Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (DEIS), the Executive Summary, the Draft Site Management and Monitoring Plan (SMMP) and the Proposed Rulemaking (Rule) is available for public review and comments.

The DEIS is being released by the U.S. Environmental Protection Agency, New England Region (EPA) in cooperation with the U.S. Army Corps of Engineers,

New England District (Corps) and was prepared consistent with the requirements of the National Environmental Policy Act, and the Marine Protection, Research, and Sanctuaries Act to evaluate the potential environmental impacts associated with the designation of open-water dredged material disposal sites in the Rhode island Region. We are soliciting and encouraging public comments on the DEIS, SMMP and the Rule during the public comment period that begins April 30, 2004 and closes on April 21, 2004 at 5:00 p.m. Please send your written comments to:

Olga Guza
US EPA, New England Region
One Congress Street
Suite 1100, CWQ
Boston, MA 02114-2023
Facsimile to (617) 918-1505
Electronic Mail to: R1_RISEIS@EPAMAIL.EPA.GOV

Comments should be submitted in writing no later than June 21, 2004 at 5:00 p.m. EPA and the Corps will also be conducting two public hearings to

solicit and encourage comment on the DEIS and SMMP. The date and location of the hearings are:

Hearing #1	Hearing #2
June 15, 2004	June 15, 2004
Starting @ 1:00 p.m.	Starting @ 7:00 p.m.
Lighthouse Inn of Galilee	Lighthouse Inn of Galilee
307 Great Island Road	307 Great Island Road
(Galilee State Pier)	(Galilee State Pier)
Narragansett, RI 02882	Narragansett, RI 02882

You also may review and/or obtain electronic copies of the notice announcing the availability of the DEIS at the EPA home page at the Federal Register http://www.epa.gov/fedrgstr/. The DEIS, SMMP and the Rule are available for review and/to obtain at the following EPA Web Page address: http://www.epa.gov/region1/eco/ridrege/index.html

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Designation of the Rhode Island Region Dredged Material Disposal Site in Rhode Island Sound

[Federal Register: April 30, 2004 (Volume 69, Number 84)]
[Proposed Rules]
[Page 23706-23715]
From the Federal Register Online via GPO Access
[wais.access.gpo.gov]
[DOCID: fr30ap04-28]
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ENVIRONMENTAL PROTECTION AGENCY
40 CFR Part 228
[FRL-7654-9]

Designation of the Rhode Island Region Dredged Material Disposal Site in Rhode Island Sound

AGENCY: Environmental Protection Agency.
ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency (EPA) is proposing today to designate the Rhode Island Sound Disposal Site beginning (RISDS) in Rhode Island Sound offshore of Rhode Island. This action is necessary to provide a long-term dredged

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material disposal site for the current and future disposal of dredged material from Rhode Island, Southeastern Massachusetts, and surrounding harbors (hereinafter referred to as the Rhode Island Region). The proposed site designation is for an indefinite period of time. The RISDS will be subject to continuing monitoring to ensure that significant unacceptable, adverse environmental impacts do not occur. The proposed action is described in the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project Draft Environmental

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Impact Statement (DEIS), and the monitoring plan is described in the RISDS Site Management and Monitoring Plan (SMMP). The SMMP is provided as Appendix C of the DEIS. Site designation does not itself actually authorize the disposal of any particular dredged material at a site. Proposals to dispose of dredged material at a designated site are subject to project -- specific reviews and authorization and still must satisfy the criteria

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for ocean dumping.

DATES: Comments must be received by 5 p.m. on June 21, 2004.

Public Hearing: The public hearings are as follows:

1. June 15, 2004 at 1 p.m., Galilee, Rhode Island
2. June 15, 2004 at 7 p.m., Galilee, Rhode Island

ADDRESSES: Comments: Comments may be submitted by mail or electronically as follows:

1. By mail: Submit written comments on this document to: Ms. Olga Guza, U.S. Environmental Protection Agency New England Region, One Congress Street, Suite 1100 (CWQ), Boston, MA 02114-2023. To ensure proper identification of your comments, include in the subject line the name, date, and Federal Register citation of this document.

2. Electronically: Submit your comments electronically to: R1_RISEIS@EPAMAIL.EPA.GOV. Electronic comments must be submitted as an ASCII or WordPerfect file avoiding the use of special characters and any form of encryption. Comments

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will also be accepted on disks in WordPerfect or ASCII file format sent or delivered to the addresses above. All comments and data in electronic form must be identified by the name, date and Federal Register citation of this notice. No confidential business information should be sent via e-mail.

Public hearings: Both public hearings will take place at:

1. Galilee, Rhode Island: Lighthouse Inn, 307 Great Island Road, Galilee, Rhode Island 02882.

FOR FURTHER INFORMATION CONTACT: Ms. Olga Guza, U.S. Environmental Protection Agency New England Region, One Congress Street, Suite 1100 (CWQ), Boston, MA 02114-2023, telephone (617) 918-1542, electronic mail: Guza.olga@epa.gov.

SUPPLEMENTARY INFORMATION: General information:

A. Regulated Entities

Entities potentially regulated by this action are persons, organizations, or government bodies seeking to dispose of dredged material into ocean

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waters of Rhode Island Sound, under the Marine Protection Research and Sanctuaries Act, 33 U.S.C. 1401 et seq. (Hereinafter referred to as the MPRSA) and its implementing regulations. This proposed rule is expected to be primarily of relevance to (a) parties seeking permits from the Corps to transport dredged material for the purpose of disposal into the waters of Rhode Island Sound and (b) to the Corps itself for its own dredged material disposal projects. Potentially regulated categories and entities that may seek to use the proposed RIR dredged material disposal site may include:

Category	Examples of potentially regulated entities
Federal Government..	U.S. Army Corps of Engineers Civil Works Projects, and other Federal agencies.
Industry and General Public.............	Port Authorities, Marinas and Harbors, Shipyards, and Marine Repair Facilities, Berth owners.

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State, local and tribal governments..Governments owning and/or responsible for ports, harbors, and/or berths, Government agencies requiring disposal of dredged material associated with public works projects.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. This table lists the types of entities that could potentially be regulated should the proposed rule become a final rule. To determine whether your organization is affected by this action, you should carefully consider whether your organization is subject to the requirement to obtain an MPRSA permit in accordance with the Purpose and Scope of 40 CFR 220.1, and you wish to use the site subject to today's proposal. EPA notes that nothing in this proposed rule alters the jurisdiction or authority of EPA or the types of entities regulated under the MPRSA. Questions regarding the applicability of this proposed rule to a particular

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entity should be directed to the contact person listed in the preceding FOR FURTHER INFORMATION CONTACT section.

B. Background

In 1972, the Congress of the United States enacted MPRSA to address and control the dumping of materials into ocean waters. Title I of MPRSA authorized EPA and the Corps to regulate dumping in ocean waters. Regulations implementing MPRSA are set forth at 40 CFR parts 220 to 229. With few exceptions, the MPRSA prohibits the transportation of material from the United States for the purpose of ocean dumping except as may be authorized by a permit or authorization (in the case of Corps projects) issued under the MPRSA. The MPRSA divides permitting responsibility between EPA and the Corps. Under section 102 of the MPRSA, EPA has responsibility for issuing permits for all materials other than dredged material (e.g., vessels, fish wastes, burial at sea). Under section 103 of the MPRSA, the Secretary of the Army has the responsibility for issuing permits and authorizations (in the case of Corps projects) for the ocean dumping of dredged material. This

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permitting authority has been delegated to the District Engineer of the Corps New England District. Determinations to issue permits and authorizations (in the case of Corps projects) for dredged material are subject to EPA review and concurrence.

Section 102(c) of the MPRSA, as amended, 33 U.S.C. 1401 et seq., gives the Administrator of EPA authority to designate sites and times where ocean disposal, also referred to interchangeably as ocean dumping, may be permitted. Section 103(b). Further provides that the Corps should use such EPA designated sites to the maximum extent feasible. EPA's ocean dumping regulations provide that EPA's designation of an ocean dumping site is accomplished by promulgation of a site designation in 40 CFR part 228 specifying the site. On October 1, 1986, the Administrator delegated authority to designate ocean dredged material disposal sites (ODMDS) to the Regional Administrator of the EPA Region in which the sites are located. The RISDS site is located within New England (EPA New England); therefore, this action is being taken pursuant to the Regional Administrator's delegated authority.

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EPA regulations (40 CFR 228.4 (e)(1)) promulgated under the MPRSA require, among other things, that EPA designate ocean dumping sites (ODMDS) by promulgation in 40 CFR part 228. Designated ocean dumping sites are codified at 40 CFR 228.15. This rule proposes to designate a site for open water disposal of dredged material. This site is currently being used under the

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authority of MPRSA section 103 as site 69B and is located in ocean waters of Rhode Island Sound approximately 9 nautical miles (nmi) south of Point Judith, Rhode Island.

The RISDS is being proposed in this action to provide a long-term disposal option for the Corps to maintain deep-draft, international commerce and navigation through authorized Federal navigation projects and to ensure safe navigation for public and private entities.

The RISDS will be subject to continuing site management and monitoring to ensure that unacceptable, adverse environmental impacts do not

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occur. The management of the RISDS is further described in the draft SMMP (Appendix C of the DEIS). Documents being made available for public comment by EPA at this time include this proposed rule, DEIS, and Draft SMMP (Appendix C of DEIS).

The designation is being proposed in accordance with 40 CFR 228.4(e) of the Ocean Dumping Regulations, which allow EPA to designate ocean sites for disposal of dredged materials.

C. EIS Development

Section 102(c) of the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. 4321 et seq., requires that Federal agencies prepare an Environmental Impact Statement (EIS) on proposals for major Federal actions significantly affecting environmental quality. The objective of NEPA is to build into agency decision-making process careful consideration of all environmental aspects of proposed actions, including evaluation of reasonable alternatives to the proposed action. While NEPA does not apply to EPA activities in designating ocean disposal sites under the MPRSA,

EPA has voluntarily agreed as a matter of policy to conduct a NEPA environmental review in connection with ocean dumping site designations. (See 63 FR 58045 (October 29, 1998), "Notice of Policy and Procedures for Voluntary Preparation of National Environmental Policy Act (NEPA) Documents.") Consistent with this policy, EPA, in cooperation with the Corps, has prepared a DEIS entitled, "Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project" which considers the environmental aspects of site designation in ocean waters of Rhode Island Sound. A Notice of Availability of the DEIS for public review and comment is being published concurrently with this proposed rule in today's Federal Register. Anyone wishing to review a copy of the DEIS may do so in one of the ways described above (see ADDRESSES). The public comment period for the DEIS will close on June 21, 2004. The public comment period on the proposed rule publication will also close on June 21, 2004. Comments may be submitted by one or more of the methods described above.

The purpose of the proposed action is to designate an ocean disposal site that will meet the

long-term dredged material disposal needs in the RIR. The appropriateness of ocean disposal for any specific, individual dredging project is determined on a case-by-case basis under the permit and authorization (in the case of Corps projects) process under MPRSA.

Designation of an ocean disposal site under 40 CFR part 228 is essentially a preliminary, planning measure. The practical effect of such a designation is only to require that if future ocean disposal activity is permitted and/or authorized (in the case of Corps projects) under 40 CFR part 227, than such disposal shall normally be consolidated at the designated sites (See 33 U.S.C. 1413 (b)). Designation of an ocean disposal site does not authorize any actual disposal and does not preclude EPA or the Corps from finding available and environmentally preferable alternative means of managing dredged materials, or from finding that certain dredged material is not suitable for ocean disposal under the applicable regulatory criteria. Nevertheless, EPA has determined that it is appropriate to designate an ocean disposal site for dredged material in the ocean waters of Rhode

Island Sound now, because it appears unlikely that feasible alternative means of managing dredged material will be available to accommodate the projected dredged material of this region in the future.

Proposals for the ocean disposal of dredged materials from individual projects are evaluated by EPA New England and the Corps' New England District on a case-by-case basis, taking into account all the alternatives available at the time of permitting. Beneficial reuse alternatives will be preferred over ocean disposal whenever they are practicable.

The DEIS describes the purpose and need for the proposed action and evaluates a number of alternatives to this action. EPA's analysis of alternatives considered several different potential ocean disposal sites for dredged material from Rhode Island, southeastern Massachusetts, and surrounding harbors, as well as potential alternative means of managing these dredged materials other than ocean disposal. As described in the DEIS, the initial screening effort was established to consider the most environmentally

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sound, economically and operationally feasible area for site designation.

Alternatives evaluated included various marine sites, upland disposal, beneficial uses, and the no-action alternative.

In addition to considering reasonable distances to transport dredged material, the ocean disposal analysis considered areas of critical resources as well as areas of incompatibility for use as a disposal site. This included but was not limited to such factors as the sensitivity and value of natural resources, geographically limited habitats, fisheries and shellfisheries, natural resources, shipping and navigation lanes, physical and environmental parameters, and economic and operational feasibility. The analysis was carried out in a tiered process. The final tier involved further analysis of the no-action alternative and the following alternative sites: Site E and Site W (the proposed RISDS). These sites were evaluated and the RISDS was selected as the preferred alternative for potential ocean disposal site designation. Management strategies were developed for the preferred alternative and are described in

the draft SMMP (Appendix C of the DEIS).

To obtain public input during the process, EPA and the Corps held public scoping meetings, meetings with local fishermen, as well as convened an EIS working group. The purpose of the working group was to assist in identifying and prioritizing initial screening criteria that assisted in the evaluation of the best long-term dredged material disposal options for the RIR. Representatives from state, local, tribal and Federal agencies were invited to participate in the working group as well as individuals representing other interests. The working group assembled for a series of 7 meetings between September 26, 2002 and November 19, 2003. Comments received were factored into the development of the DEIS. The NEPA process led to the current proposal that RISDS be designated as an ocean dredged material disposal site.

D. Proposed Sites Description

Today's proposal would designate the RISDS. A DEIS and draft SMMP have been prepared for the RISDS and are available for review and comment by the public. Copies may be obtained by request from

the FOR FURTHER INFORMATION CONTACT listed in the introductory section to this proposed rule. Use of the RISDS would be subject to any restrictions included in the site designation and the approved SMMP. These restrictions will be based on a

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thorough evaluation of the proposed sites pursuant to the Ocean Dumping Regulations and potential disposal activity as well as consideration of public review and comment.

The RISDS proposed for long-term designation by EPA is currently being used by the Corps' under their short-term site selection authority as Site 69B. Overall, Site 69B has received approximately 2.8 million cubic yards since 2003. The RISDS is in the exact same location and the same size as Site 69B. The site is a square area, approximately 1 nautical mile by 1 nautical mile, for a size of 1-nmi2. The RISDS is located approximately 9 nmi south of Point Judith, Rhode Island and approximately 6.5 nmi east of Block Island, Rhode Island, with depths from 115 to 128 feet (35 to 39 m).

The sediments at the site range from glacially derived till to soft, silty sand. The coordinates (North American Datum 1983: NAD 83) for the proposed RISDS site, are as follows: 41[deg]14'21" N, 71[deg]23'29" W; 41[deg]14'21" N, 71[deg]22'09" W; 41[deg]13'21" N, 71[deg]23'29" W; 41[deg]13'21" N, 71[deg]22'09" W.

E. Analysis of Criteria Pursuant to the Ocean Dumping Act Regulatory Requirements

Five general criteria are used in evaluating possible dredged material disposal sites for long-term use under the MPRSA (see 40 CFR 228.5).

General Criteria (40 CFR 228.5)

1. Minimize interference with other activities, particularly avoiding fishery areas or major navigation areas (40 CFR 228.5(a)). The first of the five general criteria requires that a determination be made as to whether the site or its use will minimize interference with other uses of the marine environment. For this proposed rule, a

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determination was made to overlay individual uses and resources over GIS bathymetry and disposal site locations. This process was used to visually determine the maximum and minimum interferences with other uses of the marine environment that could be expected to occur. Areas that would interfere with other activities, particularly fishing and navigation, were eliminated from further consideration. Sites E and W were the only areas left for consideration. The RISDS (site W) showed minimum interference with other activities and was thus selected for this proposal. The proposed site is not in an area of distinctive lobster, shellfish, or finfish resources and thus will not interfere with lobster or fishing activities. The proposed site is not located in shipping lanes or major navigation areas, is not in a geographically limited fishery area, and has been selected to minimize interference with fisheries, shellfisheries and regions of commercial or recreational navigation.

2. Minimize changes in Water Quality. Temporary water quality perturbations (during initial mixing) caused by disposal operations would

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be reduced to normal ambient levels before reaching areas outside of the disposal site (40 CFR 228.5 (b)). The second of the five general criteria requires that locations and boundaries of disposal sites be selected so that temporary changes in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within a site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching beaches, shorelines, sanctuaries, or geographically limited fisheries or shellfisheries. The proposed site will be used only for dredged material disposal of suitable sediments as determined by application of MPRSA criteria. Based on data evaluated as part of the DEIS, disposal of either sandy or fine-grained material would have no long-term impact on water quality at the proposed site. In addition, dredged material deposited at the RISDS will not reach any marine sanctuary, beach, or other important natural resource area. Further, disposal at the RISDS will be managed and monitored in accordance with the SMMP (Appendix C of the DEIS) such that there will be no temporary

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perturbations in water quality anywhere outside the site or within the site after allowance for initial mixing.

3. Interim Sites Which Do Not Meet Criteria (40 CFR 228.5 (c)). There are no interim sites to be considered under this criterion. The RISDS (formerly known as Site 69B) is not an interim site as defined under the Ocean Dumping Regulations.

4. Size of sites (40 CFR 228.5 (d)). The fourth general criterion requires that the size of open water disposal sites be limited to localize for identification and control any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. Size, configuration and location is to be determined as part of the disposal site evaluation. For this proposed rule, EPA has determined, based on the information presented in the DEIS, that the RISDS (formerly known as Site 69B) has been sized to provide sufficient capacity to accommodate material dredged from within the RIR. The site management and monitoring plan is described in the RISDS SMMP (Appendix C of the DEIS).

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5. EPA must, wherever feasible, designate dumping sites beyond the edge of the continental shelf and where historical disposal has occurred (40 CFR 228.5 (e)). The fifth criterion requires EPA, wherever feasible, to designate ocean dumping sites beyond the edge of the continental shelf and at other such sites that have historically been used. Sites beyond the edge of the continental shelf are not economically feasible due to the extended travel time and associated expense. In addition, the proposed site, if designated, encompasses the footprint of Site 69B, currently in use. Thus, the proposed disposal site is consistent with this criterion.

As discussed briefly above, EPA has found that the RISDS satisfies the five general criteria described in 40 CFR 228.5 of the EPA Ocean Dumping Regulations. More detailed information relevant to these criteria can be found in the DEIS and SMMP.

In addition to the general criteria discussed above, 40 CFR, 228.6 (a) lists eleven specific factors to be used in evaluating a proposed disposal site under the MPRSA to assure that the five general criteria are met. The RISDS, as

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discussed below, is also acceptable under each of the 11 specific criteria. The evaluation of the preferred disposal site relevant to the 5 general and 11 specific criteria is discussed in substantially more detail in the DEIS and SMMP.

Specific Criteria (40 CFR 228.6)

1. Geographical Position, Depth of Water, Bottom Topography and Distance From Coast (40 CFR 228.6 (a)(1)). The RISDS is in the same location and is the same size as Site 69B . The RISDS will replace Site 69B. The site is a square area, approximately 1 nautical mile by 1 nautical mile, for a size of 1-nmi2. The RISDS is located approximately 9 nmi south of Point Judith, Rhode Island and approximately 6.5 nmi east of Block Island, Rhode Island, with depths from 115 to 128 feet (35 to 39 meters). The sediments at the site range from glacially derived till to soft, silty sand. Water depths in the surrounding areas are between 110 and 118 feet to the north, east, and south of the site. The southeastern portion of the site shoals more rapidly than the northern

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area. The coordinates (North American Datum 1983: NAD 83) for the proposed RISDS site, are as follows: 41[deg]14'21" N, 71[deg]23'29" W; 41[deg] 14'21" N, 71[deg]22'09" W; 41[deg]13'21" N, 71[deg]23'29" W; 41[deg]13'21" N, 71[deg]22'09" W.

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2. Location in Relation to Breeding, Spawning, Nursery, Feeding, or Passage Areas of Living Resources in Adult Or Juvenile Phases (40 CFR 228.6(a)(2)). The Corps and EPA initiated informal Endangered Species Act (ESA) and Essential Fish Habitat (EFH) consultation in January 2003 and formal consultation with publication of the DEIS in coordination with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). Additional coordination was conducted with the Commonwealth of Massachusetts and State of Rhode Island. Through these efforts, data has been obtained on current threatened or endangered species in the RIR. The plankton community at the RISDS includes zooplankton (copepods, larval forms of many species of invertebrates and fish,

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Foraminifera, and Radiolara) and phytoplankton (diatoms diatoms and dinoflagellates). These organisms display a range of abundance by season. The populations at or near the proposed site are not unique to the site and are present over most of the RIR. It is expected that although small, short-term entrainment losses may occur immediately following disposal, no long term, adverse impacts to organisms in the water column will occur.

The benthic community at the RISDS is comprised primarily of Annelida, Crustacea, and Mollusca. It is expected that short-term reduction in abundance and diversity at the sites may occur immediately following disposal, but long term, adverse impacts to benthic organisms are not expected to occur. Recovery to levels similar to predisposal is expected within a few years after disposal.

The RISDS is located in the ocean waters of Rhode Island Sound, which is occupied by more than 116 fish species. Seven species appear consistently dominant among all trawl surveys. These were scup, butterfish, longfin squid, little skate, winter flounder, silver hake, and red hake. Atlantic

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herring, Atlantic mackerel, and ocean pout were also very abundant. It is expected that impacts to finfish resources will consist of short-term, local disruptions and the potential loss of some individual fish of certain nonmigratory species. Most of the finfish species are migratory. Several commercially harvestable species of shellfish occur in the RIR. They are Atlantic surf clams, blue mussels, lobster, northern quahogs, ocean quahogs, sea scallops, razor clams, and whelks. It is expected that impacts to shellfish within the RISDS will be short-term and associated with disposal, burial and loss of habitat or food. No impacts to shellfish or finfish resources are anticipated outside of the RISDS.

Many different types of resident, migratory, and coastal birds may potentially use the RIR as a feeding habitat or resting source. Dozens of marine and coastal birds migrate through Rhode Island Sound annually. In addition, the RIR provides limited habitat for most marine mammals and reptiles. The species that are frequent or occasional visitors to RIR are harbor porpoises, white-sided dolphins, minke whales, seals, (harbor,

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hooded, and harp) and sea turtles (green, Kemp's ridley, loggerhead, leatherback, and hawksbill).

There are 16 federally listed threatened and endangered species and 5 species of "special concern" which may occur within the area of the RISDS. The threatened and endangered species are: whales (humpback, fin, northern right, sperm, blue, and sei), turtles (loggerhead, green, Kemp's ridley, leatherback, and hawksbill), birds (bald eagle, piping plover, and roseate tern), and insects (American burying beetle and northeastern beach tiger beetle). The species of "special concern" are: common loon, common tern, arctic tern, least tern, and Leach's storm-petrel. Occurrence of these species varies by season. Use of the site by whales and birds would be incidental. The presence of sea turtles may occur in the RISDS during the summer and fall. It is not expected that disposal activities would have any significant adverse effect on these species or their critical habitat. With respect to endangered and threatened species, informal consultation was conducted with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service

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(NMFS). In 2001 EPA prepared a Biological Assessment (BA) for selection of Site 69B, which is in the exact same location as the RISDS. The USFWS and NMFS concurred with EPA's determination that species under its jurisdiction would not likely be adversely affected by the proposed action. The BA concludes that the proposed action is not likely to affect the threatened and endangered species. EPA reinitiated threatened and endangered species consultation with NMFS and USFWS as part of the designation process of the RISDS. NMFS concurred on April 8, 2004 and USFWS concurred on April 1, 2004 that there are unlikely to be any effects on threatened or endangered species or their critical habitat as a result of the proposed action. The BA is available upon request by contacting the person listed in the FOR FURTHER INFORMATION CONTACT section.

The RIR provides Essential Fish Habitat (EFH) for 33 finfish and 5 invertebrate species, mostly for adults and juveniles. All of the species occur along the northeastern Atlantic Coast of the United States and have EFH designated for waters other than those within the RIR. In 2001, an EFH

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assessment was prepared for the selection of Site 69B. The EFH assessment concludes that the proposed action is not likely to affect those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EPA reinitiated EFH consultation with NMFS as part of the designation process of the RISDS. NMFS concurred on April 8, 2004 that the proposed action is not likely to effect those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EPA has incorporated NMFS recommendations into the draft SMMP (Appendix C of the DEIS). The EFH assessment is available upon request by contacting the person listed in the FOR FURTHER INFORMATION CONTACT section. The RISDS is not located in areas that provide limited or unique breeding, spawning, nursery, feeding, or passage areas.

3. Location in Relation to Beaches and Other Amenity Areas (40 CFR 228.6(a)(3). The RISDS is located approximately 8.3 nmi from the nearest beach or other amenity area. Modeling and sediment transport studies indicate a very low probability of that any dredged material remaining in the water

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column following disposal would be transported more than 1 nmi. Plumes would be reduced to background concentrations shortly after disposal. Given the rapid dissipation characteristics of dredged material plumes and that the vast majority of released materials settle to the bottom near the release point, dredged material placed at the RISDS would not adversely affect beaches or similar amenities. As such, it is expected that impacts would not occur to beaches, areas of special concern, parks, natural resources, sanctuaries or refuges since they are either land-based or farther than 8.3 nmi from the proposed disposal site. There are also no marine sanctuaries or limited fisheries or shellfisheries at or near the RISDS. Therefore, EPA has determined that dredged material disposal at the RISDS disposal site location should not have any adverse effect on beaches or other amenity areas, including wildlife refuges or other areas of biological or recreational significance.

4. Types and Quantities of Wastes Proposed to be Disposed of, and Proposed Methods of Release, Including

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Methods of packing the waste, if any (40 CFR 228.6(a)(4)). The RISDS has an expected capacity of approximately 20 million cubic yards. However, there is no disposal site capacity volume restriction. The composition of dredged material to be disposed at the site is expected to be typical estuarine sediments dredged from channels, berths, and marinas from harbors and Federal navigation areas within the RIR. The disposal of this material shall occur at designated bouys or coordinates and would be expected to be placed so as to concentrate material from each disposal. This placement is expected to help minimize bottom impacts to benthic organisms. EPA will make a suitability determination prior to the USACE issuing any MPRSA permit or authorization (in the case of Corps projects) for disposal at the RISDS. The site proposed to be designated will receive dredged materials determined to be suitable for ocean disposal that are transported by either government or private contractor hopper dredges or ocean-going bottom-dump barges towed by tugboat.

Both types of equipment release the material at or very near the surface. Dredged material placed at the RISDS would not be containerized or packaged.

Furthermore, it should be emphasized that the RISDS is being proposed for designation only to receive dredged material; disposal of other types of material at these sites will not be allowed. It should also be noted that the disposal of certain other types of material is expressly prohibited by the MPRSA and EPA regulations (e.g., industrial waste, sewage sludge, chemical warfare agents). See, e.g., 33 U.S.C. 1414b; 40 CFR 227.5(b). For these reasons, no significant adverse impacts are expected to be associated with the types and quantities of dredged material that may be disposed at the RISDS.

5. Feasibility of Surveillance and Monitoring (40 CFR 228.6(a)(5)). Surveillance of the site can be accomplished by boat, helicopter, disposal inspectors aboard barges, scows, and tugboats, or through radar or satellite. This effort would be conducted jointly by the EPA, Corps-New England District, and the U.S. Coast Guard. Monitoring and surveillance are expected to

be feasible at the RISDS. The site is readily accessible for bathymetric surveys and has undergone monitoring, including side-scan sonar. If field monitoring of the disposal activities is required because of a future concern for habitat changes or limited resources, a management decision will be made by EPA New England and the Corps-New England District who share the responsibilities of managing and monitoring the disposal sites. EPA and the Corps have prepared a draft RISDS SMMP (Appendix C of the DEIS). Once the proposed site is designated, monitoring shall be completed in accordance with the then-current SMMP. It is expected that revisions to the SMMP may be made periodically; revisions will be circulated for review, coordinated with the affected States and become final when approved by EPA New England Region in conjunction with the Corps' New England District. See 33 U.S.C. 1413(c)(3).

6. Dispersal, Horizontal Transport and Vertical Mixing Characteristics of the area, Including Prevailing Current Direction and Velocity, if any (40 CFR 228.6(a)(6)). The RISDS is located within the ocean waters of Rhode Island

Sound, a water body that is exposed to wind and wave energy from the northwest Atlantic Ocean. The dominant tidal flow directions are northwest and southeast. The amplitude of the tidal velocity decreases with depth (12.7 cm/s at the surface and 7 cm/s near the bottom. The mean current velocity was 2.5 cm/s directed toward the west at mid-depth and 1.6 cm/s toward the west at the bottom. A modeling study performed as part of the Providence River and Harbor Maintenance Dredging Project EIS, examined the likelihood of erosion and transport of cohesive sediments proposed for placement at Site 69B (the proposed RISDS), located at a depth of 128 feet. It is concluded that a disposal mound placed at 69B would not be dispersive under any conditions other than the most severe (50-year return period) hurricane; their results, however, were based on an assumption of extremely cohesive material and should therefore be viewed as potentially underpredicting erosion. Areas of the ZSF between 170 and 105 ft, including the north-central portion northeast of Block Island, were depositional areas with some infrequent sorting and reworking by waves and currents. The deepest areas here were the most

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depositional.

It is expected that peak wave induced bottom orbital velocities are not sufficient to cause significant erosion of dredged material at the RISDS. For these reasons, EPA has determined that the dispersal, transport, and mixing characteristics and current velocities and directions at the RISDS are appropriate for designation as a dredged material disposal site.

7. Existence and Effects of Current and Previous Discharges and Dumping in the Area (including Cumulative Effects) (40 CFR 228.6(a)(7)). The RISDS is currently being used for disposal activity pursuant to the Corps' short-term site selection authority under section 103(b) of the MPRSA. 33 U.S.C. 1413(b) as Site 69B. This generally makes the RISDS preferable to more pristine sites that have either not been used or have been used in the more distant past. See 40 CFR 228.5(e). Beyond this, however, EPA's evaluation of data and modeling results indicates that these past disposal operations have not resulted in unacceptable or unreasonable environmental degradation, and that there should be

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no significant adverse cumulative environmental effects from continuing to use the RISDS on a long-term basis.

8. Interference With Shipping, Fishing, Recreation, Mineral Extraction, Desalination, Fish and Shellfish Culture, Areas of Special Scientific Importance and Other Legitimate Uses of the Ocean (40 CFR 228.6(a)(8)). In evaluating whether disposal activity at the RISDS could interfere with shipping, fishing, recreation, mineral extraction, desalination, areas of scientific importance and other legitimate uses of the ocean, EPA considered both the direct effects from depositing dredged material on the ocean bottom at the proposed sites and the indirect effects associated with increased vessel traffic that will result from transportation of dredged material to the RISDS. Area that concern the criteria of this section were removed from consideration early in the screening process for the DEIS. The RISDS is not located in shipping lanes and is not in area of special scientific importance, desalination, fish and shellfish culture or mineral extraction. Accordingly, depositing dredged material at the RISDS will not

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interfere with any of the activities mentioned in this criterion. Increased vessel traffic involved in the transportation of dredged material to the proposed disposal site should not impact shipping or activities discussed above.

9. The Existing Water Quality and Ecology of the Sites As Determined By Available Data Or by Trend Assessment Or Baseline Surveys (40 CFR 228.6(a)(9)). Water and sediment quality analyses conducted in the site and experience with past disposal in this region have not identified any adverse water quality or ecological impacts from ocean disposal of dredged material. Baseline data are further described in the DEIS

10. Potentiality for the Development or Recruitment of Nuisance Species in the Disposal Sites (40 CFR 228.6(a)(10)). Based on the available evidence, dredged material is not a potential

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source for the development or recruitment of nuisance species at the RISDS. Monitoring results

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and available data indicate that placement of dredged material at Site 69B (which is in the same exact location as the RISDS) has not extended the range of undesirable living organisms, pathogens, degraded areas, or introduced viable nonindigenous species into the area. Local opportunistic benthic species characteristics of disturbed conditions are expected to be present and abundant at any ocean dredged material disposal site in response to physical deposition of sediments. However, no recruitment of nuisance species or species capable of harming human health or the marine ecosystem is expected to occur at the site.

11. Existence at or in Close Proximity to the Sites of Any Significant Natural or Cultural Feature of Historical Importance (40 CFR 228.6(a)(11)). As part of the site selection for Site 69B, the Corps conducted an archeological assessment, Entitled "Archeological Assessment, Remote Sensing, and Underwater Archeological Survey For the Providence River and Harbor Maintenance Dredging Project, Rhode Island, April 12, 2001." The archeological assessment is available upon request by contacting the person listed in the FOR

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FURTHER INFORMATION CONTACT section. The assessment determined that no significant sites were likely to be found within the areas of interest, but there was a potential for historic resources because of known shipwrecks in the vicinity. Additional remote sensing studies were conducted and no significant cultural resources were identified. Coordination between EPA and the Corps and the Commonwealth of Massachusetts and State of Rhode Island are detailed in the DEIS. The Narragansett Indians were included as cooperating agencies during the development of the DEIS. They have also not identified any natural or cultural features of historical significance at the RISDS.

F. Proposed Action

The DEIS concludes that the RISDS (currently known as Site 69B) may appropriately be designated for long-term use as a dredged material ocean disposal site. The proposed site is compatible with the general and specific factors used for site evaluation.

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EPA is publishing this proposed rule to propose the designation of the RISDS as an EPA-approved dredged material ocean disposal site. The monitoring and management of requirements that will apply to this site are described in the draft SMMP (Appendix C of the DEIS). Management and monitoring will be carried out by EPA New England in conjunction with the Corps' New England District.

It should be emphasized that, if an ocean disposal site is designated, such a site designation does not constitute or imply Corps or EPA's approval of open water disposal of dredged material from any specific project. Before disposal of dredged material at the site may commence, EPA and the Corps must evaluate the proposal according to the ocean dumping regulatory criteria (40 CFR part 227) and authorized disposal. EPA has the right to disapprove of the actual disposal, if it determines that environmental requirements under the MPRSA have not been met.

The information generated for this project and referenced in the DEIS is available for review on line at the address;

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http://www.epa.gov/region1/eco/ridredge/index.html.

1. Electronically. You may review and/or obtain electronic copies of this document and various support documents from the EPA Home page at the Federal Register http://www.epa.gov/fedrgstr/, or on the EPA New England Region's Home page at http://www.epa.gov/region1/eco/ridredge/index.html.

2. In person. The proposed rule, the Draft Environmental Impact Statement (DEIS) which includes the SMMPS (Appendix C), and the complete administrative record for this action are available for inspection at the following locations: (A) EPA New England Library, 11th Floor, One Congress Street, Suite 1100 (CWQ), Boston, MA 02114-2023. For access to the documents, call Peg Nelson at (617) 918-1991 between 10 a.m. and 3 p.m. Monday through Thursday, excluding legal holidays, for an appointment. (B) EPA Atlantic Ecology Division, Library, 27 Tarzwell Drive, Narragansett, RI 02882. For access to the documents, call Mimi Johnson at (401) 782-3025 between 10 a.m. and 3 p.m. Monday through Thursday, excluding legal holidays, for an appointment. The EPA public information regulation (40 CFR part 2) provides that a reasonable fee may

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be charged for copying. We are also putting copies of the DEIS in all of the Town libraries in the coastal towns in RI & southeast MA.

G. Statutory and Executive Order Reviews

1. Executive ORDER 12866: Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether the regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(A) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

(B) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

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(C) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(D) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

It has been determined that this proposed action is not a "significant regulatory action" under E.O. 12866 and is therefore not subject to OMB review.

2. Regulatory Flexibility Act (RFA), as Amended By the Small Business Regulatory Enforcement Fairness Act of 1996, (SBREFA), 5 U.S.C. 601 et seq.

The RFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.

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For the purposes of assessing the impacts of today's rule on small entities, a small entity is defined as: (1) A small business based on the Small Business Administration's (SBA) size standards; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. EPA has determined that this action will not have a significant adverse economic impact on small entities because the proposed ocean disposal site designation does not regulate small entities. The site designation will only have the effect of providing a long term environmentally-acceptable disposal option for dredged material. This action will help to facilitate the maintenance of safe navigation on a continuing basis. After considering the economic impacts of today's proposed rule on small

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entities, it has been determined that this action will not have a significant adverse economic impact on a substantial number of small entities.

3. Paperwork Reduction Act

This proposed rule would not impose an information collection burden under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501, et seq.) because it would not require persons to obtain, maintain, retain, report, or publicly disclose information to or for a Federal agency.

4. The Unfunded Mandates Reform Act and Executive Order 12875

Title II of the Unfunded Mandates Reform Act (UMRA), Public Law 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under Section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with

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"Federal mandates" that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective or least burdensome alternative if the Administrator publishes with the final rule an explanation of why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments to have

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meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

EPA has determined that this proposed action contains no Federal mandates (under the regulatory provisions of Title II of the UMRA) for State, local and tribal governments or the private sector. It imposes no new enforceable duty on any State, local or tribal governments or the private sector. Similarly, EPA has also determined that this proposed action contains no regulatory requirements that might significantly or uniquely affect small government entities. Thus, the requirements of section 203 of the UMRA do not apply to this rule.

5. Executive Order 13132: Federalism

Executive Order 13132, entitled "Federalism" (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies

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that have federalism implications." "Policies that have federalism implications" are defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government."

This proposed rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. This proposed rule addresses the designation of an ocean disposal site in Rhode Island Sound for the potential disposal of dredged materials. This proposed action neither creates new obligations nor alters existing authorizations of any State, local or governmental entities. Thus, Executive Order 13132 does not apply to this rule. Although section 6 of the Executive Order 13132 does not apply to this proposed rule, EPA did consult with representatives

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of State and local governments in developing this rule. In addition, and consistent with Executive Order 13132 and EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed rule from State and local officials.

6. Executive Order 13175: Consultation And Coordination With Indian Tribal Governments

Executive Order 13175, entitled "Consultation and Coordination With Indian Tribal Governments" (59 FR 22951, November 6, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by Tribal officials in the development of regulatory policies that have Tribal implications." "Policies that have Tribal implications" are defined in the Executive Order to include regulations that have "substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and the Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes."

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The proposed action does not have Tribal implications. If finalized, the proposed action would not have substantial direct effects on Tribal governments, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes, as specified in Executive Order 13175. This proposed rule designates an ocean dredged material disposal site and does not establish any regulatory policy with tribal implications. EPA specifically solicits additional comment on this proposed rule from tribal officials. Thus, Executive Order 13175 does not apply to this rule.

7. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

Executive Order 13045 (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe might have a disproportionate

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effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health and safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency. This proposed rule is not an economically significant rule as defined under Executive Order 12866 and does not concern an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. Therefore, it is not subject to Executive Order 13045.

8. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

This proposed rule is not subject to Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355 (May 22, 2001)) because it is not a significant regulatory action under Executive Order 12866.

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9. National technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer Advancement Act of 1995 ("NTTAA"), Public Law 104-113, section 12(D) (15 U.S.C. 272 note), directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the agency decides not to use available and applicable voluntary consensus standards. This proposed rule does not involve technical standards. Therefore, EPA did not consider the use of any voluntary consensus standards.

10. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority

Populations and Low-Income Populations

Executive Order 12898 requires that, to the greatest extent practicable and permitted by law, each Federal agency must make achieving environmental justice part of its mission. Executive Order 12898 provides that each Federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under such programs, policies, and activities because of their race, color, or national origin.

No action from this proposed rule would have a disproportionately high and adverse human health and environmental effect on any particular segment of the population. In addition, this rule does not impose substantial direct compliance costs on those

communities. Accordingly, the requirements of Executive Order 12898 do not apply.

11. National Environmental Policy Act of 1969

Section 102 (c)of the National Environmental Policy Act of 1969, Section 4321 et seq., (NEPA) requires Federal agencies to prepare environmental impact statements (EIS) for major Federal action significantly affecting the quality of the human environment. The objective of NEPA is to build into the agency decision-making process careful consideration of all environmental aspects of proposed actions. Although EPA ocean dumping program activities have been determined to be "functionally equivalent" to NEPA, EPA has a voluntary policy to follow NEPA procedures when designating ocean dumping sites. See, 63 FR 58045 (October 29, 1998). In addition to the Notice of Intent published in the Federal Register on April 6, 2001, (66 FR 18244), EPA and the Corps published legal notices in local newspapers and issued a press release inviting the public to participate in DEIS scoping meetings. Formal

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scoping meetings were conducted on May 17, 2001 and May 22, 2001. In addition EPA and the Corps have held public workshops in several working group meetings. As discussed above, EPA is issuing a DEIS for public review and comment in conjunction with publication of this proposed rule.

In addition, EPA and the Corps will submit Coastal Zone Consistency determinations to the State of Rhode Island. Coordination efforts with NMFS and USFWS for ESA and EFH consultation was completed on April 8 and April 1, respectively, during the DEIS process.

12. The Endangered Species Act

Under section 7(a)(2) of the Endangered Species Act, 16 U.S.C., 1536(a)(2), Federal agencies are required to "insure that any action authorized, funded, or carried on by such agency * * * is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species * * *." Under regulations implementing the

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Endangered-Species Act, a Federal agency is required to consult with either the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (depending on the species involved) if the agency's action "may affect" endangered or threatened species or their critical habitat. See, 50 CFR 402.14(a).

In 2001, EPA prepared a BA for the selection of Site 69B, which is in the exact same location as the RISDS. EPA reinitiated threatened and endangered species consultation with NMFS and USFWS as part of the designation process of the RISDS. NMFS concurred on April 8, 2004, and USFWS concurred on April 1, 2004 that there are unlikely to be any effects on threatened or endangered species or their critical habitat as a result of the proposed action. The USFWS and NMFS concurred with EPA's determination that species under its jurisdiction would not likely be adversely affected by the proposed action. The BA concludes that the proposed action is not likely to affect threatened and endangered species. The BA is available upon request by contacting the person listed in the FOR FURTHER INFORMATION CONTACT section.

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13. Magnuson-Stevens Fishery Conservation and Management Act

The 1996 Sustainable Fisheries Act amendments to the Magnuson-Stevens Conservation and Management Act (MSFCMA) require the designation of Essential Fish Habitat (EFH) for Federally managed species of fish and shellfish. Pursuant to section 305(b)(2) of the MSFCMA, Federal agencies are required to consult with the National Marine Fisheries Service (NMFS) regarding any action they authorize, fund, or undertake that may adversely affect EFH. An adverse effect has been defined by the Act as follows: "Any impact which reduces the quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions." In 2001, an EFH assessment was prepared for the selection of Site 69B (the proposed RISDS). EPA reinitiated EFH consultation with NMFS as part

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of the designation process of the RISDS. NMFS concurred on April 8, 2004 that the proposed action is not likely to affect those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EPA has incorporated MNFS recommendations into the draft SMMP (Appendix C of the DEIS). The EFH assessment concludes that the proposed action is not likely to affect those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH assessment is available upon request by conducting the person listed in the FOR FURTHER INFORMATION CONTACT section.

14. Plain Language Directive

Executive Order 12866 requires each agency to write all rules in plain language. EPA has written this proposed rule in plain language to make this proposed rule easier to understand.

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15. Executive Order 13158: Marine Protected Areas

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Executive Order 13158 (65 FR 34909, May 31, 2000) requires EPA to "expeditiously propose new science-based regulations, as necessary, to ensure appropriate levels of protection for the marine environment." EPA may take action to enhance or expand protection of existing marine protected areas and to establish or recommend, as appropriate, new marine protected areas. The purpose of the Executive Order is to protect the significant natural and cultural resources within the marine environment, which means "those areas of coastal and ocean waters, the Great Lakes and their connecting waters, and submerged lands thereunder, over which the United States exercises jurisdiction, consistent with international law."

Today's proposed rule implements section 103 of the MPRSA which requires that permits for dredged material are subject to EPA review and concurrence. The proposed rule would amend 40 CFR 228 .15 by establishing the RISDS. As such, this proposed rule would afford additional protection of aquatic organisms at individual, population, community, or ecosystem levels of ecological

structures. Therefore, EPA expects today's proposed rule would advance the objective of the Executive Order to protect marine areas.

List of Subjects in 40 CFR Part 228

Environmental protection, Water pollution control.

Dated: April 16, 2004.

Robert W. Varney,
Regional Administrator, EPA New England.

In consideration of the foregoing, EPA is proposing to amend part 228, chapter I of title 40 of the Code of Federal Regulations as follows:

PART 228 -- CRITERIA FOR THE MANAGEMENT OF DISPOSAL SITES FOR OCEAN DUMPING

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

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

2. Section 228.15 is amended by removing and reserving paragraphs (b)(1), and (b)(2), and by

adding and reserving paragraphs (b)(3) and (b)(4) (currently proposed for LIS sites); and adding paragraph (b)(5) to read as follows:

Sec. 228.15 Dumping sites designated on a final basis.

* * * * *

(b) * * *

(5) Rhode Island Sound Disposal Site (RISDS)

(i) Location: Corner Coordinates (NAD 1983): 41[deg]14'21" N, 71[deg]23[min]29[sec] W; 41[deg]14 [min]21[sec] N, 71[deg]22[min]09[sec] W; 41[deg]13 [min]21[sec] N, 71[deg]23[min]29[sec] W; 41[deg]13[min]21[sec]N, 71[deg]22[min]09[sec] W.

(ii) Size: 1 square nautical mile.

(iii) Depth: Range from 32 to 39 meters.

(iv) Primary use: Dredged material disposal.

(v) Period of use: Continuing use.

(vi) Restriction: Disposal shall be limited to dredgedmaterial.

* * * * *

[FR Doc. 04-9720 Filed 4-29-04; 8:45 a.m.]

BILLING CODE 6560-50-P

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MODERATOR ROSENBERG: Thank you.

A transcript of this hearing is being made to ensure detailed review of all the comments. A copy of the transcript will be available at the EPA New England Region One Office in Boston at the Corps New England District Headquarters in Concord, Massachusetts, for your review, or it will also be put on the website for your use, or you may make arrangements with the stenographer for a copy at your own expense.

Individuals speaking today and this evening will be called to the microphone in the order that they signed in, and as provided for by our hearing protocol. When making a statement, please come forward to the microphone, either one, state your name and the interest you represent. As many know, we have time limits on that. Since there are a few that will be providing information this afternoon, we are setting a five-minute informal limit. We will not be using the stoplight

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this afternoon.

If you are reading prepared comments, I encourage you to also submit a written copy to the stenographer to ensure that all comments are accurately reflected in the hearing record.

Please be courteous and limit your remarks to the recommended time limit of five minutes. If not, no problem. Please identify if you're speaking for or representing a position of an organization. If you're speaking for yourself, please do so.

We will now receive those comments according to our hearing protocol. Before we begin, I would like to thank Nancy Langrall from Senator Reed's office who is here today. Thank you for coming, and please send Senator Reed our regards.

At this moment, we have one speaker that is signed up to speak, John Torgan.

(Laughter.)

AUDIENCE PARTICIPANT: Wow, imagine that.

MR. TORGAN: I should have brought my own microphone; to do more entertaining for you.

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MODERATOR ROSENBERG: Maybe we'll use the stoplight.

(Laughter.)

MR. TORGAN: Thank you very much for the opportunity to speak, and thanks for holding this hearing. I have only some very brief comments, everybody will be glad to hear, and we'll all get out of here early.

TORGAN-1

But I have one question first to the record to Carlton Hunt. If you can answer it today, that will be great, but the -- in the purpose and needs section, the survey that showed the cubic yards expected to be needed to dredge is different from the one that appears in the EIS, and I wonder if that is -- how old that is, and whether it's been recently revisited, because the dredging needs, as represented by the requests by Governor Almond in 2000 are no longer the volumes of dredging needs today. The initial request did include some eight or nine million to 14 million cubic yards for the Quonset container port project, which is no longer being pursued as an EIS.

And the other thing is that nine million cubic yards were included under the

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TORGAN-1 (cont.)

Providence River and Harbor Project, and that project is underway and near completion. So we would ask that the survey determine the need and the volumes be updated for purposes of this project.

I think the fact that I'm the only

TORGAN-2

person speaking here today may -- I'm not exactly sure what that means. I appreciate -- my phone. I appreciate the efforts of EPA and the Corps and the cooperating agencies to keep Save the Bay, the organization I'm representing, apprised of this project; participated in the working group; and it has been my impression that the public process on this has been inclusive and complete; that the scientific basis for these determinations has been thorough and professional, and we felt that we have had our comments adequately considered throughout the process; and that the science is, what we have seen so far, fundamentally sound.

In terms of the process though,

TORGAN-3

ordinarily, at Save the Bay, we get a lot of calls and comments and concerns when these projects are proposed publicly, and we haven't received any comments from -- from our membership, from the

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TORGAN-3 (cont.)

public around Narragansett Bay, about this EIS or these proceedings. I haven't heard really anything. The only calls that I have gotten on it have been from residents in Block Island and representatives of municipal organizations on Block Island. So perhaps some effort should be made to contact the Town of New Shoreham, their counsel or officers, to solicit their comments and input, because that is the only place that I'm hearing strong concerns at this time. Maybe tonight's hearing will be different.

So the comments that we have really are in two categories, process, procedural issues, and then the substantive environmental issues. The process issues, I've sort of referred to that we want to make sure, as you do, that the affected parties have the opportunity to provide input into this process; and that if you do not receive an adequate number of comments or input to field that you have reached those audiences, perhaps one way to address that would be to extend the public comment period perhaps to hold an additional hearing, maybe on Block Island, or where you find that additional comments are coming from or

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TORGAN-3 (cont.)

lacking.

TORGAN-4

The other thing about process, when this gets to the real substantive comments on this, is that Rhode Island, since the inception of this EIS in 2000, has made tremendous progress on solving our decades-old-dredged dilemma. We have worked with you, the EPA and the Corps, I think, and Congressional offices, the agencies, the University of Rhode Island, CRMC, have really changed the way we have looked at this issue to address the substantive and significant environmental issues, and to develop, both for purposes of the major Providence River Project and also for the -- for the non-Federal projects in the state, and as a matter of state policy, a new law, a new Rhode Island statute that was passed related to dredged material management, and are in the process of developing a dredged material management plan for the State of Rhode Island, which I think will be very important to inform the long-term disposal and dredging management issues.

Part of this, though, in the Rhode Island statute was to identify a preferred hierarchy for dredged material disposal; that when

TORGAN-4 (cont.)

an applicant seeks to dredge, whether it be they public or private, Federal or non-Federal interests, that they demonstrate the need for -- for the project, and that the -- that in considering disposal options, they have worked through a hierarchy that places at the top the most preferred alternative being beneficial use, and beneficial use above even upland disposal in water disposal, and other options; and Rhode Island statute requires the applicant to demonstrate that they have considered those less damaging approaches, such as beneficial use before approving inwater disposal.

And so a concern that stems out of this is that by designating an inwater disposal site for a long-term basis, it may remove some of the incentive for private or public applicants to consider beneficial use, or it may erode the feasibility of beneficial use options, recognizing that this EIS did not consider beneficial use, given the volume of the survey.

That is one concern. And the other thing that being that project that may not ordinarily be able to consider open water disposal

TORGAN-4 (cont.)

as a feasible option will now be able do it. Not to say that it amounts to a pro forma approval of a dredged project that seeks to use this disposal site, but it may indirectly serve to -- to remove some of the incentive to think of more creative and conservative strategies for dredging management.

In terms of the substantive impacts, I think that the -- from what I have seen of EIS, the science looks thorough, and the expectation of recovery time is probably fair. It's not -- you know, our concern isn't directed as much toward what we would consider to be the long-term environmental impact, so much as it is the way that -- of approving this site could impact our dredging policy and process in the State of Rhode Island, and so -- what else was I going to say?

I'll leave it at that, but I appreciate that, and if I could get an answer at some point on the question about the needs survey, the needs analysis, I would appreciate that very much.

Thank you.

MODERATOR ROSENBERG: Thank you, sir.

Is there anybody here that did not check the box to speak, but would wish to speak at

this time?

Ladies and gentlemen, we are going to recess this hearing. As individuals -- should individuals come in between now and 4:00 p.m., we will still be here to take comment. At 4:00 we will recess and reopen at 7:00.

Okay. And we will continue with the public meeting, if you will, so if you have questions, but the record will close at this point, and we will reopen should somebody come in and give testimony.

Thank you. This hearing is now in recess.

(Whereupon, at 2:14 p.m., the hearing was suspended.)

(Whereupon, the Public Meeting was conducted.)

MODERATOR ROSENBERG: Ladies and gentlemen, this hearing is now in recess until 7:00 p.m.

Thank you very much.

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E V E N I N G S E S S I O N

MODERATOR ROSENBERG: Good evening. I am Larry Rosenberg, Chief of Public Affairs for the United States Army Corps of Engineers in New England.

I would like to welcome you to this public hearing, and hope to receive your comments and input on the Draft Environmental Impact Statement for the Rhode Island Regional Long-Term Dredged Material Disposal Site Evaluation Project released by the government on April 30th.

This hearing is being held in accordance with the National Environmental Policy Act for the sole purpose of listening to you. Before we begin, I would like to thank you for getting involved in this environmental review process.

You see, we're here to listen to your comments, to understand your concerns, and provide you an opportunity to appear on the record, should you care to do so. This hearing is yours.

Our Hearing Officer this evening is Mel Cote, Manager of the Water Quality Unit, of the

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Office of Ecosystem Protection for the Environmental Protection Agency, New England Region, that is headquartered in Boston, Massachusetts.

Other Federal representatives with me this evening are from EPA: Olga Guza; EPA's Project Manager Ann Rodney, an EPA team member; and from the United States Army Corps of Engineers, Mike Keegan, the Corps of Engineers Project Manager; Kathy Rogers, the Army Corps environmental team member, and the staff of the Public Affairs office, who you met as you entered this facility.

Should you need copies of the Public Notice, it appeared in the Federal Register, the hearing procedures, or other pertinent information is available at the registration table.

The agenda this evening is following this introduction, Mel Cote will address the hearing. He will be followed by the Corps' Project Manager, Mike Keegan, who will provide a brief project history and overview of the Corps' role and discuss the public meeting that will follow this hearing.

Mike will then introduce Dr. Carlton

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Hunt from Battelle, a contractor to the Army Corps of Engineers, who will make a 30 minute or so presentation on EIS processes and the recommendations.

I will then open this hearing to public comment, using -- utilizing our hearing protocol.

I should point out that the Draft Environmental Impact Statement has made a preliminary recommendation, and that no final decision has -- will be made until your comments and concerns are heard and addressed.

The public comments for this Draft EIS started on April 30th, and will close on June 21st. We encourage you to submit your comments for consideration in the development of the final EIS decision document.

Now, before we begin, I would like to remind you of the importance of filling out those cards that were available at the door. These cards serve two purposes. First, they let us know that you are interested in this project, so we can keep you informed by adding you to the project mailing list.

Second, they provide me a list of those

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who wish to speak tonight.

If you did not complete a card, or wish to speak or receive future information regarding this project, please fill out a card, and once again, it is available at the registration desk.

One additional comment. We are here to receive your comments, not to enter into any discussion of those comments, or to reach any conclusion. Any questions you have should be directed to the record, and not to the individuals on the panel.

Once this public hearing is closed, however, we will open a public meeting where you will have the opportunity to ask questions, and be provided answers by representatives of the EPA and the Corps and others associated with this project.

Thank you.

Ladies and gentlemen, Mel Cote.

MR. COTE: Thank you, Larry.

And good evening, everyone. As Larry mentioned, my name is Mel Cote. I am the manager of the Water Quality Unit at the U.S. Environmental Protection Agency's New England Regional Office.

Thank you for coming to this public

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hearing on the Draft Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project. Whether it's the voice of support for or concerns about the Federal action proposed in this Draft EIS, or simply to learn more about the project, we welcome your participation.

On April 30th, EPA published a Federal Register notice and issued a press release announcing the availability of the Draft EIS for public comment until June 21st. We posted the Draft EIS and a link to supporting documents on our website, and based on responses to an inquiry that we sent to a large mailing list of agencies, organizations and individuals, we mailed either a Notice of Availability with directions on how to access the EIS, or an executive summary of the Draft EIS, or the complete document, to interested parties. This is consistent with our ongoing efforts throughout the site designation process to provide the public with ample opportunity to get information about the project, and to give us their feedback, and it's why we are here today, to listen to and record any comments that you may have on the

Draft EIS.

EPA and the U.S. Army Corps of Engineers jointly regulate dredged material disposal under Federal authorities provided by section 404 of the Clean Water Act and section 103 of the Marine Protection, Research and Sanctuaries Act, which is also known as the Ocean Dumping Act. Section 404 of the Clean Water Act applies to dredged material disposal in state waters, while disposal in Federal waters is subject to the rigorous sediment testing and disposal site designation criteria and site management monitoring plan requirements of the Ocean Dumping Act. Since this project is in Federal waters, the Ocean Dumping Act applies only.

In administering these programs, we work closely with other Federal resource management agencies, like the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, Indian tribes and state environmental agencies to ensure proper coordination and consistency with statutory and regulatory requirements and environmental standards.

The Ocean Dumping Act authorizes the

Army Corps of Engineers to select sites for sort-term use, and EPA designates sites for long-term use. In 2001, the Corps, in cooperation with EPA, exercised its Ocean Dumping Act authority to select the dredged material disposal site for the Providence River and Harbor Maintenance Dredging Project, the site known at Site 69B, and disposal operations from that project began in April 2003.

The Ocean Dumping Act limits the availability of Corps-selected sites for disposal activity to two five-year periods. The first five-year period begins with the first disposal activity. In this case, April 2003. And the second five-year period begins with the first disposal activity commencing after completion of the first five-year period. Thus, the Corps can select disposal sites only for short-term limited use; whereas, Congress authorized EPA to undertake long-term site designations, subject to ongoing monitoring requirements to ensure the sites remain environmentally sound.

Periodic dredging, and therefore dredged material disposal, are essential for

ensuring safe navigation and facilitating marine commerce. EPA believes it's preferable, from an environmental perspective, to dispose of dredged material in only a few discrete locations, so that -- so it can be more easily managed and monitored to protect the marine environment.

In the course of selecting Site 69B for the Providence River Project, it was acknowledged that the short-term availability of that site was insufficient to meet the long-term dredging needs of the Rhode Island region. With a continuing need for dredged material disposal, and the impending expiration of the short-term site selection for the Providence River Dredging Project, the Corps was faced with the prospect of having to continue to select new disposal sites that could only be used for a maximum of two five-year periods. In the long-term this could result in the proliferation of disposal sites in the Rhode Island region, and that is why we are here today.

In September of 2000, EPA and the Corps received a request from the Governor of Rhode Island to evaluate the designation of one or more long-term, open water dredged material disposal

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sites, citing the difficulties that navigational facilities were experiencing due to a backlog of maintenance dredging activities. This backlog stemmed from a lack of environmentally acceptable and cost-effective disposal options available to the navigation community. Subsequent dredging needs surveys conducted by EPA and the Corps confirmed the need for a long-term disposal option.

The two agencies agreed to fulfill this request, and also agreed that consistent with past practice in designating dredged material disposal sites, we would follow EPA's Statement of Policy for voluntary preparation of National Environmental Policy Act, or NEPA, documents, and would prepare an Environmental Impact Statement to evaluate different dredged material disposal options. EPA and the Corps tried to prepare this Draft EIS to be consistent with EPA's NEPA-implementing regulations, as well as those promulgated by the Council for Environmental Quality for additional guidance.

So the two primary Federal laws that are -- that were -- under which were conducting the site designation are the Marine Protection,

Research and Sanctuaries Act, or the Ocean Dumping Act, which among other things establishes criteria to identify suitable locations for dredged material disposal, and the National Environmental Policy Act, which requires Federal agencies to establish a clear purpose and need for a proposed Federal action, evaluate various alternative approaches to meeting that need, and choose the least environmentally damaging yet practicable alternative. Both statutes require public participation in the decision making process.

Although EPA is the agency authorized by the Ocean Dumping Act to designate dredged material disposal sites, the Corps is participating in the development of this EIS as a cooperating agency, because it has knowledge concerning the needs of the dredging program, as well as technical expertise in assessing the environmental effects of dredging and dredged material disposal.

The Corps is also providing technical and financial support in the development of the EIS, but all final decisions regarding any site designations will be made by EPA.

To take advantage of expertise held by

other entities, and ensure compliance with all applicable legal requirements, EPA also is closely coordinating this effort with other Federal agencies, including the National Marine Fisheries Service and Fish and Wildlife Service, Indian tribal governments, state environmental and coastal zoning management agencies and local governments, some of which are participating as cooperating agencies.

EPA and the Corps also have conducted extensive public participation activities, including numerous workshops and informational meetings, to explain the process and disseminate technical findings, and to solicit feedback from the public to help guide the process.

We are here today to present information on the Draft EIS that evaluates the long-term disposal options for the Rhode Island region, and to solicit feedback on this document and the Federal action it proposes in the form of oral or written comments.

We encourage and welcome your oral and written comments, but we will not be responding to them during the public hearing portion of this

evening's proceedings. As Larry might have explained, or Mike is about to explain, there will be a question and answer session during the public meeting immediately following this formal hearing. The comments we receive will be given equal consideration upon conclusion of the public comment period, for the purposes of finalizing the EIS and issuing final rulemaking.

The final EIS will include responses to all comments that we receive. EPA and the Corps anticipate releasing the final EIS later this year, December 2004, and if recommended by the EIS, issuing a final rule that will officially designate the site in early 2005. For accuracy of the record, your written comments should be sent to Olga Guza at the EPA New England Regional Office, and will be accepted until close of business on Monday, June 21st.

Thank you again for your participation in this public hearing, and for your interest in the issue of dredged material management in the Rhode Island region.

MODERATOR ROSENBERG: Ladies and gentlemen, Mike Keegan.

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MR. KEEGAN: Thank you, Larry.

As Larry mentioned, my name is Mike Keegan. I'm the Corps' Project Manager for the Rhode Island Region Long-Term Dredged Material Disposal Evaluation Project.

The purpose of this project is to evaluate the feasibility of designating a long-term dredged material disposal site to assist both public and private navigational facilities, while meeting maintenance requirements to ensure safety, and to meet the navigational needs of commercial shipping, fishing and recreational vessels.

The Corps currently has 18 project -- navigational projects in Rhode Island, and 17 in southeastern Massachusetts that we are required to maintain to a safe navigable depth for vessels ranging from large cargo carriers to recreational boats. Some of this dredged material from the harbor is clean sand, which is suitable for use as renourishment for the area's beaches when they are available. Other material is not compatible as nourishment, because it has a different grain size than the beach material.

Fairly recently, the Corps completed an

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Environmental Impact Statement, which selected an ocean disposal site for Rhode Island Sound for the disposal of material to be dredged from the Providence River and Harbor Project, which would restore the Federal channel to its authorized depth, and eliminate the impact that shoaling of the channel had on commercial shipping.

This material must, according to Federal law, undergo a series of rigorous physical, chemical and biological testing to prove its suitability for placement in the Sound. Although this selected site, called 69B, is currently available to meet the short-term maintenance needs of the Rhode Island region, other navigation facilities in the region have experienced a tremendous backlog in dredging needs due to the limited disposal options.

It was because of the amount of time that was needed to conduct the Providence EIS, and the fact that the state believed it was prudent to attempt to address the long-term navigation needs of the area, that the Governor of Rhode Island wrote a letter to both the Corps of Engineers and US EPA requesting that we evaluate the feasibility

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of a long-term designation.

As Mel mentioned, the EPA is the agency responsible to designate a long-term disposal site, but the Corps has a great deal of expertise in both dredging, the dredging needs, and assessing the dredging impact and disposal on potential environment. And for that reason, EPA requested the Corps become a cooperating agency in the evaluation of this project. Both agencies agreed that updated information was needed to be acquired that could supplement historic information, as well as the data that was collected as part of the Providence EIS project. Both agencies also recognized the need to involve the public in every aspect of this project.

In addition to conducting an extensive literature review to collect all the available information from the project area, various field efforts were also conducted to collect information on oceanography, fish, lobster, shellfish, both for populations and tissue analysis, benthic information was collected, and sediment analysis was also performed.

In order to determine the current and

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future dredging needs, a dredging needs survey was performed. This survey was sent to 450 navigational facilities in both Rhode Island and Massachusetts, and its purpose was to collect information on both the immediate and future dredging needs of for both maintenance and expansion of current facilities.

An investigation into the economic importance of navigation-dependent facilities in the Rhode Island and Southeastern Massachusetts region was also conducted, and it was found that these industries contributed $56,000 -- 56,000 jobs and $3.4 billion annually to the economy of this region.

We also had three meetings with the local fishermen to find out where they fished, so that we could find the areas to avoid in considering a location of an alternative disposal site, and to determine from them if there was a location where a disposal alternative should be considered.

While the field investigations, the economic analysis and dredging needs work was being initiated, the project team worked with the University of Rhode Island Coastal Institute here

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in Narragansett to establish a working group that would assist in the development of screening criteria to help focus our evaluation efforts. The working group is comprised of representatives, Federal, tribal, state and local agencies, representatives of lobster, shellfish, fishing organizations, representatives of the shipping industries, local universities and other organizations that had both an interest and an expertise that they could lend to the project.

The Coastal Institute acted as facilitators to assist the working group in identifying screening criteria that they felt should be included in the initial screening of the project, so that we could eliminate areas where dredging sites should not be considered. That presentation will be given a little later on by Mr. Carlton Hunt.

We wanted to do the screening, because the impacts to some resources, such as fisheries, shellfish or other navigational safety concerns, needed to be considered.

Throughout this project, we have attempted to present information as it became

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available, so that we could get input back from the public and help us focus our efforts. That is also the purpose of tonight's meeting. It's important that we receive your input as well. As Larry will shortly explain, the hearing process is somewhat of a one-way communication. You provide your input, and we record your comments and listen to your thoughts. It's not designed to be a question and answer process. That can be both frustrating to you. We want to have answers to your questions, and to our project team, who also want to answer those questions.

For that reason, following the formal public input period, we will conclude the hearing. We'll open up the public meeting where we can have a two-way dialogue. We will answer any questions that you ask to the best of our ability, go through any of the presentation, and any of the information that is on the placards in the back.

I want to thank you for your involvement in this project, both for the help that people have provided in the past, and for taking the time to be with us today. We have been able to get to this stage because of the assistance of the

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public, and the people who are working with us on the working group. Local knowledge has been an important component in our evaluation process. I look forward to hearing your comments today, as well as encouraging you to provide us any additional comments that you may have by June 21st.

I would like to also introduce Dr. Carlton Hunt from Battelle, who will walk us through the screening criteria, and how we got from basically a large area that we started our study on, initial consideration, down to the recommendation that we made in our draft environmental statement.

Carlton.

MR. HUNT: Thank you, Mike.

Again, I am Carlton Hunt. I work with Battelle, and I am under contract with the U.S. Army Corps of Engineers.

Tonight I briefly want to present and summarize the EIS process, review the pertinent laws and regulations, as you have heard already a little about this evening, and review the purpose and need once again.

Also, we would like to present an

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overview of the screening process that led to the areas that we further reduced to two locations within the area that we studied for sites that were carried forward into the -- as alternatives into the EIS.

I would also like to summarize the evaluation of the environmental and socioeconomic evaluations that we did, and present further alternatives, and lastly, convey the next steps.

As you all know, this started back in the -- back in 2001 with a series of scoping meetings and announcement, particularly of the decision to prepare an EIS and Notice of Intent. Over the last two years, a number of activities have occurred, to include field surveys, literature work, to identify data and information that would inform the decision process, and also included working groups, as Mike indicated, who, in fact, helped define factors that we needed to look at in order to make this recommendation.

We are now in the 45-day comment period. After this period, we will prepare a final EIS that actually incorporates and includes comments that are received during this open period.

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Lastly, towards the end of this year, the final EIS will be issued, and a designation would be carried forward, if that is the final decision.

There are three major statutes in the US that regulate and manage ocean disposal, to include the Rivers and Harbor Act of 1899, the Marine Protection Sanctuaries Act, the Water Resources Development Act and the Clean Water Act. The Clean Water Act is not activated in this process, because the disposal site that we're looking at is outside of state waters and outside -- and within the 12-mile Federal limits.

The purpose of the EIS, as you have heard already, is to evaluate one or more locations for ocean disposal site as to be potentially designated as long-term -- for the receipt of long-term -- for long-term receipt of dredged material from the Rhode Island region. It was initiated, as indicated previously, based on the Governor of Rhode Island, and also supported by Senator Reed.

We moved from that point of request through the point we're at right now by defining

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the need, by defining a Zone of Siting Feasibility, by defining candidate site locations, and also looking and evaluating these alternatives using factors and criteria that are included in the Marine Protection and Sanctuaries Act. There are five specific general criteria and 11 other criteria to look at.

Finally, we looked at the affected environment in great detail. That would include the whole of the Zone of Siting Feasibility, and we evaluated the environmental consequences of placing dredged material in the particular locations that we were evaluating. That led to the preferred alternative that you have before you.

Just to very quickly review the needs. As Mike indicated, there was a survey conducted of the University's navigation facilities, dependent facilities, to determine what their maintenance needs were, as well as new project needs. That included Federal projects, as well as non-Federal projects, and that was a planning horizon of about 20 years.

That particular evaluation determined that there were about 8.8 million cubic yards of

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material that might need to be disposed of in the ocean. This figure before you, I point to the fact that we have indicated that at the point that this is initiated, Quonset Point, was considered to maybe potentially have some dredging needs. To my knowledge, that is not carried forward, and the number that we carried forward, in terms of the need within the EIS, is 8.8 million cubic yards.

This slide depicts the location of the larger -- the bullet that you see on the slide, that dot you see on the slide, is larger volumes of material, potentially needing ocean disposal. You can see the distribution of locations for disposal are -- range throughout the area that we studied, and that the larger projects are up in the Providence River area, some partly down Narragansett Bay, and the other ones are over in the Buzzard's Bay area.

Once that was determined, we needed to determine the Zone of Siting Feasibility. That was based on five criteria, political boundaries, navigation restrictions, type of disposal equipment that could be used, cost of transporting dredged material, and lastly the distance to the

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continental shelf. These criteria are housed in a number of guidance documents, both nationally and internationally.

The major consideration in determining how far offshore we should look was safety, vessel operation safety, crew safety. Dredging oftentimes occurs in the winter, and oftentimes there are major storms, and therefore the practical factors and safety factors come into play.

This figure depicts the area that we looked at as potentially being in the Zone of Siting Feasibility. The arcs that you see there are 20 nautical mile arcs drawn around each of the dredging centers for locations that were identified, and you can see that a number of them reached further offshore, particularly south of Block Island, and south of Martha's Vineyard and the Nantucket area.

We took the information I described in the previous slide, and this particular information set. We come up with a location that you see depicted in the blue square to the south of Rhode Island that extends from the Connecticut/Rhode Island border southward, east of New York State

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waters -- excuse me -- southerly past New York State waters and the tip of Long Island Sound, extending eastward to a location south of Southeastern Massachusetts, and then back along the Massachusetts state waters into Southern Massachusetts and Rhode Island.

Once we had that identified, the next step was to, in fact, look at areas that could be acceptable for including -- for locating a dredged material disposal site, and we looked at specific alternatives in that area as part of the process.

And again, I mentioned earlier that there are five general criteria and 11 specific regulatory criteria in the regulations for designating ocean disposal sites. Those formed the cornerstone of our evaluation.

However, those are fairly general statements, and we needed factors in order to completely evaluate that information, and provide information to fully evaluate the criteria and compare. Therefore, the Rhode Island regional working group was formed to, in fact, identify those, and the major areas of concern that were identified and factors of sediment characteristics

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and sediment quality, water quality issues, biological resources that are in the area, to include benthic community, finfish, shellfish, marine mammals, coastal birds.

Rare and threatened endangered species were also considered, their habitat location in this region where they are most often found. Contaminant bioaccumulation into the food chain was a consideration, as were socioeconomic factors. Air quality and noise also were looked at in the EIS, as there are concerns for that type of impact; and lastly we looked at the geological setting and the physical oceanography of the area. That particularly looked at the potential for sediment transport due to currents in the area, currents that are generated by waves, and others come from winds, and other oceanographic factors.

In order to gather the information to complete the survey, we performed a major literature search. I believe the database contains well over 500 citations. We also conducted field studies to fill in data gaps that the literature search had identified. That information was compiled into a geographic information system,

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which is a geospacial representation where you can take various types of information and overlay it to make the kind of decision that we needed to make. I will show you some examples of that in a few moments.

As part of the process, we prioritized the criteria and the factors into two tiers. The first tier were -- was information and factors that were clearly exclusionary, that is that it would not be appropriate to put a site in that -- in a location where there was exclusionary criteria that came into play.

In Tier 2, we evaluated the remaining areas, and under that we evaluated areas that would also be exclusionary. We included areas that Tier 2 would be discussion. And level 3, discussions would be those that would be acceptable for placing a dredged material disposal site.

One of the criteria suggests that dredged material disposal should occur off the continental shelf. That factor was ruled out during the Zone of Siting Feasibility and so, therefore, the sites are not located in that area. Areas of high dispersal potential, that is where

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sediment could be lifted up and moved because of currents and other factors, were deemed areas that we did not want to put a dredged material disposal site. In other words, we wanted to contain the materials maximally within the site.

Areas of conflicting use were also eliminated, anchorages, reserves, scientific -- designated scientific areas, conservation areas, such as sanctuaries, also refuges, national seashores, any place that had conservation in mind. Active ordinance and military use areas were excluded. Particularly, the military use came into play in the evaluation.

Lastly, second to last, we looked at exclusionary, any kinds of utilities that might be in the region would be -- if they were in place within the sea floor, or otherwise that would be a place that the site could not be appropriate.

And then the last thing we looked at was culturally or historically significant areas, such as shipwrecks or other cultural concerns.

Threatened and endangered species were also looked at, in terms of critical habitat, and there are within the zone siting feasibility, so,

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therefore, that became a factor that basically was not operating. There were no concerns.

The next series of slides will show you some of the layers. The particular slide you have before you, the blue colors designate depth. The darker the blue, the deeper the depth.

Also there is a layer that is overlaying on top of this that is like a transparent layer, and outlined in black, and that is the area of potential for erosion to occur, based on the modeling that we did. Those areas were considered to be excluded, and what was left in this particular piece of information were the areas that remain blue.

This is just another example of shipwrecks. We put a half a nautical mile circle, radius circle, around each of these wrecks and excluded that area as being inappropriate for location of dredged material disposal site.

Another example is the military use and utilities. The brown lines you see on this are the cabling that goes to Europe that comes out of Southern Rhode Island. There are also four -- three areas that are military use areas

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that are designated with the hatch marks.

Because these were exclusionary, we were able to black those layers out and say we can't go there. What you see in this particular slide is the area that remained after Tier 1 for further consideration for locating dredged material disposal site.

The map set up information that we -- the set of information that we used to evaluate that remaining blue area, and to minimize impact of fisheries and other resources, living resources in the region, were evaluated underneath the -- for fish habitats, fish concentrations, living resources. Navigation and shipping lanes were another factor that we looked at, and areas where diving and active recreation was occurring.

We also addressed unexploded underwater ordinances; use of historic dump sites, which is also included in the criteria for designating sites; benthic habitat types, and also cultural resources, as previously indicated.

The next set of slides show you the type of data that we generated under this tier of screening. What you see on the slide here are

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areas that a number of people have gathered where fishing occurs, and is very important. The hatch marks depict studies that are conducted in the deep blue or valley area are -- is the location where local fishermen indicated was an important trawling area. The blue dots indicate fish concentrations that the states reported.

The next slide that I have depicts locations of ocean quahog densities in a biomass. The darker hot colors, red colors, are areas of high abundance and biomass, and the blue cool colors are lower abundances. And as you can see, there are a number of areas that there are significant resources for quahogs. This came -- comes from a data set that is approximately 20 years old.

This is a layer for screening for transportation routes. You will see the approaches to the Narragansett Bay and Buzzards Bay area. Also included are major ferry routes. For those locations, we also put a buffer zone around them, in terms of looking to see whether or not it was appropriate to locate a site near those.

This is the excluded area based on the

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Tier 2 screening. As you can see, many areas were excluded on the basis of what I have just shown you. There are some questionable areas in gray. Once you combine this layer with the Tier 1 layer, there are very few locations left in Rhode Island Sound where it was being -- that we may reasonably put a dredged material disposal site.

The two areas that were chosen to carry further in and evaluate further are shown in the pink on the particular slide. The two areas that are blue are further excluded, simply because they are very close to some high fisheries areas and resource areas.

This is a zone -- a depiction of the study areas that we identified as part of the screening process, but we had not reached, at that point in time, was the actual footprint where we would want to locate the sites. In the alternatives, what we did was with this screening layer, identify two, or for each location, each area, a single one square nautical mile footprint that we wanted to place somewhere within one of these areas. So the next step in the process was to, in fact, do that.

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And what we found was that for -- and these were determined to be areas east. That is the eastern most yellow color on the slide, and area W, which is inclusive of 69B, and sediments around that. So those were the areas that we further evaluated.

What we found was that for area E, there was very little data, so a field program was mounted to look at the dymmetry in the area in great detail; side scan sonar to look at habitat, and look for resources within the area; magnetometer surveys to look at iron bearing coastal resources. We looked at currents and tides in the region. We also looked at sediment chemistry. We used a technique called sediment profile imagery to look at the grain size distribution, as well as to get a handle on the types of benthic community that were there, and the health of the benthic community that is in those areas.

We looked at detailed benthic info, accounts, within each of the areas to look at the benthic resources. We conducted finfish trawls, as well as lobster trawls, to evaluate and assess

the -- those particular resources. And the last thing we did is a series of quahog counts to, in fact, determine whether or not we were near any of those high quahog locations that I showed previously.

This slide simply depicts the eastern area. The main point of the slide is there is quite a large variety of sediment types out there. In the upper right side is a rough area of very high relief; and to the south and west on the particular slide you see the brown colors. That is a sandy area. The very gray area, those are areas along the southern part of the study zone are more fine grain sediments.

We took the information I just spoke about and tried to determine where it would be best to locate one square nautical mile alternative. Without getting into great detail on this, the box No. 3 that is in green here was the one that was chosen. It was chosen primarily because it's away from that hard bottom area, that rough bottom area where there are -- had higher presences of lobster, and it was in a slightly sandier location and slightly deeper.

This is the west area, and the green box is the alternative that we determined to carry forward into the EIS. That happens to coincide with Site 69B, but we did conduct other studies outside of that area to determine whether or not we could move that location or -- around a little bit.

This is the -- just the position of the two areas that we carried forward into the EIS, Site W and Site E.

As part of the EIS, the NEPA process, we needed to look at alternatives. One of the alternatives that NEPA requires, one to look at, is the no action alternative. So there were three alternatives evaluated, two -- three alternatives evaluated in EIS, Site W, Site E, and the no action.

We assessed the potential for impact from each of these alternatives underneath the criteria that I have just described previously in terms of site selection and designation. Those were evaluated, in terms of impact, no impact and minimal or minor impacts. Minor impacts are defined as being those that were by the short-term, or they could be mitigated through management

processes.

Very quickly, the EIS has 10 major chapters. The technical chapters are Chapter 3, the Affected Environment, which has a complete description of both the area and the specific sites.

Chapter 4 does the environmental consequences and evaluates against the criteria I have just mentioned. The remaining chapters all provide information that relate to NEPA and the requirements within that.

I will point you to appendices. Within the appendices is a site management and monitoring plan that is also required by the regulations, and there is a draft one for review and comment.

To go through the assessment of impact, I'm not going to speak of the -- the cells that are colored in blue, because those were nondiscriminatory. The impact was determined to be no impact, and therefore no difference. So it was hard to make a decision or judgment. However, I will point out that in terms of sediment erosion and sedimentation, it was felt to be a minor impact. From the disposal process, there would be

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no impact -- no action taken.

The water column transport that was felt to be a major impact, or impact, I should just say, as Site E, and a minor impact at Site W, the reason for that was the modeling that was done for water quality determined that Site E had a higher probability of exceedences of water quality criteria from disposal because of A, its orientation; and B, the types of currents and directions of currents that are at that location.

Water column transport at Site W is considered to be a minor impact, because there is a potential for that, but also for water quality exceedences. However, the impact potential could be mitigated through site management practices.

Sediment quality, again minor impacts. Those are primarily due to changes in grain size. Because of the material going out, there would be -- have not gone through the geological history and processes, so they could be slightly different in terms of grain size.

The benthos was considered to have minor impacts, the two alternatives offshore, because while burial of organisms could occur, they

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would, in fact, recover, and documentation and reports and publications suggest quite strongly that these materials, in fact, come back. The animals, in fact, come back in the sediments once disposal ceases.

Again, minor impacts to lobster, fish and other invertebrates were identified, primarily because it's considered to be a short-term impact; and, in fact, the organisms can come back and inhabit these areas.

Lastly, the use of previous disposal sites is an important consideration, and if we went to Site E it was considered that we would be potentially disrupting another portion of the region out there, and that that was not a desirable thing to do.

And then by going to Site W, that is already being used for disposal, that would minimize any potential, further disruption in the area. That also goes to the cumulative impact that you see at the bottom of this particular graft.

And lastly, air noise and air quality was considered to be a consideration under no action.

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Under no action, the most significant piece was the economic impacts of not being able to move commerce in and out of Narragansett Bay and the southern parts of Massachusetts.

So the preferred alternative that is in the EIS is Site W. It was chosen because of the lower likelihood of sediment transport, the greater likelihood of meeting water quality criteria. It also reduces the regional economic impacts of not being able to move vessels in and out of the area. And it's also an active disposal site at the present time.

The picture you see here is the bathymetry in the site as of February of 2004. The hotter red colors are elevations caused by disposal. The deep blue area is the low topographic load that is in a particular site, in the site right now.

Next steps are to review -- receive your comments, review and respond to those, finalize the EIS, publish it and rulemaking, and then complete the designation process, as we heard, in the early parts of 2005.

Thank you for your attention, and I

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would like to turn this back now to Larry.

MODERATOR ROSENBERG: Ladies and gentlemen, it is crucial to this public process that your voice is heard, and we are here to listen, to listen to your comments, understand your concerns, and to provide you an opportunity to put your thoughts on the record should you care to do so. The information we provide this evening is important, and will assist both the EPA and the United States Army Corps of Engineers in evaluating and developing the course of action that the agencies will jointly recommend in the future.

And I would like to thank you in advance for taking the time to provide us with your views. This hearing will be conducted in a manner that all who desire to express their views will be given an opportunity to do so.

To preserve the right of all to express those views, I ask that there be no interruptions.

When you came in, copies of the Public Notice of Availability and the procedures to be followed at this hearing were available. If you did not receive these, both are available at the registration desk. I will not read either the

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procedures or the Notice of Availability, but they will be entered into the record.

A transcript of this hearing is being prepared, and the record will remain open, and written comments may be submitted tonight or by mail until 5:00 p.m. on June 21st, 2004. All comments will receive equal consideration.

If you know of anyone who cannot attend, but who desires to provide written comments, they should do so, and forward those comments to Olga Guza in EPA's New England Regional Office in Boston, Massachusetts.

Lastly, I would like to re-emphasize that the government has made no final decisions with regard to this project. It is our responsibility to fully evaluate all the information available, including your input, prior to developing the recommendation in the final EIS.

If there is no objection from the Hearing Officer, I will now dispense with the reading of Public Notice of Availability of this hearing and have it entered into the record.

MR. COTE: No objection, Larry.

MODERATOR ROSENBERG: Thank you.

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A transcript of this hearing is being made to assure a detailed review of comments. A copy of the transcript will be available at the EPA New England Regional Office in Boston, and at the Corps' New England District Headquarters in Concord, Massachusetts, for your review; or it will be on the website for your use; or you can make arrangements with the stenographer for a copy at your own cost.

Individuals speaking today will be called to the microphones, either one, in the order they signed in, and as provided for by our hearing protocol. That was, again, distributed at the reception area.

When making a statement, please come forward to the microphone and state your name, and the interest you represent. As there are not many that will be providing comment tonight, we're asking that all comments maintain a five-minute window.

If you are reading prepared comments, I encourage you to also submit a written copy to the stenographer to ensure that all comments are accurately reflected in the hearing record.

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I want to emphasize that all that wish to speak will have an opportunity to do so. While we will not run out of time, once again, if you have additional comments, please put them in writing and forward them to Olga at the EPA office.

We will now receive your comments according to those protocols.

Mr. Bruce Knight.

MR. KNIGHT: My name is Bruce Knight. I own and operate a 42-foot dragger, fishing out of Wickford, Rhode Island. I hope coming down this hot bed of fishermen we didn't scare you tonight. I see there is a Narragansett cop out front.

(Laughter.)

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MR. KNIGHT: As a representative of the Rhode Island Commercial Fishermen's Association, I went to the first public hearing at CCRI's Knight Campus to request an additional public hearing in the South County area. I read a statement and brought a petition for additional public hearings with over 100 signatures.

Our request for a second public hearing was granted and held on September 26th, at URI Bay campus. Six members of the RICFA read statements

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KNIGHT-1 (cont.)

about our concerns of using 69B as the Providence River dump site. We were promised written answers to our concerns in one month. We have received the Corps of Engineers response to comments in June 2002. We were basically told our concerns had no merit. 69B, as the Providence River dump site, was a done deal.

KNIGHT-2

This one I got to get a handle on. I sat on the panel of the Rhode Island Long-Term Dredged Material Disposal Site Evaluation Project -- thank you -- that met eight or nine times at the Coastal Institute. I reiterated at every meeting that talk of a long-term dump site was premature until the effects of dumping at 69B could be seen. The dumping license for 69B is five years, and there was no need to rush to judgment on a long-term dump site. Again, these concerns were brushed aside.

KNIGHT-3

I represented the RICFA at the Rhode Island DOT's public hearing for the disposal of the Jamestown Bridge debris. I negotiated successfully the steel to be recycled and three inshore sites to be taken off the table. The Black Point site was in trap waters and a dragging area. That left two

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KNIGHT-3 (cont.)

dump sites, 69A and Block Island Sound. The DOT refused to take Block Island Sound off the table, even though it was in a drag bottom and a major area of income for the fleet.

I told the DOT time after time that Rhode Island was blessed with a tremendous amount of natural underwater structure, and there was no need for artificial reefs. In December 2003, I thought we had an agreement with the DOT that 69A and the gravel berm on the north and west side of 69B would be used as the disposal site. This fell through when the Army Corps of Engineers decided that one site was ocean disposal and not ocean reef.

KNIGHT-4

As I thought of my statement for this public hearing on a choice of site W or E, I thought keeping it simple and just endorsing Site W. Well, that would make me an advocate of something I fought tooth and nail against just three years ago.

The manipulations of the Army Corps of Engineers has been a wonder to see. When something sinks beneath the surface of the water, it is out of sight and out of mind. We sit here now,

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KNIGHT-4 (cont.)

June 2004, with one active dump site, 69B, or Site W. Two dump sites to go active in 2005, 69A, and an inshore site to be named, and the possibility of Site E becoming the long-term dump site. Amazing.

The first week of June 2004 saw a meeting between the Army Corps of Engineers, DEM, CRMC and the DOT on a suitable inshore site for the Jamestown Bridge debris. This was a meeting even the RIDOT admitted should have occurred two years ago. The arrogance and ruthlessness of the Army Corps of Engineers was something to behold. I suspect the trouble the Army Corps of Engineers has had in courts throughout the United States comes from this attitude.

Personally, I hope this will put my -- an end to my dealings with the Army Corps of Engineers. It's nothing pleasant.

Thank you.

MODERATOR ROSENBERG: Thank you, sir.

The next speaker, Robert Shields.

SHIELDS-1

MR. SHIELDS: My name is Robert Shields. I live in Narragansett, Rhode Island. I would like to address this hearing from two

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SHIELDS-1 (cont.)

aspects, one as a recreational boater, and the other as a chemist and lifelong engineer.

As a boater -- and also, I'm not really qualified to judge the disposal site, and the impact that spoils may have there. What I would like to address is the source of potential disposal. And I realize it's only potential. This -- this could change before the 20 years elapses.

There is no mention of the type of marine activity that would require many of these locations where dredging is to be done. I have no -- as of -- as a registered boater, I have no problem with sea-going vessels moving up and down Narragansett Bay or into Mount Hope Bay. And frankly, also not into Buzzards Bay.

What concerns me is that this may open the door to an activity that I think would be disastrous for urban areas, and that is the transport of LNG into sites that currently exist, or sites, greenfield sites, that are being proposed for LNG plants. They are not shown as such on the Draft EIS, but we all know they are in Providence and in Fall River, and potentially at

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SHIELDS-1 (cont.)

Brayton Point.

I think the public ought to really be aware that the Corps of Engineers may be enabling the transport of large tankers of LNG past bridges, under bridges, past settlements into urban areas that -- that are congested. Any potential accident, namely a fire, would be disastrous. It would -- it would be virtually unextinguishable. I say that as an engineer. There is no infrastructure in place, no technology exists that would put out such a fire. It would be several orders of magnitude more disastrous than the fire balls that developed around the World Trade Center three years ago. I think people need to realize that, and they need to understand the real danger that transport by a ship movement of liquefied gas from the tanker to the wharf and the plant on land would be potentially devastating to those areas that they're going to be those potential sites.

I really have no other comments at this point. I do appreciate the fact that you're having a public hearing so that citizens can voice their concerns over this.

Thanks.

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MODERATOR ROSENBERG: Thank you, sir.

Next speaker, Christopher Brown.

MR. BROWN: Good evening. My name is Christopher Brown. I am the President of the Rhode Island Commercial Fishermen's Association. I would like to take a minute and express that the entire commercial industry in the State of Rhode Island is pretty much opposed to the expansionist tactics employed by the Army Corps into making Rhode Island not the Ocean State any longer, but maybe the ocean dump site state.

BROWN-1

It seems the potential for huge tracks of our now currently healthy environment to turn into wasteland, and hopefully, you know, they will come around and benefit the next generation of people who use the ocean to make a living maybe 20 or 30 years down the road.

It's an awful gamble. We don't care for it. And as far as our exclusion from determining the dump Site E goes, I would like to point out that at no point in time were we, as an organization, myself as a 30-year commercial fisherman, having made roughly 30,000 sets with my net within 10 miles of Block Island, ever one time

BROWN-2

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BROWN-2 (cont.)

consulted with regards to the development of a site in an area in which I make my living.

The standards that we, as commercial fishermen, today are held to with regard to respect for the environment and ecosystem destruction and all the likes is -- is pretty amazing that the same government that is sponsoring this kind of activity is holding my feet to the fire as hard and close as they are. It's -- it's amazing.

But in any event, thank you for having the public process that we have tonight, an opportunity to express my concerns, and we look forward to having an opportunity to meet with you, and possibly giving you our perspective on further dump site selections, should there be a need.

Thank you.

MODERATOR ROSENBERG: Thank you, sir.

That was the last of those individuals that signed in to speak.

Is there anyone here that did not sign in to speak, or wishes to provide comment at this time?

Just a reminder that after I turn this over to the Hearing Officer for the closing

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remarks, representatives at EPA and the Corps and others associated with this project will remain to have a public meeting.

Ladies and gentlemen, Mr. Mel Cote.

MR. COTE: Okay. Thanks, Larry.

Well, we have heard some helpful statements today. Careful analysis will be required before a determination can be made and a decision rendered. As we've mentioned several times, written statements may be submitted to the EPA until five o'clock next Monday, June 21st, 2004. All comments will receive equal consideration with those presented tonight.

We, at the Environmental Protection Agency and the Corps of Engineers, would like to thank all of you who took the time to involve themselves in this public review process.

And finally, before I conclude this hearing, I would like to extend my appreciation to the Lighthouse Inn for the use of this fine facility tonight and earlier today; the Narragansett Police Department; and I would like to thank all of you for taking the time to provide some of your thoughts, your comments and your

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concerns.

Good night.

MODERATOR ROSENBERG: This is now a public meeting for you. If you have any questions, please.

(Whereupon, the informal hearing was held.)

(Whereupon, at 8:23 p.m., the hearing was adjourned.)

June 15, 2004

CERTIFICATE

I, Marianne Kusa-Ryll, Registered Merit Reporter, do hereby certify the foregoing to be a true and complete transcript of the proceedings of the United States Army Corps of Engineers Public Hearing taken on Tuesday, June 15, 2004, at the Lighthouse Inn of Galilee, Rhode Island, Moderator Larry Rosenberg presiding.

____
Marianne Kusa-Ryll, RMR
Massachusetts CSR No. 116393

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