

**APPENDIX J-2**

**Central Long Island Sound Dredged Material Disposal Site  
Site Management and Monitoring Plan**

**Prepared for**

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**April, 2004**

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**Final**

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Site Management and Monitoring Plan**

**Prepared by**

**U.S. Environmental Protection Agency  
New England Region**

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

**April, 2004**

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Attachment B: CLIS Disposal Site Scow Log Summary by Mound – 1988 to 2002

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## ACRONYMS AND KEYWORDS

CFR	Code of Federal Regulations
CLIS	Central Long Island Sound Dredged Material Disposal Site
cm/s	centimeters per second
Corps	U.S. Army Corps of Engineers
CPUE	Catch Per Unit Effort
CSDS	Cornfield Shoals Disposal Site
CT	Connecticut
CTDEP	Connecticut Department of Environmental Protection
CTDPH	Connecticut Department of Public Health
CWA	Clean Water Act (Federal Water Pollution Control Act)
CZM	Coastal Zone Management
DAMOS	Disposal Area Monitoring System
DDT	1,1,1-trichloro-2,2-bis( <i>p</i> -chlorophenyl)ethane
deg	Degree
DEP	Department of Environmental Protection
DMMP	Dredged Material Management Plan
DMSMART	Dredged Material Spatial Management Record Tool
DO	Dissolved oxygen
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
g	grams
g/m <sup>2</sup> /yr	grams per meter squared per year
GPS	Global Positioning System
Guidance Documents	Regional Implementation Manual (EPA/USACE, 2004); Greenbook (EPA/USACE, 1991); Inland Testing Manual (EPA/USACE, 1998)
H'	Shannon-Wiener Diversity Index
ITM	Inland Testing Manual
J'	Evenness Index
LIS	Long Island Sound
LISS	Long Island Sound Study

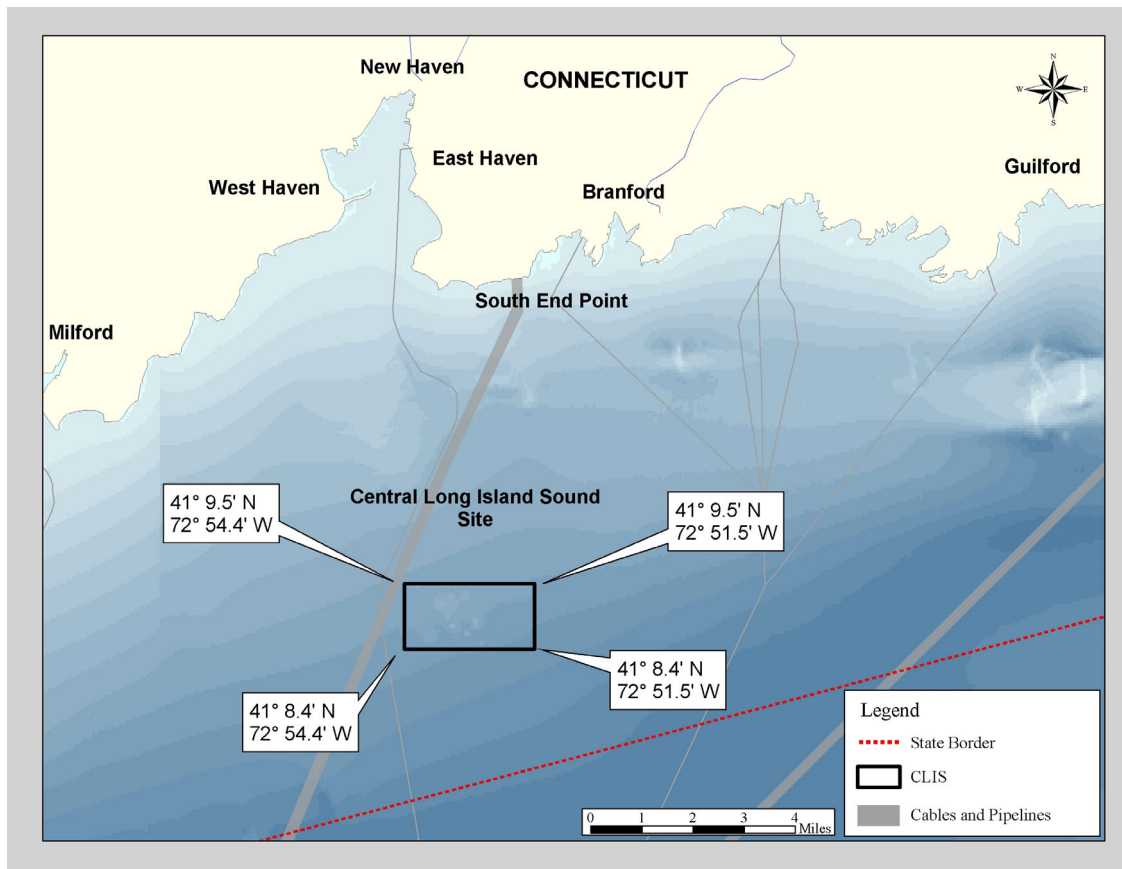
LORAN-C	Low Frequency Hyperbolic Radionavigation and time reference system
m	meters
mcy	million cubic yards
mg/L	milligrams per liter
mg/kg	milligrams per kilogram (equal to ppm)
MLW	Mean low water
MLLW	Mean low low water
MPRSA	Marine Protection, Research, and Sanctuaries Act of 1972
N	North
NAD27	North American Datum 1927
NAD83	North American Datum 1983
NAE	Corps New England District
NEPA	National Environmental Policy Act
NLDS	New London Dredged Material Disposal Site
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NY	New York
NYDOS	New York Department of State
NYSDEC	New York State Department of Environmental Conservation
ODA	Ocean Dumping Act
OLISP	Connecticut Office of Long Island Sound Programs
OSI	Organism Sediment Index
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
ppb	parts per billion
ppm	parts per million
pptr	parts per trillion
psu	Practical Salinity Unit
QA	Quality Assurance
RHA	Rivers and Harbors Act
RIM	Regional Implementation Manual
ROD	Record of Decision
RPD	Redox Potential Discontinuity
SAIC	Science Applications International Corporation
sd	Standard Deviation
SMMP	Site Management and Monitoring Plan
SPI	Sediment Profile Imagery

SQUID	Sediment Quality Information Database
SRMs	Standard Reference Materials
2,3,7,8-TCDD	Tetracholordibenzo-1,4-dioxin
TOC	Total Organic Carbon
TSS	Total suspended solids
USACE	U.S. Army Corps of Engineers
USACE-NAE	U.S. Army Corps of Engineers, New England District
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service (Department of the Interior)
W	West
WLIS	Western Long Island Sound Dredged Material Disposal Site
WRDA	Water Resources Development Act of 1992 (Public Law 102-580)
wt	Weight
µg/kg	micrograms per kilogram (equal to ppb)

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## 1.0 BACKGROUND

The U.S. Environmental Protection Agency (EPA) has designated the Central Long Island Sound Dredged Material Disposal Site (CLIS; Figure 1) in the central basin of Long Island Sound as an open-water dredged material disposal site consistent with the Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. §§ 1401 *et seq.* The CLIS site can be used for the disposal of dredged material from navigation areas within Long Island Sound. Dredged material from either Federal projects of any size, or from non-federal projects involving greater than 25,000 cubic yards (19,114 cubic meters) of material, must satisfy the requirements of the MPRSA and Section 404 of the Clean Water Act, 33 U.S.C. § 1344 (hereafter cited as "CWA § 404") before disposal can be authorized at the site (see Section 3.1). Dredged material from non-federal projects involving less than 25,000 cubic yards (19,114 cubic meters) of material would only have to satisfy the requirements of CWA § 404, before disposal would be authorized at the site. This approach is in keeping with the mandate of Section 106(f) of the MPRSA, 33 U.S.C. § 1416(f). Prior to use of the site, each project must receive a permit from or be authorized by the U.S. Army Corps of Engineers (Corps) under either Section 103 of the MPRSA, 33 U.S.C. §§ 1413 (hereafter cited as



**Figure 1. Location of the Central Long Island Sound Dredged Material Disposal Site (NAD 83)**

"MPRSA § 103") or CWA § 404. In addition, all projects will need to satisfy Federally applicable state requirements such as Connecticut's State Water Quality Certificate and receive Coastal Zone Management consistency from the Connecticut Department of Environmental Protection (CTDEP).

The State of Connecticut also has its own permit requirements that apply to permit applicants, but not to Federal (Corps) Civil Works projects. CTDEP requires that all projects that are not part of the Federal Civil Works program receive a State Structures and Dredging Permit as part of the State's process.

Management plans for 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 monitoring program and management plan for the CLIS site that complies with the requirements of MPRSA Section 103a. Although this management plan focuses on MPRSA requirements, materials determined suitable for disposal under Section 404 of the CWA will also be disposed at the site. Regardless of the source of the material (*i.e.*, CWA or MPRSA), all material disposed at the site will be subjected to the same monitoring requirements, as described in Section 6.0.

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 New England District (NAE) and other 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. The SMMP differs from a Dredged Material Management Plan (DMMP). A DMMP is not required for designating or selecting disposal sites under MPRSA, however, the Corps does prepare project-specific DMMPs when a continued need for maintenance dredging is demonstrated and available disposal site capacity is determined insufficient to meet the project's needs for at least a 20 year period for the quantity of material to be dredged. Connecticut and New York have indicated that they intend to pursue a long-term regional DMMP for Long Island Sound region in the near future. This Long Island Sound DMMP will guide future dredging and disposal operations. This SMMP will be part of the framework of the future Long Island Sound DMMP.

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"; EPA/USACE, 1996), management of the disposal site involves: regulating the times, quantity, and physical/chemical characteristics of dredged material that is dumped at the site; establishing disposal controls, conditions, and requirements; and monitoring the site environment to verify that potential unacceptable conditions which may result in significant adverse impacts are not occurring from past or

continued use of the 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].

### 1.1 History of Dredging and Disposal in Western and Central Long Island Sound

Material from projects in Connecticut and New York rivers, harbors, and coastal areas has been disposed of at open-water sites in Long Island Sound since at least the 1870s. While detailed records of dredging activities extend back to this time, disposal methods and sites for projects were not systematically recorded until the 1950s, there is evidence of continuous use of some sites since 1941 (Fredette *et al.*, 1992). From the 1950s through the early 1970s about 19 open-water disposal sites were active in Long Island Sound (Dames and Moore, 1981). Since the early 1980s, dredged material has been placed predominantly at four disposal sites: Western Long Island Sound (WLIS), Central Long Island Sound (CLIS), Cornfield Shoals (CSDS), and New London (NLDS). These sites were evaluated and chosen to receive dredged material pursuant to programmatic and site specific EISs prepared by the Corps in 1982 and 1991 (USACE, 1982a, 1982b, and 1991). Based on information collected through the Corps' Disposal Area Monitoring System (DAMOS), it is estimated that about 37 million cubic yards (28 million cubic meters) of material may have been disposed of in western and central Long Island Sound since 1941. A more detailed summary of the disposal history at CLIS is provided in Section 5.2.

**Estimated Sediment Disposal Volumes in Western and Central Long Island Sound, 1941-2002, from all Dredging Sources (USACE file data, 2004)**

<u>Disposal Site</u>	<u>Volume (cy)</u>
Central LIS	14,006,443
Western LIS	1,710,116
Stamford	2,904,884
Eatons Neck	12,972,303
Norwalk	1,313,150
Bridgeport	4,404,428
Milford	<u>398,965</u>
Total	37,710,289

## 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 at CLIS. To this end, the SMMP identifies actions, provisions, and practices necessary to manage the operational aspects of dredged material disposal at CLIS. 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)];
- 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)]).

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 impact may be occurring. The plan also incorporates ongoing regional monitoring programs in Long Island Sound that can provide additional information to inform the periodic assessment of impact.

The specific objectives of this SMMP are:

- **Objective 1: To ensure site management practices and disposal options are sufficient to avoid degradation or endangerment to the environment.** Management of CLIS involves 1) coordination among Federal and state agencies responsible for managing dredged material disposal in coastal waters, 2) regulating the timing of disposal(s), quantity of material, and physical/chemical characteristics

of dredged material placed at the site, 3) instituting disposal controls, conditions, and requirements that avoid or minimize potential impacts to the marine environment, 4) ensuring permit conditions are met, and 5) 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 CLIS or its vicinity. Factors to be considered under this objective include:

- Evaluating compliance with CWA or MPRSA permit conditions and conducting enforcement actions where warranted and as appropriate;
  - Providing 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 schedule for review and revision of the SMMP; and
- A monitoring plan.

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 CLIS 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 impact 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 impact 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 ROLES, RESPONSIBILITIES, AND AUTHORITIES**

CLIS will be jointly managed by EPA and the Corps. In addition, EPA and the Corps will coordinate with other federal agencies and the states of Connecticut and New York to ensure that dredged material disposal and impact assessments at the site follow applicable Federal and state regulations and criteria. At a minimum, agency planning meetings will be held annually to ensure that this coordination and exchange of information occurs. Other meetings may be arranged in response to unusual physical events or unexpected monitoring observations. During these meetings, the SMMP will be reviewed and revised as necessary depending on current conditions and available site-specific and scientific information.

The MPRSA designated dredged material disposal sites in Long Island Sound are unique in that they fall under both MPRSA and CWA 404 jurisdiction (see Section 3.1). As such, authorization for disposal of dredged material from Federal navigation projects and large non-federal projects at the site must comply with both CWA and MPRSA requirements. Permits for disposal of dredged material from non-federal projects less than 25,000 cubic yards (19,114 cubic meters) will be issued under the CWA only. In addition, all private and federal projects will comply with all relevant state requirements for disposal of dredged material, such as water quality certification requirements.

#### **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), WRDA, 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 (*e.g.*, transportation, recreation). It also modifies other Acts, as necessary (*e.g.*, MPRSA).

Section 404 of the Clean Water Act (33 U.S.C. § 1344) authorizes the Corps to issue permits for the disposal of dredged materials in the territorial sea, the contiguous zone, and ocean as long as the material meets guidelines developed by EPA pursuant to CWA § 404(b)(1). EPA's guidelines are promulgated at 40 CFR Section 230. These guidelines set forth environmental standards and analytical requirements for use in determining when the Corps should authorize disposal of particular dredged material at a particular location. The Corps' regulations governing the issuance of Section 404 permits are codified at 33 CFR Parts 320-338.

Because Long Island Sound is an estuary wholly contained within state boundaries, it falls within the geographical jurisdiction of Section 404 of the Clean Water Act as described

above. However, in 1980, Congress enacted the “Ambro Amendment<sup>1</sup>,” an amendment to the MPRSA requiring that the disposal of dredged material in Long Island Sound from all Federal projects and non-federal projects that exceed 25,000 cubic yards (19,114 cubic meters) of dredged material comply with the MPRSA provisions, also known as the Ocean Dumping Act. Regulations implementing MPRSA were promulgated by EPA and are codified at 40 CFR Parts 220 to 228 (referred to as the Ocean Dumping Regulations). Under MPRSA Section 102, EPA is assigned permitting authority for non-dredged material. In addition, it authorizes EPA to designate sites or time periods for disposal according to site evaluation criteria promulgated by EPA at 40 CFR Part 228.

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 ocean disposal sites. The Corps may select a site if a designated site is not feasible and the selected site may be used for two, 5-year periods. Section 33 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 the 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 NEPA process, EPA prepared a Federal determination of consistency with State approved Coastal Zone Management Programs. In addition, individual projects are subject to consistency review by Connecticut and New York, as determined appropriate by the respective states.

Additionally, EPA has obtained concurrence pursuant to the Fish and Wildlife Coordination Act from U.S. Fish and Wildlife Service (USFWS) and Section 7 of the Endangered Species Act from National Marine Fisheries Service (NMFS) for the CLIS designation. The USFWS and NMFS concurrence confirmed that the proposed plan will not adversely affect threatened or endangered species or adversely modify critical habitat. NMFS also concurred with EPA on the Essential Fish Habitat (EFH) findings.

### **3.2 State Responsibilities**

All projects authorized for dredged material disposal at CLIS are required to obtain Federally applicable state requirements such as Connecticut’s State Water Quality Certificate (WQC)

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<sup>1</sup> The Ambro Amendment was first enacted during reauthorization of MPRSA in 1980, adding Section 106(f) (33 U.S.C. § 1416(f)) (Pub. L. No. 96-572). The language was amended again in 1990 (Pub. L. No. 101-596). As currently enacted, Section 106(f) reads: “In addition to other provisions of law and notwithstanding the specific exclusion relating to dredged material in the first sentence in section 1412(a) [33 U.S.C. § 102(a)] of this title, the Long Island Sound from any Federal project (or pursuant to Federal authorization) or from a dredging project by a non-Federal applicant exceeding 25,000 cubic yards shall comply with the requirements of this subchapter [MPRSA].”

and Coastal Zone Management consistency from the CTDEP pursuant to Section 401 of the CWA [33 U.S.C., § 1341]. The WQC sets an overall policy for management of Connecticut's surface and groundwaters in accordance with the directives provided by Section 22a-426 of the Connecticut General Statutes and Section 303 of the Federal Clean Water Act.

The State of Connecticut also has its own permit requirements that apply to permit applicants, but not to Federal (Corps) Civil Works projects. CTDEP requires that all projects that are not part of the Federal Civil Works program receive a State Structures and Dredging Permit (Sec 22a-359 through 22a-363(f) of the Connecticut General Statutes) as part of the State's process.

In some cases applicants may qualify for authorization under a state Programmatic General Permit, which is a more expedited process (CTDEP, 2001). This expedited permit process is available for some maintenance projects and is called a Certificate of Permission (COP).

If CTDEP determines that a specific project has the potential to impact any endangered or threatened species, species of concern, or the essential habitats of these species, the application will require additional review by the Natural Diversity Data Base Staff (CTDEP, 2001). Although the Environmental Impact Statement for the Designation of Dredged Material Disposal in Central and Western Long Island Sound (hereafter cited as "the EIS") concluded that dredged material disposal at this site does not have potential to impact endangered or threatened species, this does not preclude the need for Connecticut's concurrence on a project-by-project basis.

### **3.3 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 CWA and MPRSA provide for both surveillance and enforcement. EPA and the Corps share surveillance and enforcement responsibilities at CLIS. The Coast Guard may also assist with such surveillance (See 33 U.S.C. Sec 1417[c]). However, while all missions of the Coast Guard remain vital, maritime homeland security is currently at the forefront and mission priorities and resource constraints may not allow the Coast Guard to participate fully in these activities (USCG, 2003). 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 for CWA 404 projects. EPA has enforcement responsibility 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 CLIS. Monitoring data may be generated by the agencies or through coordination or use of data gathered under other programs. Monitoring data from other agencies (*e.g.*, CTDEP Trawl Surveys and Long Island Sound Study [LISS] programs) will be utilized as appropriate to maximize the availability of information at CLIS. EPA will lead the evaluation of these data for potential impacts from disposal. Under MPRSA, EPA has the responsibility for determining that an unacceptable impact has occurred as a result of dredged material disposal at CLIS. 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 taut-wire buoy 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 CLIS 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 locations 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"; USACE, 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 Inspector's Daily Report of Disposal By Scow (hereafter cited as "scow logs"; see Attachment A). An example of this would be discharge of the material at a location other than that specified. The inspector must be especially aware of permit conditions for capping, which sometimes require dredged material to be discharged at several locations to make sure base material is entirely covered.

The inspector must complete a scow log 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 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 dredged material management review group, in consultation with CTDEP, New York State Department of Environmental Conservation (NYSDEC), and the Connecticut Office of Long Island Sound Programs (OLISP) and the New York Department of State (NYDOS) for Coastal Zone Management Issues.

#### **4.0 MANAGEMENT APPROACH**

All dredged material projects using CLIS are subject to CWA Section 404, although private projects larger than 25,000 cubic yards (19,114 cubic meters) and all Federal projects will also be authorized under MPRSA Section 103. Regardless of authorizing statute, 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; and
- Recognize and correct conditions before unacceptable impact occurs.

The practices to address these management goals at CLIS 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. This SMMP was written as part of an MPRSA site designation process and, therefore, focuses primarily on MPRSA management requirements. However, all materials disposed at the site, whether originating from MPRSA or CWA permits will be monitored under the same program described in Section 6.0.

#### **4.1 Management Practices**

EPA and the Corps will jointly manage CLIS. They will also coordinate with the states of Connecticut and New York. 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 includes an annual agency planning meeting to review the SMMP with respect to current information and conditions as well as scientific advancements.

Management of CLIS has historically included and will continue to 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 and CWA), is determined through three guidance documents which include the Regional Testing Manual (RIM; EPA/USACE, 2004), Ocean Testing Manual (Greenbook; EPA/USACE, 1991) and the Inland Testing Manual (ITM; EPA/USACE, 1998). However, management of the material may differ depending on the regulations under which it is disposed;
- Specification of disposal conditions, location, and timing in permits as appropriate (*e.g.*, disposal restricted between June 1 and September 30 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 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;
- As appropriate, placing current materials over historic sediments with higher levels of contamination to minimize potential environmental impact;
- Building disposal mounds to no shallower than 46 feet (14 meters) mean low low water;
- Conducting disposal site monitoring in a consistent, systematic manner;

- Holding technical advisory panel meetings for the monitoring program, as needed;
- Maintaining existing (historic) caps by augmenting the cap if cap thickness is reduced to less than 1.5 feet (approximately 0.5 meters);
- Identification of appropriate time for de-designation (*i.e.*, closure).

In addition, special management practices may exist at CLIS for individual projects to improve site management, anticipate future disposal requirements, or improve the conditions at the site. Examples include:

- Managing sediment quality by placement of MPRSA authorized sediments over CWA authorized sediments;
- 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, each 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 three mechanisms: scientific reports and peer reviewed publications, participation in symposia, and 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 Greenbook (EPA/USACE, 1991) and Inland Testing Manual (EPA/USACE, 1998). The Regional Implementation Manual (EPA/USACE, 2004), consistent with the Green Book and the Inland Testing Manual, provides specific testing and evaluation methods for dredged material disposal projects in New England. Hereafter these guidance documents will be cited as “the guidance documents.”

The guidance documents are consistent in their application of test procedures used to determine acceptability for CWA 404 and 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 regardless of statute. However, management of the material may differ depending on the regulations under which it is disposed. All projects that propose to use CLIS for disposal of dredged material must adhere to the guidance documents or superceding versions of these documents.

### **4.3 Classification of Dredged Material for Disposal at CLIS**

Any proposal for the disposal of dredged material from a particular project must begin with an examination of the nature of the material. Federal and non-Federal projects evaluated under MPRSA are subjected to the same qualitative analysis. The tiered approach to sediment testing has been developed with reference to the requirements of MPRSA and the guidance documents for dredged material testing and evaluation. In order to be approved for open-water disposal, or most other disposal options, dredged material must be found suitable for disposal by applying the testing protocols and evaluating the results. This process is described in general terms below.

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

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

The next tier of testing, the toxicity test, consists of exposing test organisms to the dredged material and comparing survivability rates to those of organisms exposed to reference and control materials. Where the dredged material exhibits greater toxicity to benthic test species than the reference sediments (using statistical tests and nationally developed interpretation guidance), project proponents may elect to forgo any further cost of testing for suitability for open-water disposal and seek alternative disposal methods. Otherwise, material that exhibits toxicity comparable to the reference sediments shall undergo bioaccumulation testing before any determination on suitability for open-water disposal can be made. In general terms, bioaccumulation involves a long exposure of test organisms to the sediment followed by analysis of their tissues to determine the potential for uptake of contaminants from the dredged material. The test results are evaluated to determine the risk of exposure to ecological and human health. Dredged material that is determined through these testing protocols to pose no unacceptable risk to the human or ecological health is deemed suitable for ocean disposal. These findings may be accompanied by disposal management requirements, such as limitations on disposal rates to maximize dilution.

The unique nature of the regulatory requirements in Long Island Sound; the dual application of MPRSA and the CWA; result in different regulation of dredged materials depending on the proponent and size of the proposed dredging project (see discussion in Chapter 1 of the EIS on the Ambro Amendment; EPA, 2004). Non-Federal projects seeking to dispose of 25,000 cubic yards of dredged material or less are not subject to the requirements of MPRSA. Materials from these smaller dredging projects that exhibit potential for adverse impacts may sometimes still be disposed in open-water under the CWA with proper disposal management techniques.

The application of the tiered testing protocol to the dredged material disposal alternatives analysis for individual projects is discussed in Section 6.0.

#### **4.4 Disposal Conditions, Location, and Timing**

The following list represents special conditions that are to be applied to projects using CLIS 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 (617-223-8355 or 617-223-8356 or by e-mail at [jmauro@d1.uscg.mil](mailto:jmauro@d1.uscg.mil) or [mswanaon@d1.uscg.mil](mailto:mswanaon@d1.uscg.mil)) 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 Captain of the Port Long Island Sound (203-468-4429 or 203-468-4444 or by e-mail at [opcen@grumsolis.uscg.mil](mailto:opcen@grumsolis.uscg.mil)) shall be notified of the location and estimated duration of the dredging and disposal operations.
3. The Captain of the Port, Long Island Sound (203-468-4464) shall be notified at least two hours prior to each departure from the dredging site.
4. 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.
5. 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. They may start as soon as this letter is issued.

6. The permittee shall ensure that a separate Corps disposal inspection report (scow log; see Attachment A) 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.
7. Except when directed otherwise by the Corps DAMOS Program Manager for site management purposes, 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 100 feet (30 meters) 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.
8. 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.
9. 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. The Corps shall copy EPA on such notification no later than the next business day. 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.

#### **4.5 Disposal Technologies and Methods**

Dredging and dredged material disposal in Long Island Sound has historically been accomplished using a bucket dredge to fill split hull or pocket scows for transport to the disposal site or by using hopper dredges. Hopper dredges, which suction material from the bottom into split hull hoppers, have seen limited use in the past several years in Long Island Sound. Large dredging projects (greater than 500,000 cubic yards; 382,277 cubic meters), such as New Haven, Bridgeport, and Norwalk, have historically used scows with a 5,000 cubic yard (3,823 cubic meter) capacity. For projects of 200,000 to 500,000 cubic yards (152,911 to 382,277 cubic meters) scows with a capacity of 1,500 to 3,000 cubic yards (1,147 to 2,294 cubic meters) are typically used. For projects under 150,000 to 200,000 cubic yards (114,683 to 152,911 cubic meters), scows with a capacity of 1,500 cubic yards (1147 cubic meters) or less are used. These types of equipment are expected to be used in Long Island Sound in the future, although disposal practices are not necessarily limited to this equipment.

#### **4.6 Modifications to Disposal Practices and the Site**

Based on the findings of the monitoring program (Section 6.0), modifications to the site use may be required. Corrective measures such as those listed below, but not limited to, will 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 loss of contaminants 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 area (*i.e.*, to prevent any additional disposal at the site).

#### **4.7 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 NMFS and 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) under the Magnuson Stevens Fishery Conservation and Management Act as amended, 16 U.S.C. 1801 *et seq* and the Endangered Species Act (ESA) concerns;
- Compliance with Fish and Wildlife Coordination Act on critical habitats for endangered and threatened species.

Any changes to special permit conditions will be discussed at the annual Agency planning 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 EIS (EPA, 2004). Baseline conditions are defined as the conditions existing at the time data to support the FEIS were developed. The section includes first a general characterization of the site and a description of past disposal at the site including information on the dredged material disposal mounds in the site.

### **5.1 Site Characterization**

This section provides a summary of the physical, chemical, and biological environment at the site.

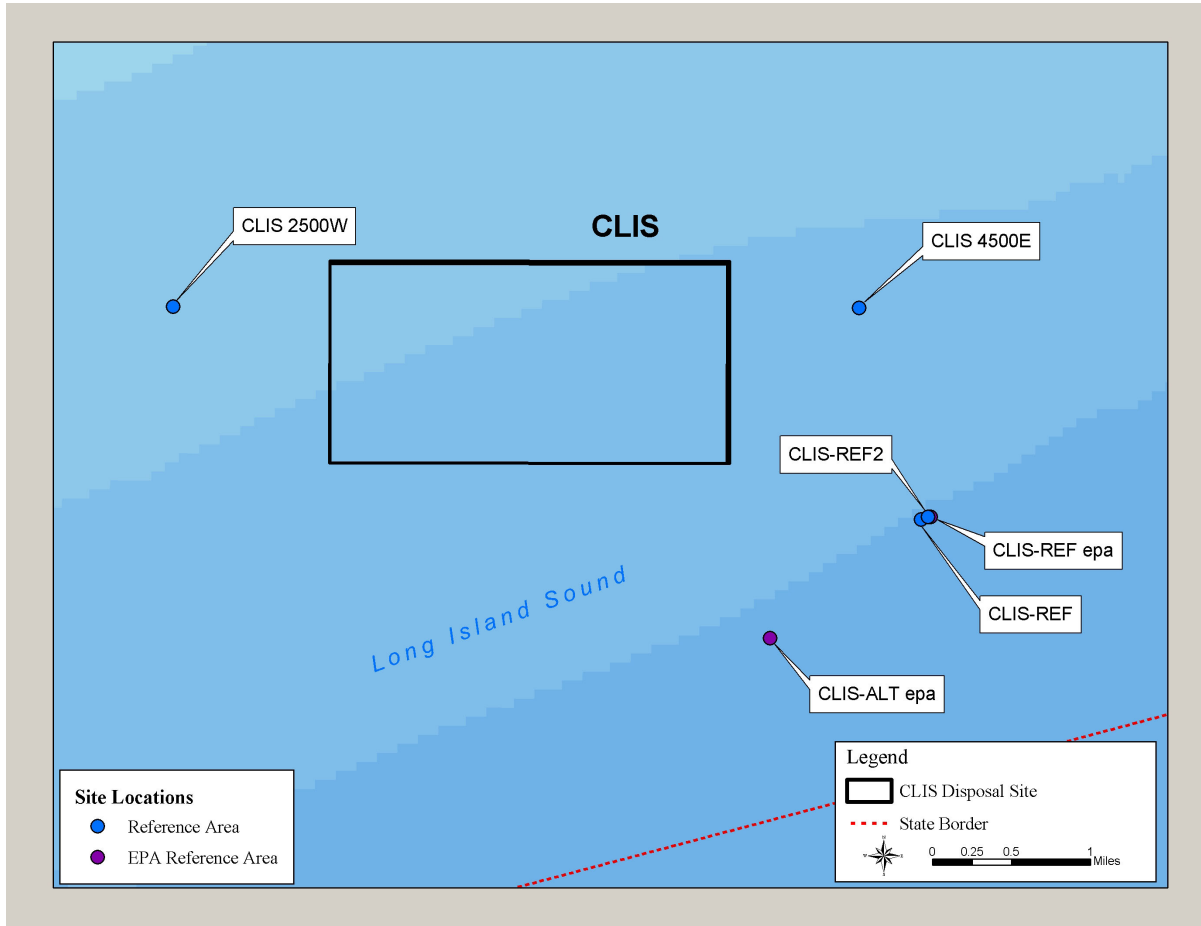
#### **5.1.1 Site Location**

The CLIS dredged material disposal site, as proposed by MPRSA designation, is located in Connecticut state waters approximately 5 nautical miles (6.5 miles) due south of South End Point, New Haven, Connecticut and over 10 nautical miles (18.5 kilometers) north of Shoreham Beach, New York. It is approximately 1.1 by 2.2 nautical miles in size (2 by 4 kilometers) and is centered at 41°8.9' N and 72°53.0' W (NAD83) (see Figure 1 for corner coordinates). CLIS occupies an area of seafloor located in the central basin of Long Island Sound.

#### **5.1.2 Reference Areas**

The baseline assessment activities conducted at CLIS as part of the EIS sampled two historic disposal mounds, an active disposal mound within the site, a reference area outside of the disposal site, and two farfield stations outside of the disposal site. The DAMOS program has generally maintained reference areas outside the disposal site (Figure 2), three of which (CLIS-REF, 2500W, and 4500E) are incorporated into this monitoring plan.

Table 1 shows the range in mean concentrations of chemicals at the CLIS reference sites as determined during various studies including sampling conducted in support of the EIS.



**Figure 2. Location of Former and Current Reference Sites used to Support Testing of Dredged Material and for Site Monitoring. (NAD 83)**

**Table 1. CLIS Reference Site Data from Various Studies including Sampling Conducted in Support of the EIS (USACE, 2000a; USACE, 2001a, USACE, 2001b; USACE, 2002a)**

Parameter	Mean Concentrations Based on LIS EIS Sampling
<b>Metals (ppm)</b>	
Arsenic	5.3-10.7
Cadmium	0.098-0.171
Chromium	45.1-72.3
Copper	31.5-55
Mercury	0.078-0.231
Nickel	20.5-28.3
Lead	23.4-45.1
Zinc	88.5-139
<b>PAH's (ppb)</b>	
Fluorene	7-42
Phenanthrene	22-100
Anthracene	10-49
Naphthalene	15-33
Acenaphthylene	9-53
Acenaphthene	4.7-35
Fluoranthene	52-230
Pyrene	59-260
Benzo(a)anthracene	33-130
Chrysene	42-150
Benzo(b)fluoranthene	38-280
Benzo(k)fluoranthene	39-145.49
Benzo(a)pyrene	43-190
Dibenzo(a,h)anthracene	12-45
Benzo(g,h,i)perylene	31-160
Ideno(123-cd)pyrene	33-180
<b>Total Organic Carbon (%)</b>	
	1.55-2.3
<b>PCBs (ppb)</b>	
PCB 8	0.7-16.1
PCB 18	0.68-4.9
PCB 28	0.7-1.37
PCB 44	0.7-4.8
PCB 49	0.7-4.2
PCB 52	0.7-6.4
PCB 66	0.7-6.8
PCB 87	0.7-6.7
PCB 101	0.7-13.2
PCB 105	0.53-3.6
PCB 118	0.7-6.8
PCB 128	0.51-3.3
PCB 138	0.7-6.4

**Table 1. CLIS Reference Site Data from Various Studies including Sampling Conducted in Support of the EIS (continued)**

Parameter	Mean Concentrations Based on LIS EIS Sampling
<b>PCBs (ppb)</b>	
PCB 153	1.48-5.4
PCB 170	1-11.3
PCB 180	0.7-5.2
PCB 183	0.63-6.5
PCB 184	1-2.3
PCB 187	0.7-5.8
PCB 195	0.36-5.6
PCB 206	0.7-2.8
PCB 209	0.7-2.5
<b>Pesticides (ppb)</b>	
1,1,1-trichloro-2,2-bis (p-methophenyl)-ethane	0.7-7.5
2,4'-DDD	0.7-6.9
2,4'-DDE	2-7.3
2,4'-DDT	0.7-2
4,4'-DDD	0.37-2.3
4,4'-DDE	1.1-26.1
4,4'-DDT	0.34-311.3
Aldrin	2-31
Alpha-BHC	2-7.7
Alpha-Chlordane	0.7-7
Beta-BHC	0.7-6
cis Chlordane	2
Delta-BHC	2-13.7
Dieldrin	0.69-5.2
Endosulfan I	0.7-7.4
Endosulfan II	0.7-2
Endosulfan Sulfate	0.7-6.3
Endrin	0.7-2
Endrin Aldehyde	2
Gamma-BHC	0.7-7.9
Gamma-Chlordane	0.13-6.4
Heptachlor	2-10.3
Heptachlor Epoxide	0.041-2
Alpha-HCH	0.038
Methoxychlor	2
Toxaphene (Camphechlor)	2-173.4

### 5.1.3 Physical Characteristics

The seafloor at CLIS slopes from a depth of 59 feet (18 meters) at the northwest corner to 74 feet (22.5 meters) in the southeast corner, with distinct disposal mounds from past dredged material disposal activities as high as 46 feet (14 meters) deep.

The bottom sediments at the CLIS site are composed of fine silts and clays characteristic of the low-energy environment found in deep areas of the western and central basins (Table 2). The site is in an area of sediment accumulation, which is indicative of a generally low current regime. Bokuniewicz and Gordon (1980) data indicated that the area in which CLIS is situated has been a long-term depositional environment.

**Table 2. Average Grain Size and TOC Content for Sediment Samples from CLIS, February 2000<sup>1</sup>**

Station Type	Average % fines	Average % TOC
CLIS Active	81.8	2.2
CLIS Farfield	87.4	1.9
CLIS Historic	57.4	1.4
CLIS Reference	92.4	1.9

<sup>1</sup> Source USACE 2001a.

Tidal currents dominate the current regime at CLIS and predominately run east and west. Average peak ebb and peak flood currents range 20 to 30 centimeters per second (depth-averaged) with the spring tides 20 to 40 percent stronger. While currents throughout Long Island Sound are continuously driven by the rise and fall of the tide, they are also intermittently driven by strong, steady wind events and by the density effect of freshwater inflows. Peak near-bottom flood currents of 45 centimeters/second (1.5 feet/second) have been measured in the presence of winds in excess of 30 knots. The net west-southwestward flow (long-term mean) is approximately 2.5 centimeters per second and is indicative of the density driven estuarine circulation.

Tidal currents are intermittently supplanted by currents caused by strong, steady wind events and by the density effect of freshwater inflows. The 2-month current meter deployment, observed a peak near-bottom flood event of 45 centimeters/second (1.5 feet/second) associated with winds in excess of 30 knots (15 meters/second). Also observed was a net west-southwestward flow (long-term mean) of approximately 2.5 centimeters/second (0.08 feet/second) indicative of the density driven estuarine circulation.

Tidal ellipse parameters for surface, middle, and bottom currents measured in CLIS in the spring 2001 are presented in Table 3 (USACE, 2001c). The dominant flow direction is nearly east-west and the narrow ellipses indicate that there was little flow normal to the dominant flow direction. Amplitude decreases with depth and near-bottom amplitude is less than 25 centimeters/second (0.8 feet/second). Fifty to 95 percent of the current variance during the entire 2-month spring deployment period was due to the tide with 96 percent of the near bottom current variance in the direction of the major axis of the Sound due to tides.

**Table 3. Tidal Ellipse Parameters for Bottom, Middle and Surface Currents Measured at CLIS, Spring 2001**

Layer	Dist. Bottom (m)	Major Amplitude (cm/s)	Minor Amplitude (cm/s)	Inclination (degree)	Phase (degree)	Major Axis % Tidal Variance	Minor Axis % Tidal Variance
Surface	20.1	26.3	2.3	355.0	122.3	51.3	28.9
Middle	10.1	31.9	0.0	352.0	102.9	83.8	51.0
Near-Bottom	2.1	24.1	3.1	351.6	93.4	84.9	52.1
Bottom	~1.0	14.2	2.4	342.9	40.5	96.0	68.6

Source: USACE 2001c

The wind fetch at CLIS is limited by the semi-enclosed nature of Long Island Sound, which limits the wave heights that can be developed at the site. This is particularly true for winds from directions other than the east and northeast (along the axis of the Sound). Considering that winter storms can generate powerful winds from the northeast (northeasters), the potential effect of waves must be taken into account despite the limited fetch. Few wave measurements are available at or near CLIS. A 2-month record of waves made in the spring of 2001 at a station within CLIS recorded 5-foot (1.5-meter) high waves (significant wave height) with 4 to 6 second periods associated with a 10 meters/second (19 knot) wind event (winds from the east) (USACE, 2001c). Near bottom peak orbital wave velocities measured at 69-foot (21-meter) depth reached approximately 8 centimeters/second (0.3 feet/second). This, however, represents a very short record of potential wave activity. Therefore, the 12-year record of wind data from the Buzzards Bay Tower was analyzed for the periods from July 1985 to February 1994 and from May 1997 to March 2001 to develop wind climatology and waved predictions for the region encompassing CLIS and are presented in Table 4.

The prevailing direction of waves in the region follows the prevailing wind directions, from the north and northwest in fall and winter with occasional northeast events and from southwest in spring and summer. The data show a northeast storm with a return period of 2 years will generate waves of 8.0 feet (2.5 meters) with a 5.5 second period over the CLIS site. Storms with a return period of 10 years will generate 10-foot (3.0 meter) waves with a 6.1 second period over the site. The short period relative to wave height is indicative of locally generated, fetch-limited waves. The waves reported in USACE (2001c), with a peak wave height of 5 feet (1.5 meters), represent storms that can be expected several times a year.

Peak wave induced near-bottom orbital velocities calculated from linear wave theory for the 2 to 10 year storms are estimated to generate bottom orbital velocities of 17 to 31 centimeters per second. Velocities of this magnitude are not sufficient to cause significant resuspension and mound erosion at depths of approximately 69 feet (21 meters).

**Table 4. Wave Height and Period at CLIS for Storms of Various Return Periods Estimated from Wind Data**

Return Period (years)	Wind Direction (Degrees from True North)									
	0°		45°		90°		135°		180°	
	Wave Height (ft) <sup>1</sup>	Peak Wave Period (sec)	Wave Height (ft)	Wave Period (sec)	Wave Height (ft)	Wave Period (sec)	Wave Height (ft)	Wave Period (sec)	Wave Height (ft)	Wave Period (sec)
1	3.49	3.58	5.99	4.75	7.25	5.24	6.29	4.86	5.31	4.41
2	3.81	3.73	6.57	4.97	8.04	5.50	6.92	5.09	5.76	4.58
5	4.24	3.91	7.34	5.24	9.06	5.83	7.74	5.36	6.36	4.79
10	4.57	4.04	7.92	5.43	9.83	6.07	8.36	5.57	6.82	4.95
20	4.90	4.17	8.50	5.62	10.60	6.30	8.99	5.76	7.28	5.10
50	5.35	4.34	9.27	5.86	11.60	6.59	9.81	6.01	7.88	5.29
100	5.69	4.46	9.85	6.04	12.35	6.80	10.42	6.19	8.35	5.43

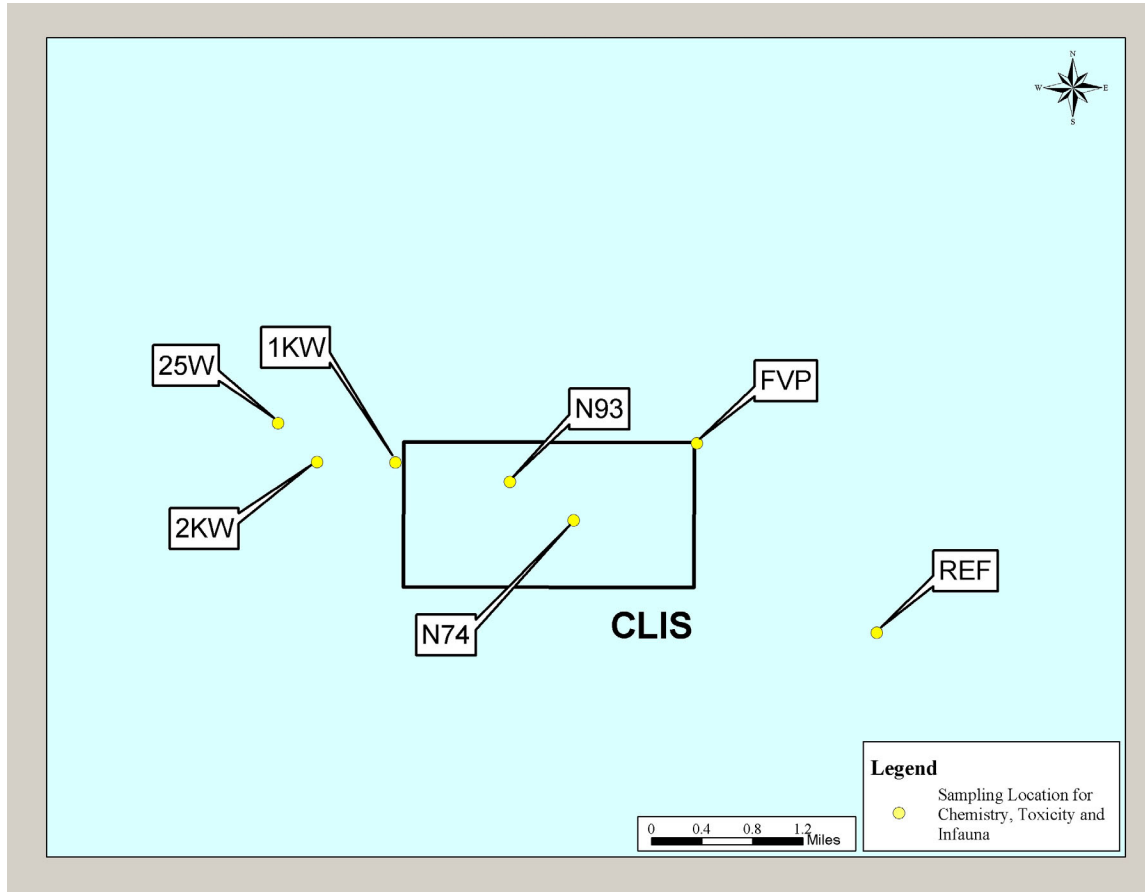
Return Period (years)	Wind Direction (Degrees from True North)					
	225°		270°		315°	
	Wave Height (ft)	Wave Period (sec)	Wave Height (ft)	Wave Period (sec)	Wave Height (ft)	Wave Period (sec)
1	6.05	4.70	6.10	4.74	4.49	4.09
2	6.52	4.87	6.53	4.89	4.80	4.21
5	7.13	5.07	7.10	5.08	5.21	4.37
10	7.59	5.23	7.53	5.22	5.52	4.49
20	8.06	5.37	7.96	5.36	5.83	4.61
50	8.67	5.56	8.53	5.54	6.25	4.75
100	9.14	5.70	8.96	5.67	6.57	4.86

<sup>1</sup>Wave heights are reported as significant wave height, which is the average of the one-third highest waves.

#### 5.1.4 Sediment Quality

To evaluate sediment quality, concentrations of metals and organic chemicals measured in sediments were collected from the site and nearby vicinity (see Figure 3 for sampling locations). In addition, the results of toxicity tests conducted using these sediments were considered, as described below.

At CLIS the average concentrations of four metals (copper, nickel, silver, and mercury) exceeded the Effects Range-Low (ER-L) for at least one type of station (Table 5). None exceeded the Effects Range-Median (ER-M). Average concentrations of silver, cadmium, copper, and mercury exceeded the average background concentration for depositional environments of Long Island Sound for at least one type of station. In general, average contaminant concentrations were higher in the active area samples than in samples from historical, farfield or reference locations.



**Figure 3. CLIS Sediment Sampling Locations (NAD 83)**

Source: USACE, 2001d

**Table 5. Summary of Metals Concentrations (mg/kg dry weight) in Sediment Samples from CLIS**

Station	Silver	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
ER-L <sup>1</sup>	1.0	1.2	81	34	0.15	20.9	46.7	150
ER-M <sup>1</sup>	3.7	9.6	370	270	0.71	51.6	218	410
<b>Sound-wide Sediment Concentrations<sup>2</sup></b>								
LIS average	0.27	0.16	67.9	<b>39.1</b>	0.12	<b>24.8</b>	36.1	103
LIS depositional environment average	0.44	0.25	<b>93.3</b>	<b>59.5</b>	<b>0.18</b>	<b>32.2</b>	<b>47.7</b>	146
<b>CLIS<sup>3</sup></b>								
CLIS Active	<b>1.33</b>	<b>0.58</b>	79.3	<b>75.8</b>	<b>0.20</b>	<b>23.2</b>	44.2	139
CLIS Farfield	<b>0.66</b>	0.18	62.4	<b>51.2</b>	0.12	<b>22.7</b>	33.7	108
CLIS Historic	<b>0.78</b>	<b>0.52</b>	62.6	<b>85.1</b>	0.15	17.4	28.9	92.3
CLIS Reference	<b>0.60</b>	0.13	52.8	<b>44.0</b>	0.11	<b>23.1</b>	29.0	107

Shaded values exceed the average background level for Long Island Sound depositional environments; Bold values exceed the ER-L; Italicized values exceed the ER-M.

<sup>1</sup> Ecological effects values derived by Long *et al.* (1995)

<sup>2</sup> Mecray and Buchholtz ten Brink (2000)

<sup>3</sup> Collected in February 2000 (USACE 2001a)

The concentrations of the most common organic contaminants are low at CLIS (Table 6), and below relevant ecological effect levels. Concentrations were typically below the ER-Ls with the exception of total PCBs at the active and historic stations. Total analyte concentrations were generally higher at the historic or active stations than at the reference or farfield stations.

**Table 6. Summary of Organic Chemical Concentrations (µg/kg dry weight) in Sediment Samples from CLIS**

	Low Molecular Weight PAH	High Molecular Weight PAH	Total PAH	Total PCB	Total DDT	2,3,7,8-TCDD <sup>1</sup>
ER-L <sup>2</sup>	552	1700	4022	22.7	1.58	—
ER-M <sup>2</sup>	3160	9600	44792	180	46.1	—
Long Island Sound Average <sup>3</sup>	747	3470	2416	108	5.61	—
CLIS Alternative <sup>4</sup>						
CLIS Active	274	896	1036	<b>59</b>	0.40	0.00066
CLIS Far Field	203	624	748	7	ND	0.00021
CLIS Historic	298	855	1019	<b>95</b>	0.7	0.00053
CLIS Reference	202	674	783	16	0.8	0.00028

Shaded values exceed background levels; Bold values exceed the ER-L

<sup>1</sup> 2,3,7,8-TCDD is presented as a representative dioxin/furan

<sup>2</sup> Ecological effects values derived by Long *et al.*, 1995

<sup>3</sup> NOAA NS&T Benthic Surveillance Program 1984-1991

(<http://ccmaserver.nos.noaa.gov/NSandT/NSandTdata.html>)

<sup>4</sup> Source: USACE 2001a

At CLIS, the mean percent survival of organisms exposed to the sediments under standard acute toxicity testing protocols ranged from 94 to 100 percent (Table 7). Amphipod survival in the test sediments was not significantly different from that in the reference site samples (the difference in survival between test sediments and the reference sediment did not exceed 20 percent). Therefore, sediments at the active, historic, and farfield stations at WLIS were not acutely toxic to *Ampelisca abdita*.

**Table 7. Mean and Standard Deviation (sd) Survival in the 10-day Solid-Phase *Ampelisca abdita* Acute Toxicity Tests, for CLIS March 2000**

Station IDs	Percent Survival		Survival Statistically Different from Reference? <sup>1</sup>	Absolute Difference from Reference (%)
	Mean	sd		
Reference (REF)	97	3	NA	NA
Farfield (1KW)	98	3	No	+1
Farfield (2KW)	98	3	No	+1
Historical (FVP)	94	5	No	-3
Historical (N74)	100	—	No	+3
Active (N93)	98	4	No	+1

<sup>1</sup> Site sediments were compared only to their site-specific reference sediment.

Source: USACE 2000b