Western Long Island Sound Dredged Material Disposal Site

Site Management and Monitoring Plan

Final

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

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

EPA

US Army Corps of Engineers®

April 2004

APPENDIX J-1

Western Long Island Sound Dredged Material Disposal Site Site Management and Monitoring Plan

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April, 2004

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ACRONYMS AND KEYWORDS

CFR	Code of Federal Regulations
C.I.	Contour Interval
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(*p*-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/m2/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
WLDS	Western Long Island Sound Dredged Material Disposal Site (same as WLIS)
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 Western Long Island Sound Dredged Material Disposal Site (WLIS; Figure 1) in the western 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 WLIS 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

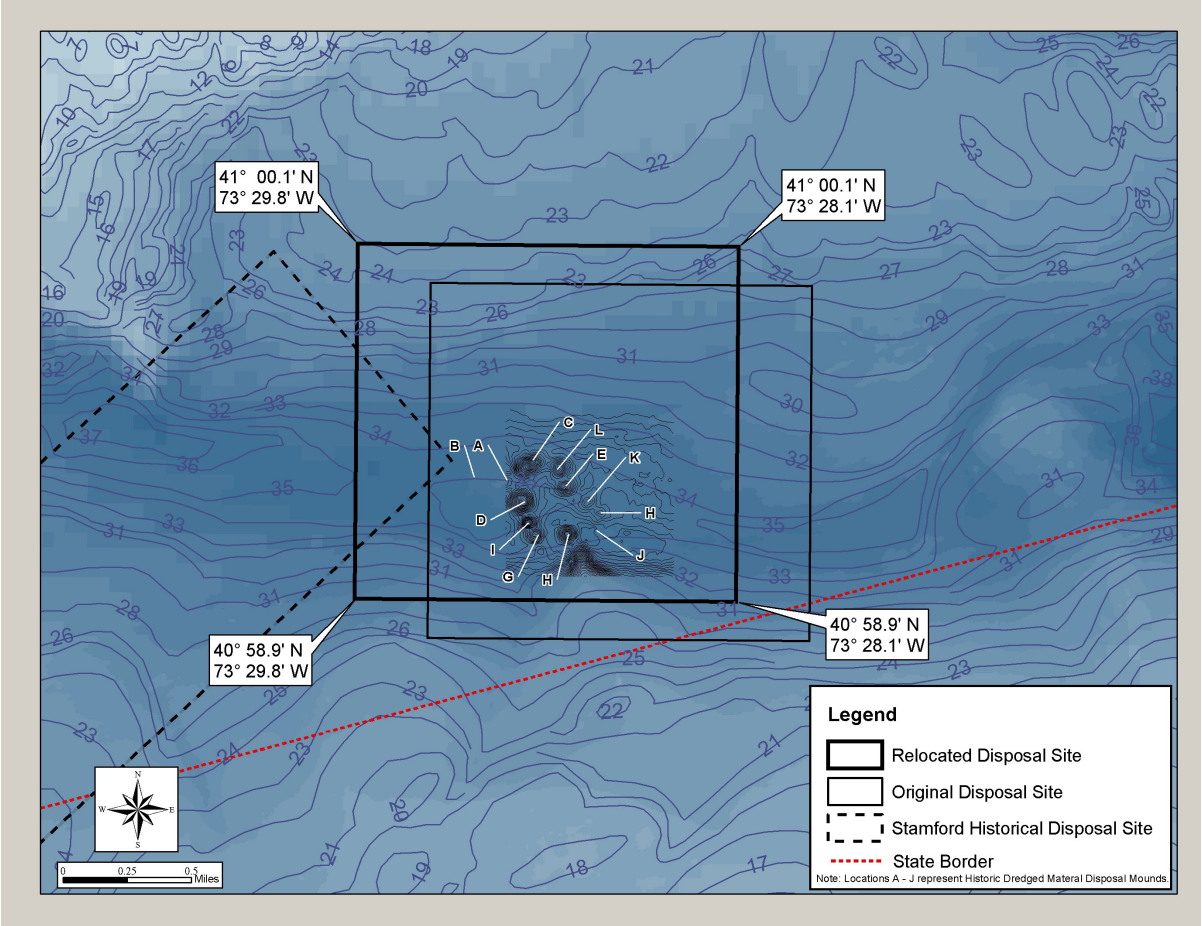

Figure 1. Location of the Western Long Island Sound Dredged Material Disposal Site (NAD 83)

"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 WLIS site that complies with the requirements of MRPSA 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 WLIS 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)

Disposal Site	Volume (cy)
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	398,965
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 WLIS. To this end, the SMMP identifies actions, provisions, and practices necessary to manage the operational aspects of dredged material disposal at WLIS. 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 WLIS 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 WLIS 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 WLIS 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

WLIS 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[1]," 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 WLIS 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.

[1] 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 not withstanding 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]."

3.2 State Responsibilities

All projects authorized for dredged material disposal at WLIS are required to obtain Federally applicable state requirements such as Connecticut's State Water Quality Certificate (WQC) 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 WLIS. 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 WLIS. 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 WLIS. 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 WLIS. 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 WLIS 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. The inspector should be aware that certain approach and return lanes have been stipulated for the Western Long Island Sound (WLIS) disposal site. These are indicated in the permit conditions or, for Corps projects, the contract specifications. 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 WLIS 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 WLIS 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 WLIS. 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 WLIS 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;
- 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 WLIS 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.

Management of WLIS has historically also involved carefully controlled dredged material disposal practices and monitoring of the site and reference sites. WLIS is located in an area of Long Island Sound that experiences low dissolved oxygen conditions each summer, and therefore is in an area of environmental stress. To appropriately manage disposal of dredged material at WLIS current management practices will continue.

If it is determined that environmental stress in the western portion of Long Island Sound has lessened, as indicated by ongoing regional monitoring results and supporting documentation through other programs, an interagency coordination meeting will occur and it may be determined that special management practices may be used at the site.

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. However, management of the material may differ depending on the regulations under which it is disposed. All projects that propose to use WLIS 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 WLIS

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 WLIS 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 or mswanson@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) 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 EIS were developed. The section includes 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 WLIS dredged material disposal site, as proposed by MPRSA designation, is located in Connecticut state waters approximately 2.7 nautical miles (5 kilometers) south of Long Neck Point, Darien, Connecticut and 2 nautical miles north of Lloyd Point, New York. It is a square of approximately 1 square nautical mile (1.9 kilometers), centered on 40°59.5'N, 73°28.95'W (NAD 83) (see Figure 1 for corner coordinates). WLIS occupies an area of seafloor located in the western basin of Long Island Sound.

5.1.2 Reference Areas

The baseline assessment activities conducted at WLIS as part of the EIS sampled a historic disposal mound, 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 Corps' DAMOS program has historically monitored the site and generally maintains reference areas outside the disposal site (Figure 2); three of these (S-REF, SW-REF, and SE-REF) are adopted under this monitoring plan. The SE-REF area was added to replace 2000W due to the apparent presence of relict dredged material at 2000W (SAIC 2002a). Several other reference areas (EAST, WLIS REF, 2000N, 3000E, and 2000S) have been abandoned in the past due to the presence of relict dredged material (Morris, 1998).

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

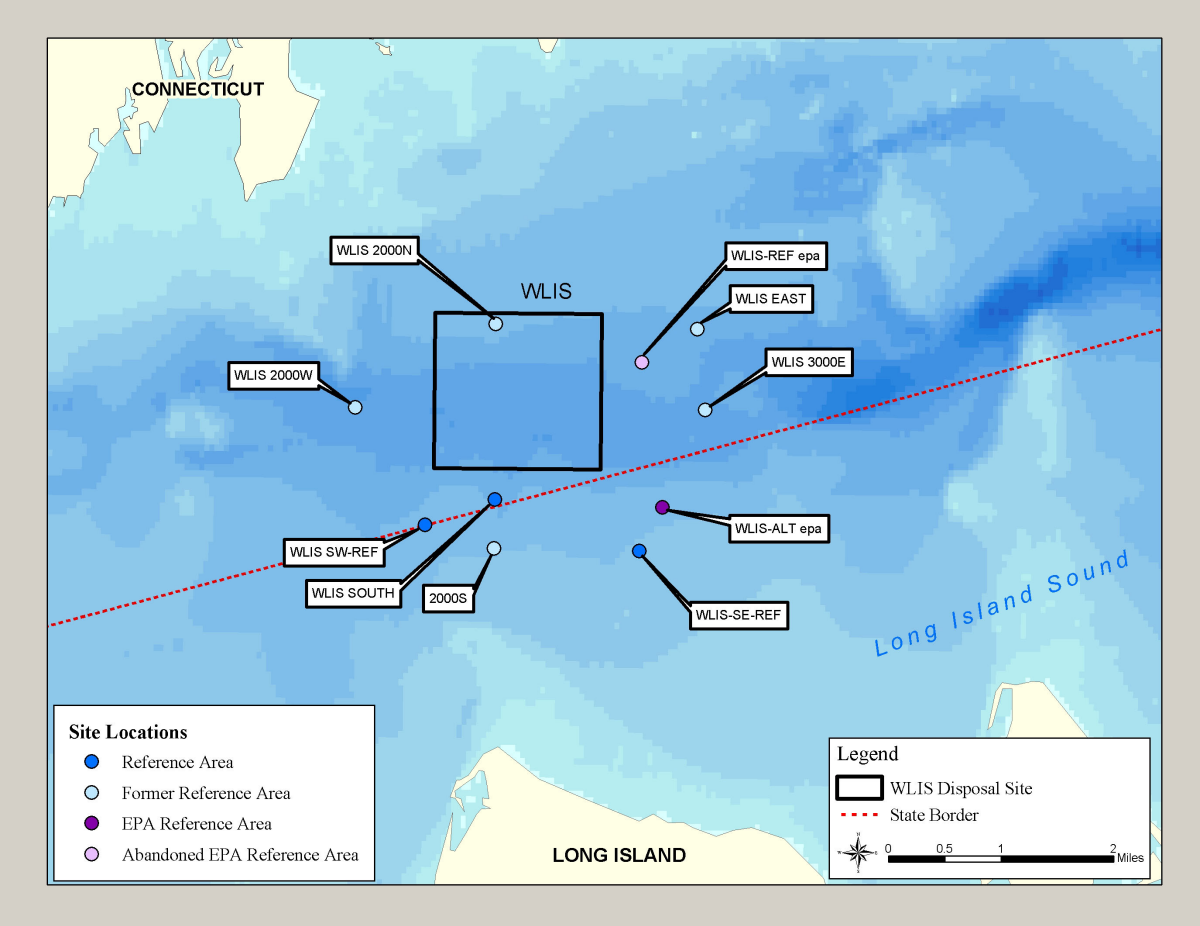

Figure 2. Location of Former and Current Reference Sites used to Support Testing of Dredged Material and for Site Monitoring. (NAD 83)

Table 1. WLIS Reference Site Data from Various Studies including Sampling Conducted in Support of the EIS (USACE, 2001a)

Parameter	Mean Concentrations Based on LIS EIS Sampling
Metals (ppm)	
Arsenic	3.3-5.6
Cadmium	0.18-0.3
Chromium	20.8-46.2
Copper	24.8-88.3
Mercury	0.071-0.35
Nickel	10.2-20.2
Lead	15.8-57.1
Zinc	55.9-448
PAH's (ppb)	
Fluorene	64
Phenanthrene	16-59
Anthracene	11-36
Naphthalene	5-28
Acenaphthylene	10-25
Acenaphthene	73
Fluoranthene	34-97
Pyrene	44-120
Benzo(a)anthracene	30-91
Chrysene	34-94
Benzo(b)fluoranthene	28-78
Benzo(k)fluoranthene	28-73
Benzo(a)pyrene	41-100
Dibenzo(a,h)anthracene	5-13
Benzo(g,h,i)perylene	21-57
Ideno(123-cd)pyrene	26-66
Total Organic Carbon (%)	0.825-3.05
PCBs (ppb)	
PCB 8	3.2-3.5
PCB 18	4.7-5.1
PCB 28	10.2-11.1
PCB 44	4.7-5.1
PCB 49	6.6-7.1
PCB 52	7.3-8
PCB 66	10.3-11.2
PCB 87	4-4.4
PCB 101	0.5-1.2
PCB 105	10.2-11.1
PCB 118	0.5-0.7
PCB 128	6-6.6
PCB 138	0.5-1.4
PCB 153	0.6-13.9

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

Parameter	Mean Concentrations Based on LIS EIS Sampling
PCBs (ppb)	
PCB 170	22.1-24.1
PCB 180	0.5-3.5
PCB 184	3.2-3.5
PCB 187	0.5-1.4
PCB 209	0.6-1.4
Pesticides (ppb)	
1,1,1-trichloro-2,2-bis (p-methophenyl)-ethane	1.3-30
2,4'-DDD	14.1-15.4
2,4'-DDE	18-19.7
2,4'-DDT	5.1-5.5
4,4'-DDD	0.5-1.4
4,4'-DDE	0.6-1
4,4'-DDT	6-6.6
Aldrin	3.6-3.9
Alpha-BHC	3.3-3.6
Alpha-Chlordane	5.4-5.9
Beta-BHC	7.2-7.9
Delta-BHC	8.3-9.1
Dieldrin	5.7-6.2
Endosulfan I	6.6-7.1
Endosulfan II	4.8-5.2
Endosulfan Sulfate	10.6-11.5
Endrin	6.9-7.5
Gamma-BHC	2.4-2.6
Gamma-Chlordane	6.8-7.4
Heptachlor	8.3-9
Heptachlor Epoxide	9.3-10.1
Toxaphene (Camphechlor)	148.8-162.1

5.1.3 Baseline Assessment of the Former WLIS Site Conducted in 1980

An Environmental Impact Statement supporting the selection of the former WLIS Disposal Site was developed in 1980 by the Corps (USACE 1982a and 1982b). It provides a historical context for former conditions in the vicinity of WLIS (see also 2004 EIS Section 5.7.4; EPA, 2004). This former and present WLIS site is near a historical dumping ground known as Eatons Neck East Disposal Site. The location of the former WLIS was described as being in an area with depths of 30 to 40 meters and relatively high vessel traffic. The sediment composition was reported to be sand with some clay and gravel associated with the former disposal areas. The maximum average current in the area was recorded as 33 to 38

centimeters/second (1.1 to 1.2 feet/second) at the surface, running in a predominantly west to south direction. The interpolated current at the bottom was recorded as 28 to 33 centimeters/second (0.9 to 1.1 feet/second). The EIS did not find evidence of significant dispersion of dredged material from the abandoned Eaton's Neck Site. The major concern relative to water quality was low bottom water dissolved oxygen levels in the summer.

The benthic infaunal community reported in 1980 EIS differed for different sediment types. The sandy areas had various species of polychaetes, oligochaetes, nematodes, bivalves, and amphipods. The mud sediments contained primarily polychaetes, amphipods and bivalves. Previous reports for the area (Middle Atlantic Coastal Fisheries Center, 1974) concluded that although the historic disposal site contained high contaminant concentrations, the benthos was relatively stable ecologically.

The major fishery in the area was noted to be lobster, which due to the density of lobster pots caused the areas east of the chosen site to experience heavy trawling. Active oyster leases were noted in areas 2.5 kilometers (1.6 miles) to the north of the historic disposal area in water depth to 12 to 15 meters (39 to 49 feet). The predominant finfish in the area included windowpane and winter flounder and abundant red hake in early summer to the east of the historic WLIS location. The most active commercial fishing season was the scup fishery in the fall.

5.1.4 Baseline Assessment of the Current WLIS Site

Baseline data in support of this EIS are described below (EPA 2004).

Physical Characteristics

The seafloor at WLIS is a gentle downward sloping plane from north to south and bisected by an axial depression that runs from east to west. Water depths range from 75 to 89 feet (23 and 27 meters) in the northwest and northeast corners, respectively, down to 98 feet (30 meters) along the southern boundary. The axial depression dips to 118-feet (36-meters) deep and occupies one quarter of the area of the site in the southern half. Distinct disposal mounds from past dredged material disposal activities are present throughout the site with peaks as high as 89 feet (27 meters) below the sea surface. Some mounds have been placed in the axial depression.

Natural sediments at WLIS consist primarily of fine silt and clays (Table 2), as confirmed by the EIS sampling (EPA 2004). 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 WLIS is situated has been a long-term depositional environment.

Table 2. Average Grain Size and TOC Content for Sediment Samples from WLIS, February 2000[1]

Station Type	Average % fines	Average % TOC
WLIS Active	52.5	1.5
WLIS Far Field	76.4	2.6
WLIS Historic	88.8	2.6
WLIS Reference	24.8	1.3

[1] Source USACE (2001a).

Throughout Long Island Sound tidal currents are dominant running east-southeast and west-northwest parallel to the long axis of the Sound. Average peak ebb and peak flood currents run 20 to 30 centimeters/second (0.7 to 1 feet/second) (depth-averaged), with the spring tides 20 to 40 percent stronger. Tidal ellipse parameters for surface, middle, near-bottom, and bottom currents measured in WLIS in the spring of 2001 are presented in Table 3 (USACE, 2001b). The dominant flow direction is nearly east-west (8.9 and 353 to 358 degrees) and the relatively smaller minor amplitude speeds indicate that there was little flow in the north/south direction. Amplitude decreases with depth and near-bottom amplitude is less than 20 centimeters/second (0.7 feet/second). Seventy to 90 percent of the current variance during the entire 2-month spring deployment period was due to the tide with nearly 90 percent (89.3) 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, Near-bottom, Middle and Surface Currents Measured in WLIS, Spring 2001

Layer	Distance from Bottom (m)	Major Amplitude (cm/s)	Minor Amplitude (cm/s)	Inclination (degree)	Phase (degree)	Major Axis % Tidal Variance	Minor Axis % Tidal Variance
Surface	31.1	25.9	0.6	8.9	125.2	71.5	34.6
Middle	16.1	26.5	1.3	357.5	113.9	78.8	25.1
Near-Bottom	2.1	19.1	4.3	353.2	96.1	76.1	55.3
Bottom	~1.0	14.2	3.4	358.4	50.6	89.3	52.1

Source: USACE 2001b

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. The year-long current meter deployment reported by Fredriksson and Dragos (1996) revealed periodic strong near bottom flows to the west-southwest caused by the combining of the ebb tide with a west-southwestward flow associated with wind stress and to a lesser extent the density gradients. While near bottom peak ebb and flood tides run from 20 to 30 centimeters/second (0.7 to 1 feet/second), flows directed to the west-southwest run as high as 40 to 45 centimeters/second (1.3 to 1.5 feet/second) for 2 percent of the time and 35 to 40 centimeters/second (1.1 to 1.3 feet/second) for 5 percent of the time, with flows as high as 50 to 55 centimeters/second (1.6 to 1.8

feet/second) recorded on occasion. These results are consistent with the USACE (2001b) 2-month measurement from the spring of 2001 of 42 centimeters/second (1.4 feet/second) peak near-bottom current (2 meters [6.6 feet] above the bottom) and also with a month-long current meter deployment inside the boundaries of WLIS completed in January 1982 under the DAMOS program (Morton *et al.,* 1982). A current meter deployed 1.5 meters (4.9 feet) above the bottom in that study recorded a peak flood event of 45 centimeters/second (1.5 feet/second) associated with winds in excess of 30 knots (15.4 meters/second). Fredriksson and Dragos (1996) and Morton *et al.,* (1982) reported a net west-southwestward flow (long-term mean) of 1.5 to 5.5 centimeters/second (0.05 to 0.18 feet/second) indicative of the density driven estuarine circulation.

The wind fetch at WLIS is limited by the semi-enclosed nature of Long Island Sound which limits the wave heights that can be developed at the site by winds from directions other than the northeast (along the axis of the Sound). Winter storms can produce powerful winds from the northeast (nor'easters). The 2-month record of waves made in the spring of 2001 at a station within WLIS (USACE 2001b) recorded 6.5-foot (2-meter) high waves (significant wave height) with 4 to 6 second periods associated with a 10 meter/second (19 knot) wind event (winds from the east). Near bottom peak orbital wave velocities measured at a 118-foot (36-meter) depth in the axial depression reached only 2 centimeters/second (0.07 feet/second). This survey, however, represents a short record of potential wave activity. A 12-year record of wind data from the Buzzards Bay Tower analyzed for the period July 1985 to February 1994 and May 1997 to March 2001 developed wind climatology and wave predictions for the region encompassing WLIS 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. A northeast storm with a return period of two years can generate waves of 9 feet (2.8 meters) with a 6 second period over WLIS. Storms with a return period of 10 years will generate 11-foot (3.4-meter) waves with a 6.6 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 (2001b) with a peak wave height of 6.5 feet (2 meters), represent storms that can be expected several times a year.

The oscillatory motions beneath steep waves do not penetrate as deeply as those beneath fully developed waves. For a representative depth of 98 feet (30 meters), peak wave induced near-bottom orbital velocities calculated from linear wave theory for the 2 and 10 year storms would generate bottom orbital velocities of 10 and 20 centimeters/second (0.3 to 0.7 feet/second), respectively. Velocities of this magnitude are not sufficient to cause significant erosion (Bokuniewicz and Gordon, 1980). Model estimates indicate that bottom orbital velocities of 35 centimeters/second (1.1 feet/second) are required to mobilize 1 millimeter (0.04 inches) non-cohesive sediments.

Table 4. Wave Height and Period at WLIS 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 (feet)[1]	Peak Wave Period (second)	Wave Height (feet)	Wave Period (second)	Wave Height (feet)	Wave Period (second)	Wave Height (feet)	Wave Period (second)	Wave Height (feet)	Wave Period (second)
1	4.64	4.17	7.19	5.27	8.39	5.72	6.68	5.09	3.17	3.50
2	5.06	4.34	7.86	5.50	9.25	6.01	7.33	5.33	3.45	3.65
5	5.61	4.56	8.73	5.80	10.35	6.36	8.17	5.62	3.82	3.83
10	6.03	4.71	9.38	6.01	11.17	6.62	8.80	5.83	4.11	3.96
20	6.45	4.86	10.03	6.21	11.97	6.87	9.42	6.04	4.40	4.09
50	7.02	5.06	10.87	6.47	13.02	7.18	10.24	6.30	4.78	4.25
100	7.45	5.20	11.50	6.66	13.79	7.40	10.85	6.49	5.07	4.37

Return Period (years)	Wind Direction (Degrees from True North)					
	225°		270°		315°	
	Wave Height (feet)	Wave Period (second)	Wave Height (feet)	Wave Period (second)	Wave Height (feet)	Wave Period (second)
1	4.96	4.22	4.15	3.89	3.03	3.35
2	5.35	4.37	4.46	4.02	3.24	3.45
5	5.87	4.55	4.86	4.18	3.52	3.58
10	6.26	4.69	5.17	4.29	3.74	3.68
20	6.66	4.82	5.48	4.41	3.96	3.78
50	7.20	5.00	5.89	4.56	4.25	3.90
100	7.60	5.12	6.21	4.66	4.47	3.99

[1]Wave heights are reported as significant wave height which is the average of the one-third highest waves.

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 WLIS, the average concentrations of six metals (copper, mercury, nickel, lead, silver and zinc) exceeded the Effects Range-Low (ER-L) at one or more of the stations sampled in 2000 (Table 5). The average mercury concentration in samples from the WLIS active mound station also slightly exceeded the Effects Range-Median (ER-M). Average concentrations of six metals exceeded the average background concentration for the depositional environments of Long Island Sound (silver, cadmium, copper, mercury, lead, and zinc). In general, average contaminant concentrations are highest in the farfield samples, followed in decreasing concentration at the active mound, historical disposal areas, and reference locations (Table 5).

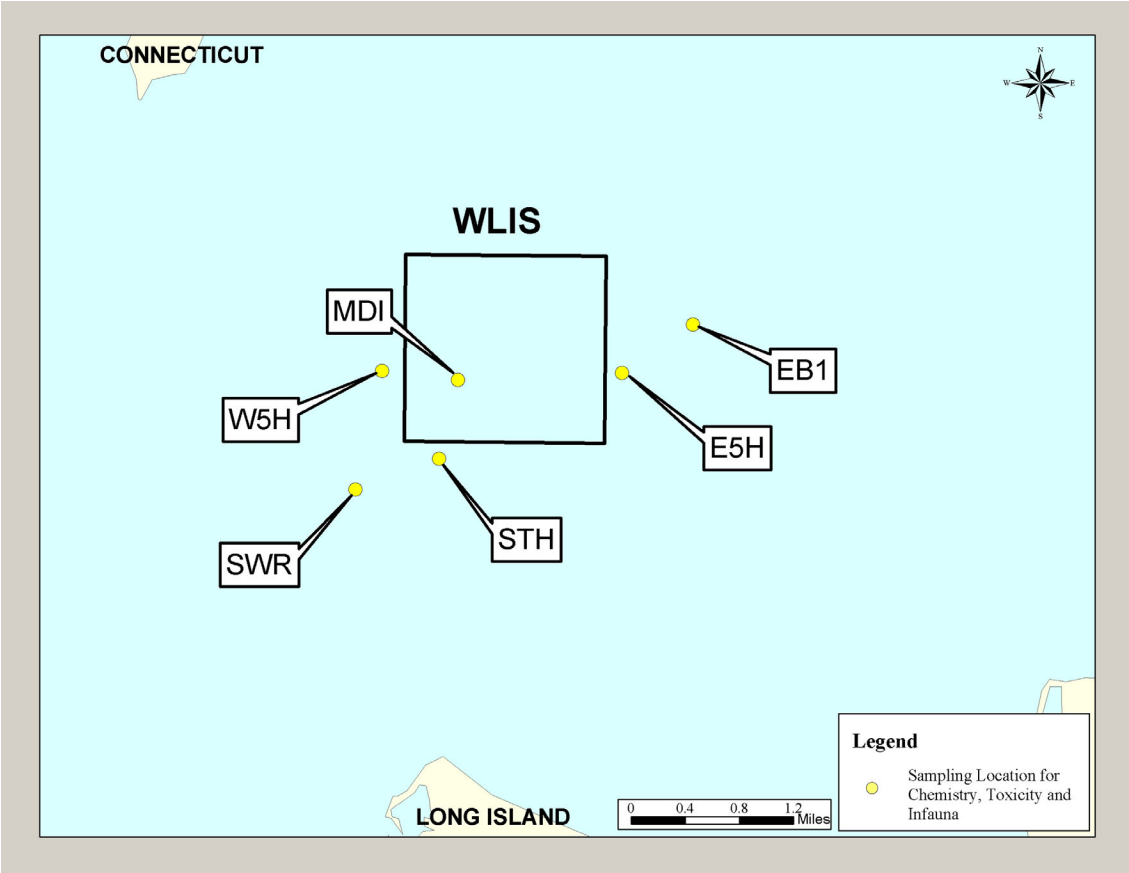

Figure 3. WLIS Sediment Sampling Locations (NAD 83)

Source: USACE, 2001c

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

Station	Silver	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
ER-L[1]	1.0	1.2	81	34	0.15	20.9	46.7	150
ER-M[1]	3.7	9.6	370	270	0.71	51.6	218	410
Sound-wide Sediment Concentrations[2]								
LIS average	0.27	0.16	67.9	**39.1**	0.12	**24.8**	36.1	103
LIS depositional environment average	0.44	0.25	**93.3**	**59.5**	**0.18**	**32.2**	**47.7**	146
WLIS[3]								
WLIS Active	0.97	0.60	44.5	**63.5**	**0.79**	18.5	**49.4**	110
WLIS Far Field	**1.09**	0.62	68.8	**76.6**	**0.41**	**27.0**	**53.1**	**152**
WLIS Historic	0.90	0.31	68.6	**67.3**	**0.18**	**25.6**	44.6	139
WLIS Reference	0.36	0.20	27.2	**36.5**	0.13	12.9	24.1	118

Shaded values exceed the average background level for LIS depositional environments; Bold values exceed the ER-L; underlined values exceed the ER-M.
[1] Ecological effects values derived by Long *et al.* (1995)
[2] Mecray and Buchholtz ten Brink (2000)
[3] Collected in February 2000 (USACE 2001a)

Average concentrations of total low and high molecular weight PAHs and total PCBs at WLIS exceeded the ER-L at the active and farfield stations (Table 6); total DDT exceeded the ER-L in the samples from the active station. Average concentrations of total PCBs and total DDT exceeded the ER-L in the samples from the historic stations. Average concentrations of most organic contaminants in the reference site samples were less than the ER-Ls (Table 5). The sediments from which the ER-L and ER-M values were derived contained approximately 1 percent total organic carbon (TOC). The TOC of sediments from Long Island Sound is typically higher than 1 percent which might reduce the bioavailability of many organic chemicals.

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

	Low Molecular Weight PAH	High Molecular Weight PAH	Total PAH	Total PCB	Total DDT	2,3,7,8-TCDD[1]
ER-L[2]	552	1700	4022	22.7	1.58	—
ER-M[2]	3160	9600	44792	180	46.1	—
Long Island Sound Average[3]	747	3470	2416	108	5.61	—
WLIS[4]						
WLIS Active	**1008**	**3283**	3865	**69**	**4.6**	0.0009
WLIS Far Field	**698**	**2000**	2414	**83**	1.1	0.0035
WLIS Historic	382	1016	1255	**43**	**1.8**	0.0016
WLIS Reference	158	542	630	9	1.1	0.00051

Shaded values exceed background levels; Bold values exceed the ER-L
[1] 2,3,7,8-TCDD is presented as a representative dioxin/furan
[2] Ecological effects values derived by Long *et al.*, 1995 using sediments containing 1 percent TOC
[3] NOAA NS&T Benthic Surveillance Program 1984-1991
(http://ccmaserver.nos.noaa.gov/NSandT/NSandTdata.html)
[4] Source: USACE 2001a

At WLIS, the mean percent survival of organisms exposed to the sediments under standard acute toxicity testing protocols ranged from 96 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, at WLIS March 2000

Station IDs	Percent Survival		Survival Statistically Different from Reference? [1]	Absolute Difference from Reference (%)
	Mean	sd		
Sediment Toxicity Results for WLIS, March 2000				
WLIS				
Reference (STH)	98	3	NA	NA
Farfield (EFH)	96	2	No	–2
Farfield (W5H)	98	3	No	0
Historical (EB1)	98	3	No	0
Active (MD1)	100	–	No	+2

[1] Site sediments were compared only to their site-specific reference sediment.
Source: USACE 2000b

Water Column Characteristics/Circulation

The salinity at WLIS is slightly less than the waters to the east of the site ranging from approximately 27 to 29 psu in the summer and 25 to 28 psu in the winter. Temperatures in the summer may range from 19 to 25 °C (66 to 77 °F) and be as low 2.5 °C (36.5 °F) or less in the winter. The water clarity in the summer months is slightly lower than the other areas of Long Island Sound. Hypoxia (dissolved oxygen less than 2 mg/L) in the bottom waters of the region that includes WLIS is well documented. Hypoxic conditions in the waters in and around WLIS develop earlier in the season, are more severe, and last longer than in the waters farther east. The hypoxia at WLIS results from higher levels of nutrients (primarily nitrogen) that enter the waters of the western Long Island Sound relative to the central and eastern Long Island Sound basins and its smaller volume and restricted flow. The levels of contaminant chemicals in the waters at WLIS and the surrounding region are expected to be similar to or slightly higher (due to the proximity to sources, its lower salinity, and smaller water volume) than the central and eastern regions of the Sound.

Biological Characteristics

This section summarizes the key biological communities at the WLIS site, including the benthic community, fish and shellfish, and endangered and threatened species.

Benthic Community

Benthic invertebrates sampled in July 2000 from an active mound ("I"), a historical disposal area (Eaton's Neck), a reference area (SOUTH), and two farfield stations 500 meters outside of the disposal site (E5H, W5H) showed similar benthic infaunal community within WLIS and the SOUTH reference site (see Figure 2 for sampling locations) (USACE, 2001c). The number of infaunal animals within each area in July 2000 was relatively high, with about

23,000 individuals per square meter within the disposal site and about 25,000 individuals per square meter occurring within the reference area (Table 8; USACE, 2002). The average number of species found in the disposal and reference site samples were 36 and 45, respectively. These values were reflected in the moderately high Shannon-Wiener diversity (H′) values calculated for the WLIS samples (Table 8). Rarefaction analysis, which uses data from each sample to estimate the number of species expected for samples of various sizes (Sanders, 1968; Hurlbert 1971), of pooled WLIS samples showed that species diversity among the disposal site and reference stations was very similar. Rarefaction information for the reference station in July 2000 was slightly higher than that at the active "I" mound. Evenness values were moderately high in WLIS and at the reference station (0.7) (Table 8).

Table 8. Comparison of the Biological Characteristics of WLIS

	WLIS[1]	Reference[2]
SPI Features (July 1996)[3]		
Grain Size (phi)	>4	>4, 4–3
Prism Penetration (centimeters)	11–19	8–14
Dominant Processes	Biological/Physical	Biological/Physical
RPD Depth (centimeters)	0.4–4.9	1.6–2.7
Successional Stage	I, III	I, III
Organism-Sediment Index (OSI)	−1–10.5	3.5–9.0
Infaunal Community Features (February, July 2000)[4]		
Average Abundance (/sample)	910 (~23,000/m2)	1,002 (~25,000/m2)
Average Species (/sample)	36	45
Average Diversity (H′)	3.6	3.9
Average Evenness (J')	0.7	0.7
Five Most Abundant Taxa[5]	*Nucula annulata* *Mediomastus ambiseta* *Ampharete finmarchica* *Macoma tenta* *Tharyx sp. 1B*	*Nucula annulata* *Ampharete finmarchica* *Mediomastus ambiseta* *Macoma tenta* *Tharyx sp. 1B*

[1] Four SPI stations; range of values shown.
[2] Three SPI stations; range of values shown.
[3] Source: SAIC, 1998
[4] Source: USACE 2002
[5] In order of decreasing abundance.

Three deposit feeders, the small clams *Nucula annulata* and *Macoma tenta* and the polychaete worm *Mediomastus ambiseta*, were the most abundant infaunal organisms among the WLIS samples. Together they accounted for about 49 percent of the fauna identified from WLIS in July 2000. The density of *N. annulata* among all WLIS samples collected in July 2000 was about 10,800 individuals per square meter. Other numerically important species were the tube-dwelling polychaete worm *Ampharete finmarchica* and the surface deposit feeding worm *Tharyx* sp, which has not yet been described in the formal scientific literature; its taxonomic status is presently being studied.

The benthic communities evaluated by using sediment profile imagery (SPI) showed a range of sediment characteristics and generally advanced successional stages both within WLIS and at its reference stations (Table 8). The camera data indicted that the quality of the sediments and the condition of the benthic community were generally good.

Commercial/Recreational Fish and Shellfish Resources

Standard research tows for fish and shellfish conducted by the CTDEP Long Island Sound Trawl Survey between 1984 and 2000 documented the average CPUE for the spring trawls in the area that includes WLIS in spring 1984, fall 1985 and both seasons in 2000. The spring CPUE results show the area around WLIS to be productive compared to other parts of the Sound, with notably high CPUE from one trawl in 1984. The fall CPUE results are generally lower than the other disposal sites, most strongly in the average of nine trawls in fall 2000 when WLIS had high average CPUE. The species richness in the WLIS area was 12.5 in the fall and 12.3 in the spring. The trawl survey results from 1984, 1985, and 2000 provided examples of the species that typically dominate the WLIS area. Winter flounder and windowpane flounder dominated the catch in the area during the spring trawl surveys (1984, 2000), scup also dominated the catch in 2000, and these three species range widely showing little fidelity for specific locations. The fall trawl surveys (1985, 2000) found scup, butterfish, and weakfish to be the species with the highest catch numbers these species also show little fidelity for specific locations suggesting that the WLIS area does not contain unique natural characteristics essential to any of the abundant species of finfish. The fall and spring species composition found within the WLIS area is highly comparable to that found in surrounding habitat areas which include data collected from 72 tows from 1984 to 2000 and provide a more comprehensive assessment of fish resources in the area surrounding WLIS. Although this is in an area of relatively high habitat heterogeneity, the most abundant species appear to range across the western basin.

During the EIS process, EPA consulted with NMFS on the EFH findings. NMFS stated that use of ongoing and mutually agreed upon seasonal constraints on disposal operations (June 1 through October 1) as well as the overview program described in the this document, and concluded that no conservation recommendations are needed to protect EFH managed under the MSA at the sites.

The average 1984 to 2000 trawl lobster CPUE data in the areas in which WLIS is located was approximately 120 lobsters in the fall (1985, 2000) and about 115 in the spring (1984, 2000). The decline in lobster beginning in 1999 has lowered the abundance of lobster and commercial lobstering in the area (as of 2003). With respect to other commercial shellfish species, the average CPUE at WLIS in the fall was about 90 squid per tow but very low (nearly zero) in the spring. Longfin squid are less abundant in the area encompassing WLIS than at the other areas of the Sound. Commercially harvested clam species were not found in benthic samples collected at the WLIS site in 2000 and there is no evidence of substantial populations. Oyster and clam harvesting is very active in the nearshore regions north of WLIS along the Connecticut coastline.

During EFH consultation NMFS also noted that the WLIS site has been managed in such a way that disposal activities are minimized when the most sensitive American lobster lifestages are most "at risk." Although the American lobster population was decimated in the summer and fall of 1999, the potential for and probability of recovery exists. In light of that potential, NMFS recommended that the management measures invoked at the WLIS disposal site remain in place, should the site be designated.

Endangered/Threatened Species

An endangered species is one whose overall survival in a particular region or locality is in jeopardy as a result of loss or change in habitat, overall exploitation by man, predation, adverse interspecies competition, or disease. Unless an endangered species receives protective assistance, extinction may occur. Threatened or rare species are those with populations that have 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 (NYSDEC, 2003). Endangered and threatened species are protected under the Federal Endangered Species Act, 16 U.S.C. §§ 1531 *et seq.* and under state law while species listed as "special concern" are protected by state law.

Endangered and Threatened Mammals. In general, whales and other marine mammals are not frequently observed in Long Island Sound, however, incidental sightings have resulted in the inclusion of several species on the endangered species list for Connecticut and New York (CTDEP, 2003; NYSDEC, 2003; USFWS, 2003). Table 9 lists the whale species on the Federal endangered and threatened species list for Connecticut and New York. Pursuant to Section 7 of the Endangered Species Act, EPA requested input from NMFS on the identification of Threatened and Endangered Species in Long Island Sound. Based on information received, NMFS concurred that marine mammals are not expected to spend significant portions of time within the western and central basins of Long Island Sound and that adverse impacts to mammals are not likely.

Table 9. Endangered Marine Mammals and Reptiles for Connecticut and New York

Species	Federal Status[1]	CT Status[2]	NY Status[3]
Humpback whale (*Megaptera novaeangliae*)	Endangered	Endangered	Endangered
Fin whale (*Balaenoptera musculus*)	Endangered	Endangered	Endangered
Right whale (*Eubalaena glacialis*)	Endangered	Endangered	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Endangered	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened	Threatened	Threatened
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Endangered	Endangered
Green sea turtle (*Chelonia mydas*)	Threatened	Threatened	Threatened
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered	Endangered	Endangered

Source: [1]USFWS, 2003, [2]CTDEP, 2003; [3]NYSDEC, 2003;

Endangered and Threatened Reptiles. Sea turtles are the only endangered reptile species noted in the Long Island Sound area. Sea turtles are highly migratory and are often found throughout the world's oceans (NOAA, 1995). Pursuant to Section 7 of the Endangered Species Act, EPA requested input from NMFS, U.S. Fish and Wildlife Service (USFWS), CTDEP, and NYSDEC on the identification of Threatened and Endangered Species in Long Island Sound. Their assessment noted the five species of sea turtles with possible occurrence in the waters of Long Island Sound.

Use of Long Island Sound by turtles appears related to the availability of prey, annual migration patterns, and age. The coastal waters of New York provide an important habitat for juvenile Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), and loggerhead (*Caretta caretta*) turtles and adult-sized leatherbacks (*Dermochelys coriacea*). Hawksbill (*Eretmochelys imbricata*) turtles are only an incidental visitor to Long Island Sound, therefore Long Island Sound is not considered important habitat to the Hawksbill turtle. USFWS and NMFS have concurred with the finding of the EIS that no adverse impacts to these endangered and threatened reptiles are expected to occur as a result of the designation of dredged material disposal sites.

Endangered and Threatened Fish. The shortnose sturgeon (*Acipenser brevirostrum*) is listed as an endangered species in both the state of Connecticut (CTDEP, 2003) and New York (NYDEC, 2003) and is managed by NMFS under the Endangered Species Act. Shortnose sturgeon occur in the lower Connecticut River from the Holyoke Pool to Long Island Sound. Shortnose sturgeon spawn in fresh water from the end of March to the first week of May (CTDEP, 2003). Populations of shortnose sturgeon in North America have declined due to overfishing, loss of habitat, limited access to spawning areas and water pollution. Unlike other anadromous species such as salmon and shad, shortnose sturgeon do not appear to make long-distance offshore migrations (NMFS, 2001a). It is possible that shortnose sturgeon utilize portions of Long Island Sound since the species is known to spawn in the Connecticut River; however, they have not been captured in the CTDEP trawl survey, which has been sampling Long Island Sound since 1984, or in any other DEP sampling programs conducted in Long Island Sound (Appendix H-6, personal communication, Charles Evans, 2003).

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is listed as "threatened in inland waters" for the state of Connecticut (CTDEP, 2003). This designation means that the Atlantic sturgeon is not protected within the waters of Long Island Sound under the Connecticut's endangered species legislation, but a moratorium on harvesting the species in Long Island Sound has been enacted. In February 2003, a proposal was made to change the status of the Atlantic sturgeon to "endangered in all state waters" (personal communication Tom Savoy, Connecticut Marine Fisheries Division). This proposal is still under consideration at this time.

Atlantic sturgeon is an anadromous species that lives up to 60 years, reaching lengths up to 14 feet (4 meters) and weighing over 800 pounds (363 kilograms) (NMFS, 2001b). Long Island Sound may be an important feeding or resting area on-the-way to and from spawning areas in the Hudson River because all sizes of Atlantic sturgeon have been seen or captured

in the Sound. Atlantic sturgeon were caught in all three basins of Long Island Sound but were mainly located in the vicinity of Falkner Island (Savoy and Pacileo, 2003).

Endangered and Threatened Birds. Table 10 lists the Federal and state endangered and threatened coastal and marine birds and bird species of special concern that have been recorded in Connecticut or New York and may occur within the Long Island Sound area. As described in the table, birds are not expected to frequently occur at WLIS due to their foraging and breeding requirements.

Table 10. Federal and State Endangered and Threatened Birds, and Birds of Special Concern in the Long Island Sound Area

	Classification	Season	Federal Status	CT State Status	NY State Status	Use of offshore, open-water areas
Black tern (*Chlidonias niger*)	Colonial waterbird	Spring – early fall	--	--	Endangered	None
Common tern (*Sterna hirundo*)	Colonial waterbird	Spring – early fall	--	--	Threatened	Occasional
Least tern (*Sterna antillum*)	Colonial waterbird	Spring – summer	--	Threatened	Threatened	Occasional
Roseate tern (*Sterna dougallii*)	Colonial waterbird	Spring – early fall	Endangered	Endangered	Endangered	Occasional
Great egret (*Ardea albus*)	Colonial waterbird	Summer	--	Threatened	--	None
Black rail (*Laterallus jamaicensis*)	Marsh	Spring – fall	--	Endangered	Endangered	None
Common Loon (*Gavia immer*)	Pelagic	Winter	--	--	Special Concern	Occasional
Pied-Billed Grebe (*Podilymbus podiceps*)	Pelagic	Permanent	--	Endangered	Threatened	None
Bald eagle (*Haliaeetus leucocephalus*)	Raptor	Winter	Threatened	Threatened	Threatened	None
Northern harrier (*Circis cyaneus*)	Raptor	Resident	--	Endangered	Threatened	None
Osprey (*Pandion haliaetus*)	Raptor	Spring and early-late fall	--	--	Special concern	None
Peregrine falcon (*Falco peregrinus*)	Raptor	Early fall		Endangered	Endangered	None
Piping plover (*Charadrius melodus*)	Shore	Spring – early fall	Threatened	Threatened	Threatened	None
Willet (*Catoptrophorus semipalmatus*)	Shore	Spring – early fall	--	Special concern	--	None

Source: NYSDEC Endangered Species List (www.dec.state.ny.us/website/dfwmr/wildlife/endspec/etsclist.html) 12/31/2002; CTDEP Wildlife Division Endangered and Threatened Species Series (http://dep.state.ct.us/burnatr/wildlife/learn/esfact.htm) 12/31/2002; USFWS, 2003, Alsop, 2001

Bioaccumulation and Potential Risks

Based on data collected for NOAA's National Status and Trends Program, chemical contaminants in mussel tissue from Long Island Sound are generally low and appear to be declining (Turgeon, *et al.,* 1989; O'Conner and Beliaeff, 1995). Concentrations of most chemicals tended to be highest in the western basin. Chemical concentrations in fish and lobster tissue collected in support of the EIS were low and showed little spatial variability across the areas evaluated (see Figure 4 and Figure 5 for sampling locations).

Potential risks to human health associated with exposure to sediments at the site are low (Table 11). Tissue concentrations were well below Food and Drug Administration (FDA) limits, (the only available thresholds for tissue data), for all chemicals.

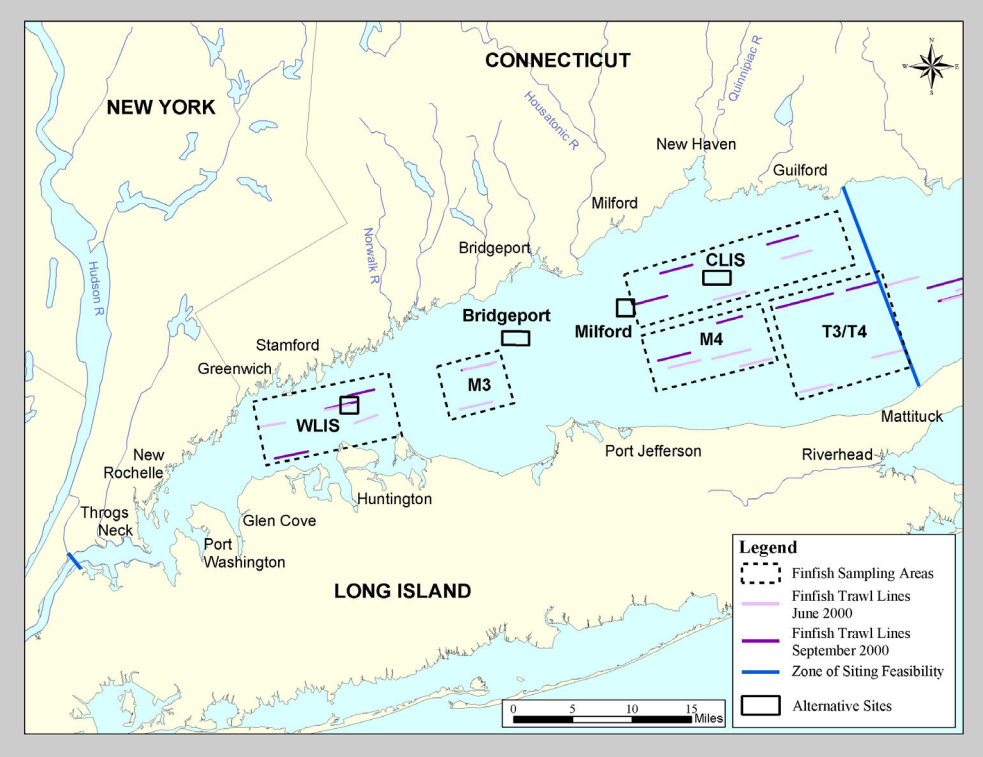

Figure 4. Finfish Sampling Locations, June and September, 2000 (NAD 83)
Source: USACE, 2000c

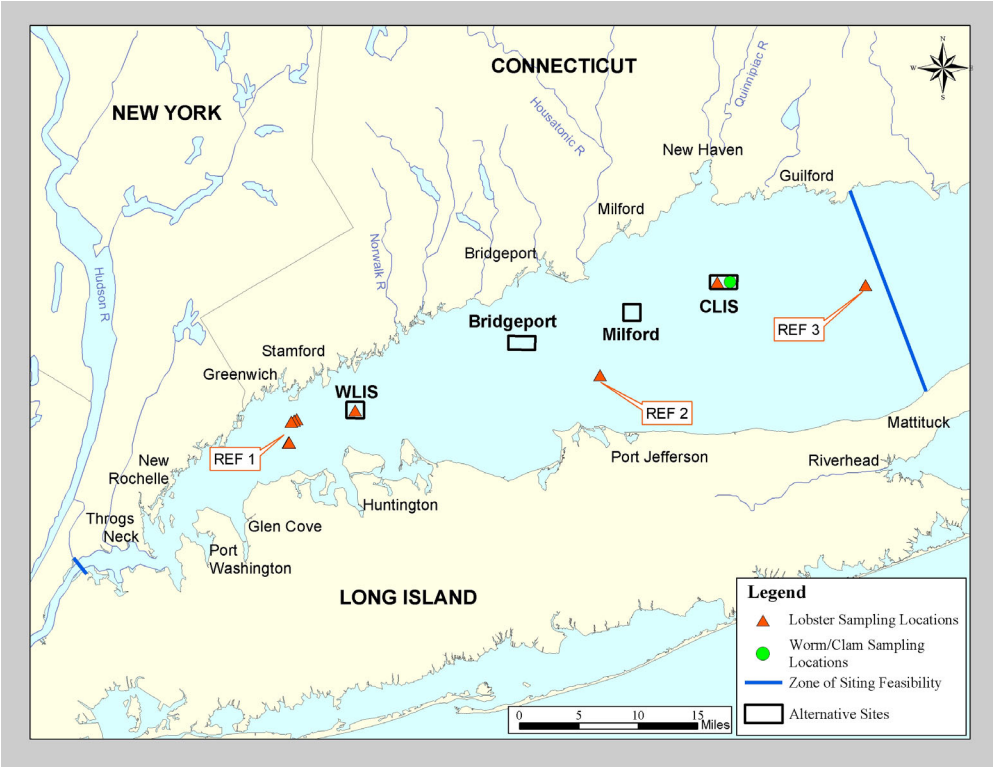

Figure 5. Benthic Tissue (Lobster, Clam, and Worm) Sampling Locations (NAD 83)
Source: USACE, 2000c

Table 11. Comparison of Lobster and Finfish Edible Tissue Concentrations[1] (wet weight) to Human Health Action Levels (*i.e.*, FDA Action Levels)

Station	Species	Total PCB (µg/kg)	Total DDT (µg/kg)	Total Chlordane (µg/kg)[2]	Aldrin (µg/kg)	Dieldrin (µg/kg)	Heptachlor (µg/kg)	Heptachlor Epoxide (µg/kg)	Mercury (mg/kg)
FDA Human Health Action Levels		2000	5000	300	300	300	300	300	1
CLIS	Winter Flounder	82 – 108	6 – 9	1.19 - 1.25	0.02 U	0.75 – 1.04	0.02 U	0.02 U	0.01 - 0.02
	Scup	72 – 168	5 -12	0.5 – 0.7	0.02 U	0.34 – 3.9	0.02 U	0.02 U	0.06 – 0.07
	Bluefish	300	30	4	0.02 U	7	0.02 U	0.02 U	0.10
	Striped Bass	368	37.4	1.90	0.02 U	3.5	0.02 U	0.02 U	0.33
	Lobster	14 - 20	0.9 – 1.2	0.06 – 0.1	0.03 U	0.3 – 0.9	0.04 U	0.02 U	0.17 – 0.33
Strata M3	Winter Flounder	84 – 250	6 – 8	1.16 – 1.56	0.02 U	0.71 – 0.94	0.02 U	0.02 U	0.02 - 0.03
	Scup	80 – 250	5 – 20	0.5 – 1.0	0.02 U	0.39 - 5	0.02 U	0.02 U	0.08 - 0.09
	Bluefish	854	24	3.2	0.02 U	7.5	0.02 U	0.02 U	0.09
	Lobster	7.8 - 10	0.6 – 0.9	0.09 – 0.1	0.02 U	0.4 – 0.6	0.02 U	0.02 U	0.04 – 0.06
WLIS	Winter Flounder	60 – 68	5.2	1.13 – 1.56	0.02 U	0.77 - 0.89	0.02 U	0.02 U	0.02
	Scup	60 - 88	5 - 9	0.55 – 1.12	0.02 U	0.44 – 1.54	0.02 U	0.02 U	0.03 - 0.09
	Striped Bass	308	28.5	1.55	0.02 U	1.19	0.02 U	0.02 U	0.21
	Lobster	12 - 32	1.1 - 2	0.1 – 0.2	0.02 U	0.6 – 1.6	0.02 U	0.02 U	0.05 – 0.08
Strata M4 and Strata T3/T4	Winter Flounder	44 - 86	3 - 7	0.7 – 1.1	0.02 U	0.3 –1.0	0.02 U	0.02 U	0.01 – 0.03
	Scup	32 – 228	3 - 7	0.5 - 1	0.02 U	0.2 –5.1	0.02 U	0.02 U	0.03 - 0.07
	Lobster	18 - 32	1.1 – 2.1	0.09 – 0.17	0.02 U	0.4 – 0.6	0.02 U	0.02 U	0.04 – 0.06

Source: EPA, 2004 Appendix H-5

Shaded cells indicate that maximum values are greater than the minimum CTDPH consumption restriction level (*i.e.,* 100 µg/kg for Total PCBs) (Toal and Ginsberg, 1999).

[1] Half the Detection limit reported for those analytes that were not detected.

[2] Total chlordane is the sum of cis Chlordane and trans-Nonachlor, as described in FDA (1989).

[3] Total PCBs defined as two times the sum of the congeners

U = Not detected

5.2 Disposal Site History

The WLIS Dredged Material Disposal Site has received dredged material since 1982. After completion of an EIS in 1982 (USACE, 1982a, and 1982b), the site was established as a regional disposal site to serve the needs of the western area of Long Island Sound. It is adjacent to three historic disposal sites (Eaton's Neck, South Norwalk, and Stamford, [Figure 6]) that collectively received over 17 million cubic yards (13 million cubic meters) of dredged material between 1954 and 1972 (personal communication, Dr. Thomas Fredette, USACE, September, 2002).

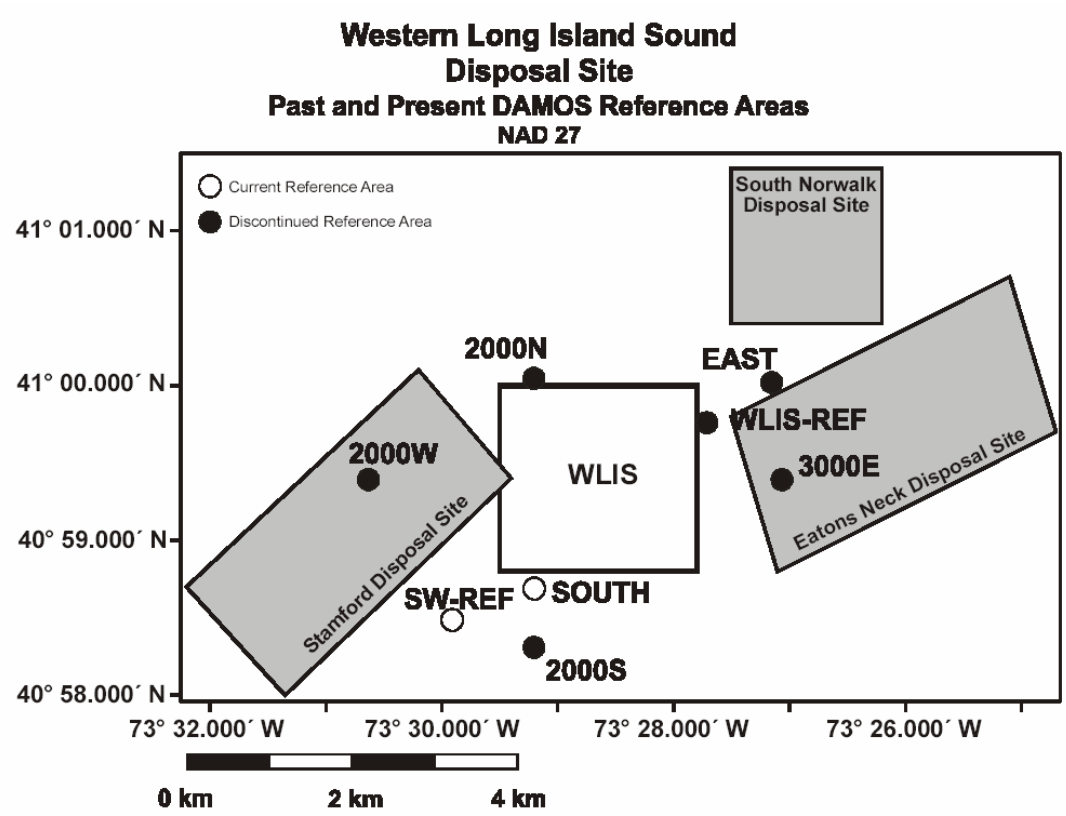

Figure 6. Location of Closed Disposal Sites and Discontinued Reference Areas Adjacent to WLIS Disposal Site

A summary of the source and volume of material placed at each of the disposal mounds since 1982, based on the disposal volume database maintained by the DAMOS program, is provided in Table 12. Information on the harbors of origin and disposal mounds where disposed of can be found in Attachment B.

This dredged material has been placed in 12 distinct disposal locations marked by taut-wire moored disposal buoys during the disposal season. Distinct low profile disposal mounds are detectable at each of these disposal locations (apart from WLIS-J with less than 14,000 cubic yards [10,704 cubic meters] in 1997). The DAMOS program has identified each mound with a letter designation to support monitoring and tracking of disposal activity (Figure 7 and Figure 8). Beginning in 1984, mounds were deliberately placed in rings to form a network of mounds to facilitate containment of larger projects in artificial berms (SAIC 2002a).

Table 12. Disposal Years, Volumes, and DAMOS Mound Designations for WLIS Based on Estimated Barge Volumes[1]

Year(s) Active	Mound	Project(s) Disposed	DAMOS Contributions	Approximate Volume Disposed (cubic yards)
1982-1983	A	Milton Harbor Mamaroneck Harbor Charles Creek New Rochelle	18, 19, 27, 35, 46, 55, 61, 74, 76, 114	200,000
1984,1986-1988	B	Milford, Port Chester, Mianus, New Rochelle, Cos Cob	44, 46, 55, 61, 74, 76, 85	190,000
1984-1986	C	Mianus R., Norwalk Cove, Saugatuck	55, 61, 74, 76	200,000
1989-1990	D	Mamaroneck, Stamford, Cos Cob, Wilson Cove	85, 99, 114, 119	240,105
1990-1991	E	Rye, Oyster Bay, Kings Point	99	114,215
1991-1994	F	Cos Cob, Rye, Greenwich, E. Norwalk, Glen Cove	102, 119	112,074
1994-1995	G	Norwalk Cove, Greenwich, Village Creek	119	83,012
1995-1996	H	Village Creek, Manhasset	119, 125	18,659
1996-1997	I	Riverside, Manhasset, Norwalk	125	63,420
1997-1998 2001-2002	J	Oyster Bay, Manhasset Norwalk, Stamford, Darien	138	14,050 69,475
1998-1999	K	Five Mile River, Rye	138	43,900
1999-2001	L	Greenwich Cove, Larchmont Harbor, Darien, Goodwives River	138	73,250

[1] Projects included in this table represent the largest projects sent to each of the noted mounds; this is not meant to be a complete listing of all disposal (See Attachment B for more information). The DAMOS Contributions used to develop this information are noted. Disposal volumes reported in the DAMOS Contribution may differ from this table because not all disposal records were available prior to publication of each Contribution. Volumes prior to 1989 are based on reconstruction of disposal records and are broad estimates.

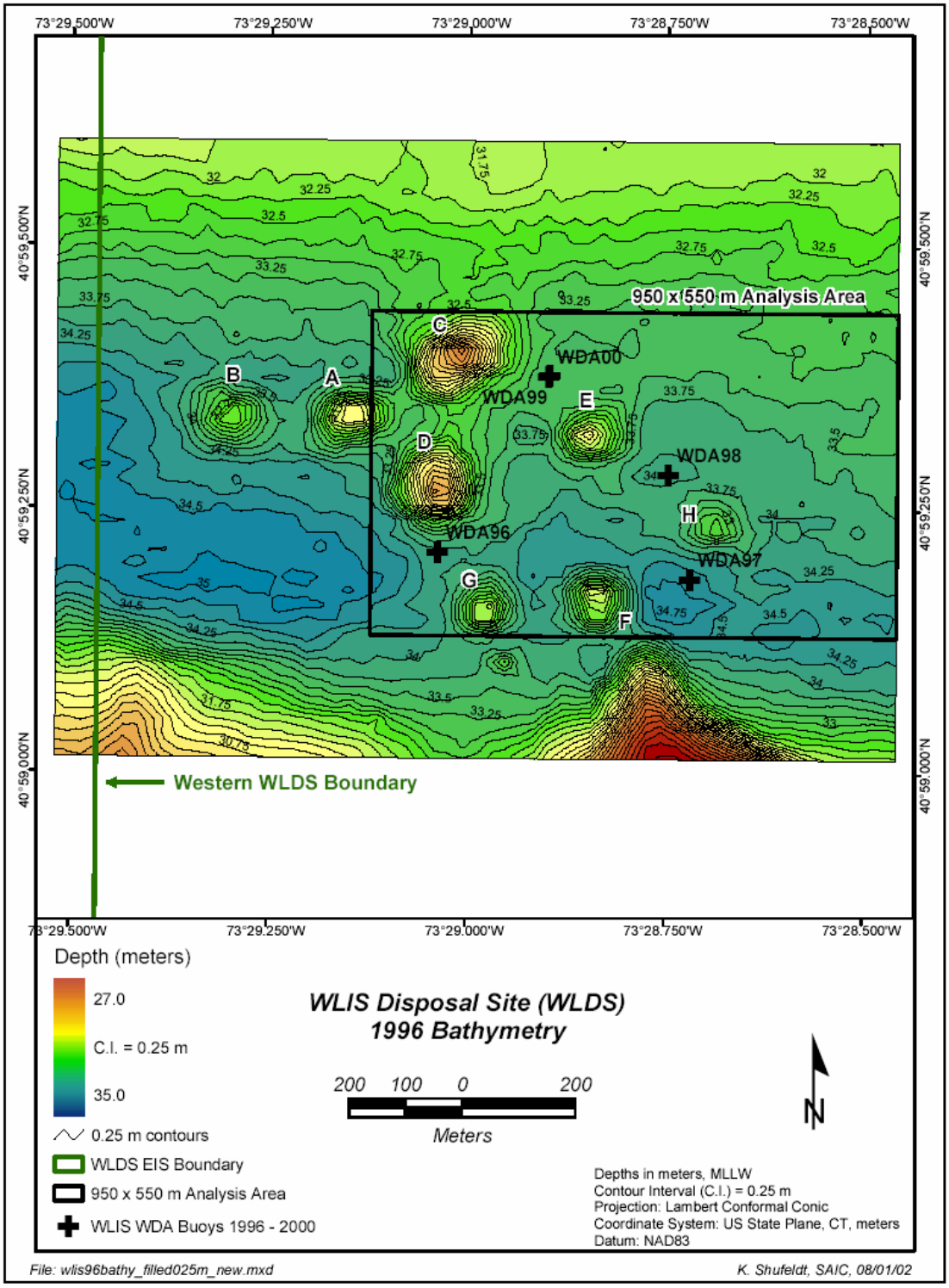

Figure 7. Location of Disposal Mounds and Disposal Buoy Locations within WLIS Based on DAMOS Disposal Logs and a Bathymetric Survey Conducted in 1996

Source: SAIC 2002a
(Note: Full boundaries of WLIS are not shown; WLDS and WLIS are used to describe the WLIS disposal site)

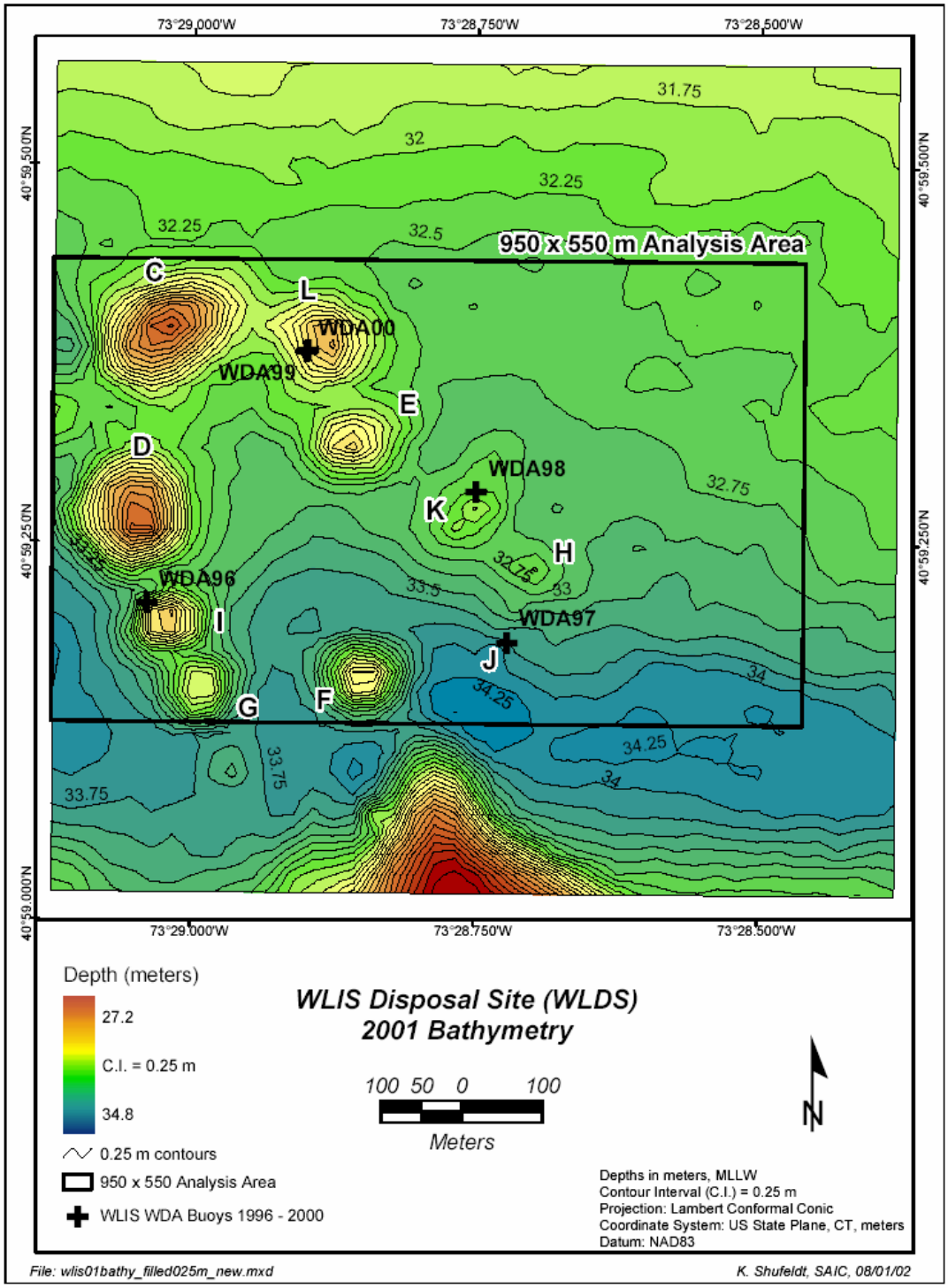

Figure 8. Location of Disposal Mounds and Disposal Buoy Locations within WLIS Based on DAMOS Disposal Logs and a Bathymetric Survey Conducted in 2001

Source: SAIC 2002a
(Note: Full boundaries of WLIS are not shown)

6.0 MONITORING PROGRAM

Dredged materials managed under both MPRSA and CWA will be disposed at WLIS. 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 WLIS 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 WLIS.

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 WLIS 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.,* CTDEP Sediment Quality Information Database [SQUID], USACE Dredged Material Spatial Management and Resolution Tool [DMSMART]). These data will be provided to the EPA, Corps, and states of Connecticut and New York at least one month prior to the annual agency planning 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 will use this information and the monitoring data gathered in the previous year to assess the potential impact and 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 address any need to mitigate unacceptable situations.

This monitoring plan provides a general framework for the monitoring program and guides future sampling efforts at WLIS. 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 WLIS 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 (*i.e.,* progressive water quality changes; 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 and reviewed to identify mounds where sediment quality might be reduced relative to other mounds and to track the quality of material in the future. The remaining premises require various types and scales of monitoring to ensure dredged material disposal at WLIS 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 evaluated and decisions to conduct Tier 2 activities made. When not defined in this plan, 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 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 within successive five-year periods. 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;

[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.

- 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 C 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 (Attachment A) 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 WLIS. 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 address 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 WLIS is a non-dispersive site; therefore 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 0.3 meters (1.0 feet) over an area greater than 50 square meters (538 square feet).

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 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 square meters [538 square feet]; as defined by DAMOS studies) mound changes of more than 0.3 meters (1.0 feet) occurs 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 WLIS.

This hypothesis tests whether storms that produce waves greater than 11 meters (36 feet) height with a period of 7 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 (14 meters [46 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 2 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 0.3 meters (1.0 feet) 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 WLIS does not increase the (a) bathymetry more than 15 centimeters (0.5 feet) over an area larger than 50 square meters (538 square feet) and (b) the OSI 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 15 centimeters [0.5 foot]). SPI may also be used to evaluate changes in sediment characteristics (see Section 6.3.2). The SPI 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 SPI data from areas of concern to reference areas will be used to determine whether the transported material has a potential significant adverse biological impact.

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 WLIS 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 WLIS reference sites to test this hypothesis (see Section 6.3.4).

Chemical and toxicity testing and analysis will be conducted using current methods required by the Corps Civil Works Program and the guidance documents or subsequent approved versions of these 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 WLIS reference sites. Data comparison will consider three measurements as a basis to determine effects (*i.e.,* sediment chemistry, 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

[3] Rapidly in this context means up to three (or more) years depending on a variety of factors that influence recolonization in coastal waters.

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 2002a; 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, 1990a; SAIC, 1988a; SAIC, 1987; SAIC, 1988b; SAIC, 1985; Morton *et al.,* 1984; Scott *et al.,* 1984; Scott and Paquett*,* 1983; Morton and Paquett, 1983; Arimoto and Feng, 1984; Morton *et al.,* 1982; Morton and Stewart, 1982; SAIC, 1982; Morton, 1980a; Morton, 1980b; 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?

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 12 to 16 months after mound completion. Evaluation of selected historic (inactive) mounds and imaging of the WLIS 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 SPI 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 SPI 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 will 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 mound 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 6.3.4). Sediment chemistry and toxicity will be measured at representative locations from within the deposited material and at WLIS references sites (see Section 6.3.4).

Chemical and toxicity measures will be conducted as defined in the guidance documents or subsequently approved versions of these documents. Data from the area of concern will be compared statistically to data collected concurrently from the WLIS reference sites to determine if the quality of transported material is unacceptable. The number of stations to include in the testing will be determined at the annual meeting. The decision of unacceptable conditions will be based on all three measures (*i.e.,* sediment chemistry, benthic community analysis, and toxicity).

6.1.4 Management Focus 3: Changes in Water Quality

The premise underlying this management focus is that water quality in the western basin of Long 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 and that long-term monitoring programs underway in the Sound provide the level of information necessary to determine if the dredged material disposal at WLIS is affecting the overall quality of water in the western basin of the Sound. Relevant questions for water quality include:

- Is short-term water quality in WLIS 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 WLIS must pass the requirements of the guidance documents (or subsequently approved versions of these documents) for disposal. 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 EIS (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) below) occurs is not proposed under Tier 1 but may be required as part of a disposal permit.

Tier 1

Under this tier, it is assumed that water quality at WLIS is not degraded by disposal of dredged material. Moreover, it is assumed that regional monitoring programs such as LISS can provide sufficient information to assess whether disposal of dredged material at WLIS contributes significantly to the changes in water quality of the western basin of the Sound. It is also assumed that the quality of the sediment placed at the site does not affect the marine environment as the sediments undergo testing for acceptance into the site. Thus, sediment quality issues are not tested under this Tier, but rather are evaluated under the tiered monitoring structure under Management Focus 2.

H_0 3-0: The LPC is not exceeded at the site boundary nor four hours after a dredged material disposal event.

H_0 3-1: Spatial and temporal trends in water quality in waters outside of the disposal site boundaries do not indicate WLIS as a contributing factor of change.

Hypothesis H_o3-1 examines the trend in leading water quality indicators (*e.g.,* chlorophyll, dissolved oxygen, turbidity) in the vicinity of WLIS. These parameters are measured at a series of locations near WLIS by the LISS Program (see Section 4.7.1 of the EIS; EPA 2004). The data from this and other relevant programs will be obtained by the agencies managing WLIS and evaluated to determine whether or not there are spatial gradients in the measures near WLIS that can be attributed to the site and whether there are long term changes in water quality in the general vicinity of the site.

Consistent gradients pointing to WLIS as a potential source of poor water quality or long-term trends determined to show detrimental changes in water quality will trigger assessments under Tier 2 of this management focus.

Tier 2

Measurements under this Tier will be triggered if trends evaluated under Tier 1 suggest WLIS as a potential contributing factor of poor water quality in the western basin of Long Island Sound.

H_0 3-2: Water quality at WLIS 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 3) after discussion by the managing agencies.

Tier 3

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 three WLIS 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.

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. These organisms will be monitored in the vicinity of WLIS. As discussed in the EIS (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 Long Island Sound are also unlikely, but are more difficult to predict. However, these populations are regularly monitored by the State of Connecticut 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 WLIS is affecting the fish and lobster populations in the western basin of the Sound. Relevant questions include:

- Are disposal operations at the site creating unacceptable adverse impacts to the composition of the pelagic and demersal fish community?
- Are disposal operations at the site creating unacceptable adverse impacts to the composition of macro benthic biota?

The EIS identifies endangered species in general as a concern for dredged material disposal in Long Island Sound. However, the EIS found that no significant impact would be expected to endangered species from disposal at WLIS.

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 CTDEP fish trawl surveys. These data are collected on a yearly basis under a stratified random sampling design. Data from near the site will be compared with data obtained from other similar areas (depth, sediment type, *etc*.) in the western basin of Long Island Sound to determine if there are significant spatial differences that could be related to dredged material disposal at WLIS.

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 would be determined during the annual agency meeting. 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 WLIS is potentially having a significant 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 WLIS 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 WLIS before any study is conducted.

If studies under Tier 2 demonstrate a link between reduced fish or shellfish abundance and dredged material disposal at WLIS, 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 WLIS 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 WLIS. The basic premise of this management focus is that testing of sediments for open water disposal eliminates material that pose an unacceptable risk to the marine environment from disposal at WLIS. Moreover, because bioaccumulation of contaminants is a phenomenon, 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 WLIS 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 WLIS.

If either of these questions is answered in the negative, significant adverse impact from the disposal operations may be present. The first question will be addressed through evaluation of the testing data submitted as part of the permit application and approval process. The second question is addressed under the Tiered approach below.

Tier 1

The premise of this Tier is that bioaccumulation potential at WLIS, and thus risk, does not increase after the sediments are deposited.

H0 5-1: Bioaccumulation potential of sediments collected from WLIS 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 WLIS 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 WLIS 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 WLIS 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 WLIS.

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 in WLIS. The specific study design will be developed and approved by the agencies managing WLIS 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 guidance documents 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 WLIS 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 1200 meters (0.5 to 0.75 mile) 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 centimeter) over areas of 50 square meters (538 square feet). Side scan sonar and sediment profile imaging systems (Germano and Rhoads, 1982; 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 (Rhoades, 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 SPI (Germano and Rhoads, 1982; 1994). Stations will center on the disposal buoy and sampled in a star pattern at 100 meter (328 feet) 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 in a cross pattern at 100 meter (328 feet) intervals at each of the three reference sites will be obtained. At each station three photos will be taken with the SPI 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;
- OSI.

6.3.3 Water Quality

The National Estuary Program's LISS (http://www.epa.gov/ region01/eco/lis/index.htm) routinely measures temperature, salinity, and dissolved oxygen using vertical hydrocasts. In addition, water samples will be collected via Niskin bottle and analyzed via Winkler titration at selected stations. Data collected near WLIS will be obtained from the LISS program and evaluated. Should site specific monitoring be required, methodologies comparable to the LISS program data collections will be used (http://www.epa.gov/region01/eco/lis/index.htm).

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 (see the guidance documents). 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 three WLIS reference stations.

Toxicity tests will be selected from those used to evaluate dredged material proposed for disposal at WLIS (see the guidance documents). 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 three WLIS reference stations.

6.3.5 Living Resources

Data from the CTDEP Trawl Survey (http://www.dep.state.ct.us/burnatr/fishing /geninfo/fisherie.htm#Coastal%20Programs) will be obtained and analyzed to determine whether the diversity and abundance of recreational and commercial fish in the vicinity of WLIS area differs from other similar areas (depth, sediment type, *etc*.) of the Long Island Sound.

A body burden analysis will also be conducted to determine the concentrations of persistent, bioaccumulatable chemicals such as trace metals (mercury, lead, iron, cadmium, copper), PAHs, and total PCBs in benthic invertebrates. The methodologies used will be consistent with those recommended in the guidance documents. The specific species to be evaluated as well as 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 three replicate samples should be obtained from each station sampled including each of the

three WLIS reference stations. Benthic infaunal organisms analyzed may include *Nephtys incisa* or other infaunal species representative of the site and its contiguous areas that have sufficient tissue mass to enable chemical analysis.

Sampling and chemical analysis of higher trophic levels will be at the discretion of the site managers and focus on determining bioaccumulation in species that can clearly document whether bioaccumulations from the deposited sediments may be determined.

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 the guidance documents. 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 three WLIS reference stations.

Laboratory based bioaccumulation testing will follow the requirements outlined in the guidance documents.

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. WLIS is designated to receive dredged material only. No other material may be placed in the site.

The capacity of WLIS to receive dredged material is large considering the water depth in the site is at least 23 meters (75 feet) and that creating mounds to depths no greater than 14 meters (46 feet) depth below MLLW provides sufficient clearance for the largest vessels (drafts of less than 40 feet [12 meters]) expected to transit Long Island Sound. For perspective, four meters of sediment placed over a 1 square mile area equals 12.5 million cubic yards (9.6 million cubic meters). Thus, building mounds to no more than the 14 meter (46 feet) depth provides more than 20 million cubic yards (15 million cubic meters) of capacity. Historically, WLIS has received an average of 85,000 cubic yards (65,000 cubic meters) annually. This equates to 1.7 million cubic yards (1.3 million cubic meters) over a twenty year period which is far below the potential site capacity. Based on the WLIS site configurations and the best available bathymetry, 62.8 million cubic yards (48 million cubic meters) of dredged material would have to be disposed of at WLIS to reach site capacity.

Site capacity was defined as a mound with a depth of 14 meters (46 feet) below MLW at the mound top, and a mound side slope of 1:10.

The 2000 dredging needs survey of Long Island Sound (USACE, 2001d) 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 the Central and Western regions is 21,601,350 cubic yards (Table 2-1, 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), which is consistent with the pattern of dredging in Long Island Sound over the past 20 years. Sediments projected for disposal are expected to come primarily from maintenance dredging projects, although expansion dredging may be required for deeper draft vessels or from increased commerce in Long Island Sound. Of this volume approximately 1 million cubic yards is anticipated to be derived from improvement dredging. Approximately 13.9 million cubic yards (10.6 million cubic meters) of material is expected to be from Federal navigation projects with the rest of the volume coming from other facilities.

Historically one third of the dredged material volume comes from projects >500,000 cubic yards (382,277 cubic meters), one third from projects 200,000 to 500,000 cubic yards(152,911 to 382,277 cubic meters), and one third from projects <200,000 cubic yards (152,911 cubic meters). The sediment properties are expected to be variable although the predominant sediment type is likely be silty material (silts, organic silts, sandy silts, *etc.*). About 70 percent of the maintenance material volume can be characterized as silty material. Approximately, 10 percent the expansion material are expected to be sands and clays.

All dredged material projects using WLIS 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. 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 either CWA 404 or MPRSA 103. The quality of MPRSA material will be consistent with the requirements of the guidance documents.

Estimates of the aggregated volume historically going to the Central Long Island Disposal Site (CLIS) and to WLIS indicate that 61% and 39% of the projected volumes went to CLIS and WLIS, respectively. From these percentages the projected volume of dredged material that may go to WLIS is 8,424,527 cubic yards (6,441,013 cubic meters), which is 54.4 million cubic yards (41.6 million cubic meters) less than the site's capacity

A specific closure date for WLIS has not been assigned as of the date of this SMMP. The potential capacity at WLIS is far in excess of the potential site use over the next twenty years, thus developing a closure plan at this time is not critical. WLIS has the capacity to meet the regional disposal needs for at least 80 to100 years. The capacity of the site will be evaluated at least every three years and the prospect of closure will be evaluated. 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 (Section 3.0). 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.

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 the WLIS 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.

An interagency dredged material management review group composed of representatives from EPA, Corps, NMFS, USFWS, and New York and Connecticut state representatives meets approximately every two months 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 LORAN-C coordinates (or differential GPS, if available) of disposal as well as the due-date for the documentation itself.

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 comment 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. 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 02114-2023
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 New England Region 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 Long 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 (*i.e.,* CTDEP Trawl Survey) will depend solely on funds allocated to the programs by those agencies or other supporting agencies.

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Attachment A

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	Round 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	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 _____

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Attachment B

WLIS Disposal Site Scow Log Summary by Mound - 1988 to 2002

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PERMITTEE or PROJECT NAME	PERMIT or CORPS CONTRACT #	SCOW VOLUME(CUBIC YARDS)	CITY/TOWN	HARBOR	CT/NY
1988-1989 Disposal Season - No Projects					
NA	NA	NA	NA	NA	NA
1989-1990 Disposal Season - D Mound					
ARNOLD SURESKY	198800704	1,750	Westport	Saugatuck River	CT
CITY OF STAMFORD	198900701	30,400	Stamford	Westcott Cove	CT
COS COB BOAT BASIN	198900865	24,450	Greenwich	Cos Cob/Mianus River	CT
COVE MARINA	198900239	900	Norwalk	NA	CT
HARBOR VILLAGE LTD PARTNERSHIP	198702174	16,925	Greenwich	Cos Cob/Mianus River	CT
IMPERIA FAMILY REALTY	NY15530	3,400	Bronx - Pelham	Eastchester Creek	NY
NORWALK COVE MARINA	198700293	3,850	Norwalk	Charles Creek	CT
CORPS NAN (NYD) MAMARONECK HARBOR	1990C0024	131,150	Mamaroneck	Mamaroneck Harbor	NY
RIVER LANDING ASSOC.	198800005	1,350	Greenwich	Mianus River	CT
SUTTON MANOR ASSOC.	NY15283	3,125		New Rochelle	NY
THE CRESCENT GROUP	NY15076	3,200	Mamaroneck	Mamaroneck Harbor	NY
TOWN OF GREENWICH	198400687	1,700	Greenwich	Mianus River	CT
WILSON COVE MARINA	198901737	17,905	Norwalk	Wilson Point Harbor	CT
	TOTAL	**240,105**			
1990-1991 Disposal Season - E Mound					
ARNOLD & MADIA SURESKY	199010344	1,700	Westport	Saugatuck River	CT
BURRITTS LANDING	199011169	9,300	Westport	NA	CT
CHRISTIAN I. TREFZ	198701341	500	Westport	Saugatuck River	CT
CITY OF RYE, NY	NY16042	24,950	Rye	Milton Harbor	NY
DARIEN BOAT CLUB	198900566	8,550	Darien	Darien River	CT
NORWALK COVE MARINA	198700293	9,525	Norwalk	Charles Creek	CT
PLAZA MATERIALS	NY15826	6,200	Bronx - Pelham	Eastchester Creek	NY
TIDE MILL YACHT BASIN	NY14761	350	Port Chester	Byram River - Port Chester Hbr	NY
TOWN OF OYSTER BAY	NY15714	28,375	Oyster Bay	Oyster Bay Harbor	CT
US MERCHANT MARINE	NY15816	24,185	Great Neck	Little Neck Bay	CT
VICTOR BORGE	199000006	580	Greenwich	NA	CT
	TOTAL	**114,215**			
1991-1992 Disposal Season - F Mound					
ALLEN GREEN	NY16195	1,500	NA	Larchmont	NY
HARBOR VILLAGE LTD PARTNERSHIP	198702174	30,610	Greenwich	Cos Cob/Mianus River	CT
L. SCOTT FRANTZ	199000685	1,175	NA	Greenwich	CT
PAUL HOFFMAN	NY16220	950	NA	Larchmont	NY
TALLMADGE BROTHERS	198803504	1,700	NA	Norwalk	CT

PERMITTEE or PROJECT NAME	PERMIT or CORPS CONTRACT #	SCOW VOLUME(CUBIC YARDS)	CITY/TOWN	HARBOR	CT/NY
TIDE MILL YACHT BASIN	NY14761	10,450	Port Chester	Byram River - Port Chester Hbr	NY
TRUST OF J. MCMICHAEL	NY16225	4,550	Mamaroneck	Mamaroneck Harbor	NY
VILLAGE CREEK HOMEOWNERS ASSOC	199010449	376	NA	Norwalk	CT
	TOTAL	**51,311**			
1992-1993 Disposal Season - F Mound					
BREWER MARINA, INC	NY16221	225	Rye	Mamaroneck Harbor	NY
L. SCOTT FRANTZ	199000685	50	NA	Greenwich	CT
MR MRS GARY L. SWENSON	199102606	500	NA	Greenwich	CT
PONINGO NECK APTS CORP	199000665	8,035	Rye	Milton Harbor	NY
TOWN OF GREENWICH	199102620	19,450	Greenwich	Greenwich Harbor	CT
	TOTAL	**28,260**			
1993-1994 Disposal Season - F Mound					
BELLE HAVEN YACHT CLUB	199300975	3,950	Greenwich	Byram Harbor - Belle Haven Cove	CT
BREWER MARINA, INC	NY16221	8,028	Rye	Mamaroneck Harbor	NY
DANIEL A SPERANDIO, JR	199300620LS	2,400		New Rochelle	NY
INDIAN COVE PROPERTY OWNERS	199214770	4,050	Mamaroneck	NA	NY
NOROTON YACHT CLUB	199011261	1,450	Darien	Darien River	CT
NORWALK BOAT CLUB	199302630	4,075	Norwalk	Norwalk Harbor - West Branch	CT
SHORE AND COUNTRY CLUB	199200670	8,550	Norwalk	Norwalk Harbor - Outer Harbor	CT
	TOTAL	**32,503**			
1994-1995 Disposal Season - G Mound					
ANNE C. CAMBELL	199102738	1,675	NA	Norwalk	CT
J ARTHUR URCIUOLI	199400841	1,475	NA	Stamford	CT
MILT COMPANY	198900236	2,250	NA	Stamford	CT
ROTON POINT ASSOC	199402175	1,550	Norwalk	Five Mile River	CT
TOMS POINT MARINA	199313130	3,900	Port Washington	Manhasset Bay	NY
TOWN OF GREENWICH	199200433	7,850	Greenwich	Greenwich Harbor	CT
TOWN OF WESTPORT	199301107	50,435	Westport	Saugatuck River	CT
VILLAGE CREEK HOMEOWNERS ASSOC	199010449	13,877	Norwalk	Village Creek	CT
	TOTAL	**83,012**			
1995-1996 Disposal Season - H Mound					
MANHASSET BAY MARINA	199313150	4,700	Port Washington	Manhasset Bay	NY

PERMITTEE or PROJECT NAME	PERMIT or CORPS CONTRACT #	SCOW VOLUME(CUBIC YARDS)	CITY/TOWN	HARBOR	CT/NY
MR & MRS ALBERT ZESIGNER	199500691	2,950	NA	Norwalk	CT
PETER WARD	199600874	1,500	NA	Darien	CT
STAMFORD YACHT CLUB	199502521	1,750	Stamford	Stamford Harbor	CT
TOMS POINT MARINA	199313130	2,150	Port Washington	Manhasset Bay	NY
VILLAGE CREEK HOMEOWNERS ASSOC	199010449	5,609	Norwalk	Village Creek	CT
	TOTAL	**18,659**			
1996-1997 Disposal Season - I Mound					
MANHASSET BAY MARINA	199313150	11,350	Port Washington	Manhasset Bay	NY
RIVERSIDE YACHT CLUB	199001268	45,300	Greenwich	Cos Cob/Mianus River	CT
ROTON POINT ASSOC	199402175	6,770	Norwalk	Five Mile River	CT
	TOTAL	**63,420**			
1997-1998 Disposal Season - J Mound					
L. SCOTT FRANTZ	199701232	1,100	NA	Greenwich	CT
RIVERSIDE YACHT CLUB	199001268	1,150	Greenwich	Cos Cob/Mianus River	CT
ROOSEVELT MARINA	199101073	9,250	Oyster Bay	Oyster Bay Harbor	NY
TOMS POINT MARINA	199313130	2,550	Port Washington	Manhasset Bay	NY
	TOTAL	**14,050**			
1998-1999 Disposal Season - K Mound					
BRUCE DEBOER	199602654	1,250	NA	Norwalk	
COE-FIVE MILE RIVER	1999C0004	34,550	Darien & Norwalk	Five Mile River	
DOUGLAS & SANDRA CAMPBELL	199600311	1,000	NA	Norwalk	
MS. KAREN CASEY	199900946	400	NA	Norwalk	
PONINGO NECK APTS CORP	199801856	4,150	Rye	Milton Harbor	NY
WENDY CRUIKSHANK	199900379	700	NA	Norwalk	
WILLIS CAVANAGH	199601090	350	Norwalk	Five Mile River	
WILSON COVE MARINA	199800684	1,500	Norwalk	Wilson Point Harbor	
	TOTAL	**43,900**			
1999-2000 Disposal Season - L Mound					
FANNY RAYMOND	199900793	1,000	NA	Five Mile River	CT
FRANK MAGUIRE	199602325	275	NA	Five Mile River	CT
FRITZ SCHWEITZER	199900173	300	NA	Five Mile River	CT
IRENE PLAGIANAKOS	199600927	8,600	NA	Greenwich	CT
LARCHMONT YACHT CLUB	199801590	9,975	Mamaroneck	Larchmont Harbor	NY
STAMFORD LANDING CONDO ASSOC.	199802236	550	Stamford	Stamford Harbor - West Branch	CT

PERMITTEE or PROJECT NAME	PERMIT or CORPS CONTRACT #	SCOW VOLUME(CUBIC YARDS)	CITY/TOWN	HARBOR	CT/NY
	TOTAL	**20,700**			
2000-2001 Disposal Season - L Mound					
CHARLES CREEK & DORLON MARINA BASIN	199902819	600	Norwalk	Norwalk Harbor	CT
ERIC ROSENFELD	199801640	2,300	Mamaroneck	Larchmont Harbor	NY
GREACEN POINT GROUP	199804160	24,300	Mamaroneck	Larchmont Harbor	NY
IRENE PLAGIANAKOS	199600927	900	NA	Greenwich	CT
NOROTON YACHT CLUB	200000671	8,050	Darien	Darien River	CT
SCHOONER COVE YACHT CLUB	199802695	300	Stamford	Stamford Harbor - East Branch	CT
SHELLEY TRUBOWITZ	199902014	600	NA	Five Mile River	CT
STEPHEN LAMONDO	200002956	400	Westport	Saugatuck River	CT
TOWN OF DARIEN	199901863	15,100	Darien	Darien River	CT
	TOTAL	**52,550**			
2001-2002 Disposal Season - J Mound					
C & L IVES	200101240	375	NA	Norwalk	CT
CHARLES CREEK & DORLON MARINA BASIN	199902819	14,500	Norwalk	Norwalk Harbor	CT
CITY OF STAMFORD	199902133	16,500	Stamford	Westcott Cove	CT
DARIEN BOAT CLUB	199903168	13,000	Darien	Darien River	CT
DEVINE BROTHERS	200102560	4,450	NA	Norwalk	CT
JEAN ROSOW	200100027	400	Fairfield	NA	CT
JEFFERY ERDMANN	200002270	1,700	NA	Norwalk	CT
MIANUS RIVER & YACHT CLUB	200002513	6,350	Greenwich	Mianus River	CT
PRATT COVE ASSOC.	200101261	12,200	Darien	Darien River - Pratt Cove	CT
	TOTAL	**69,475**			

NA – Information not available.

Attachment C

Hypotheses Flowcharts and Summary Table

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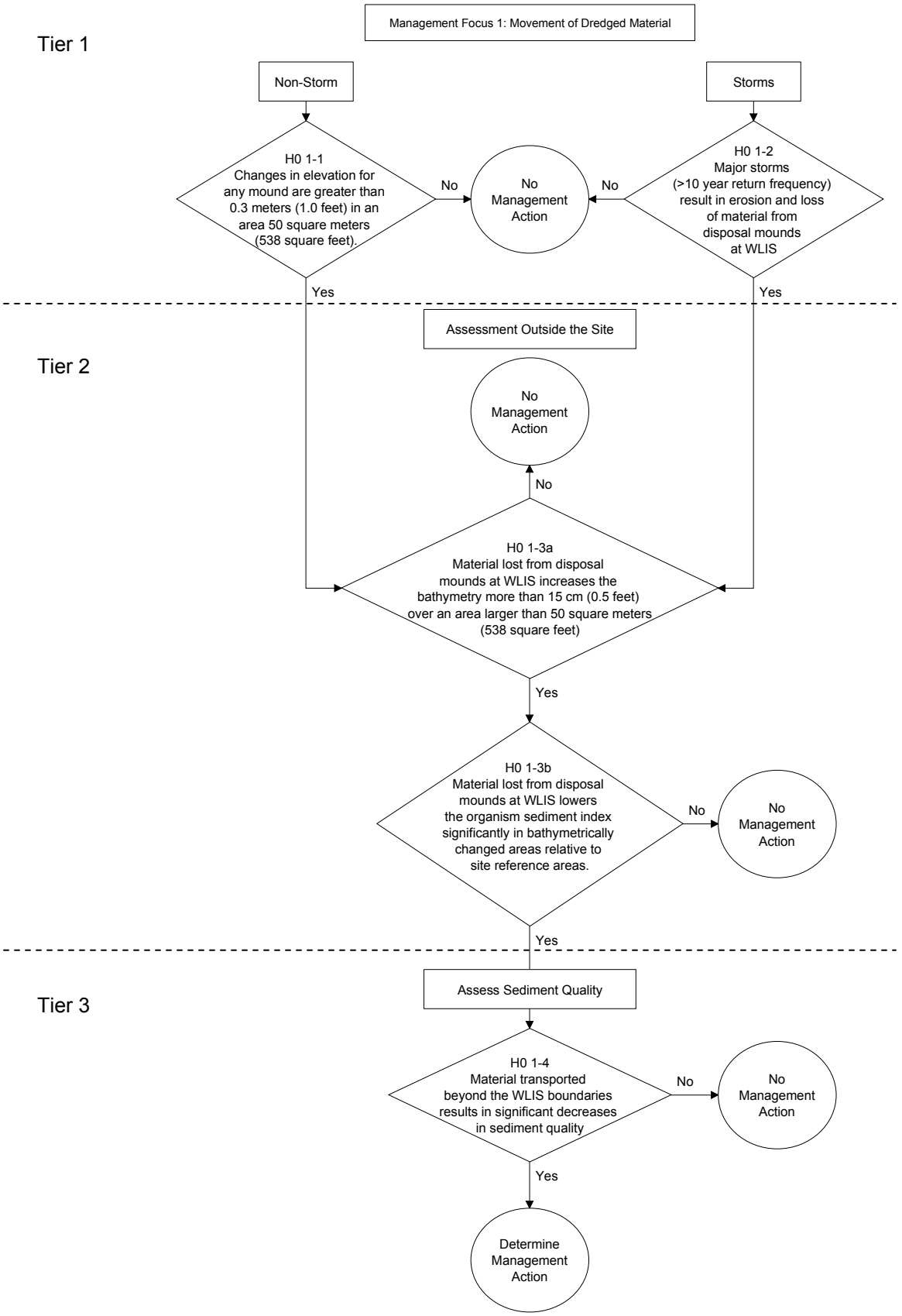
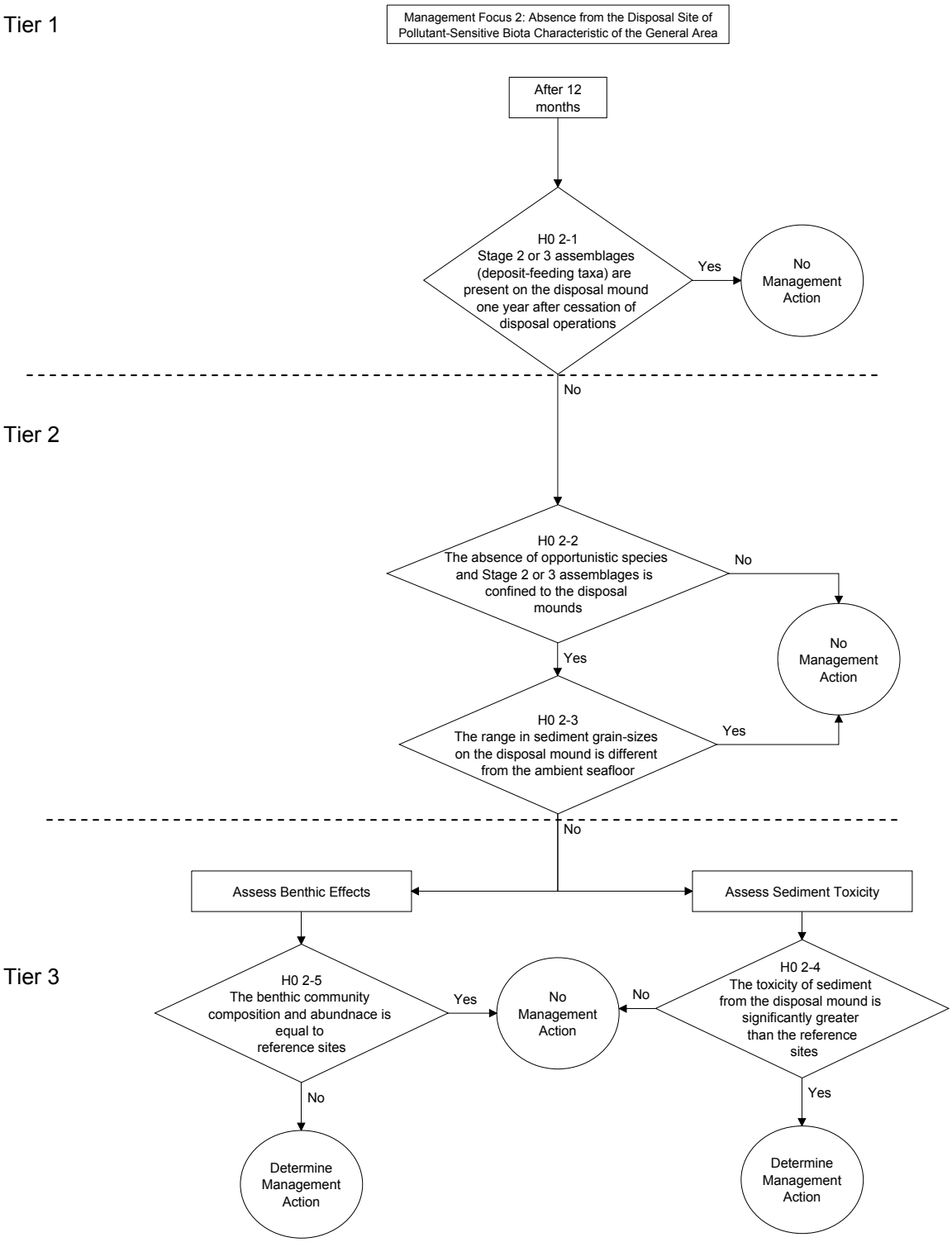
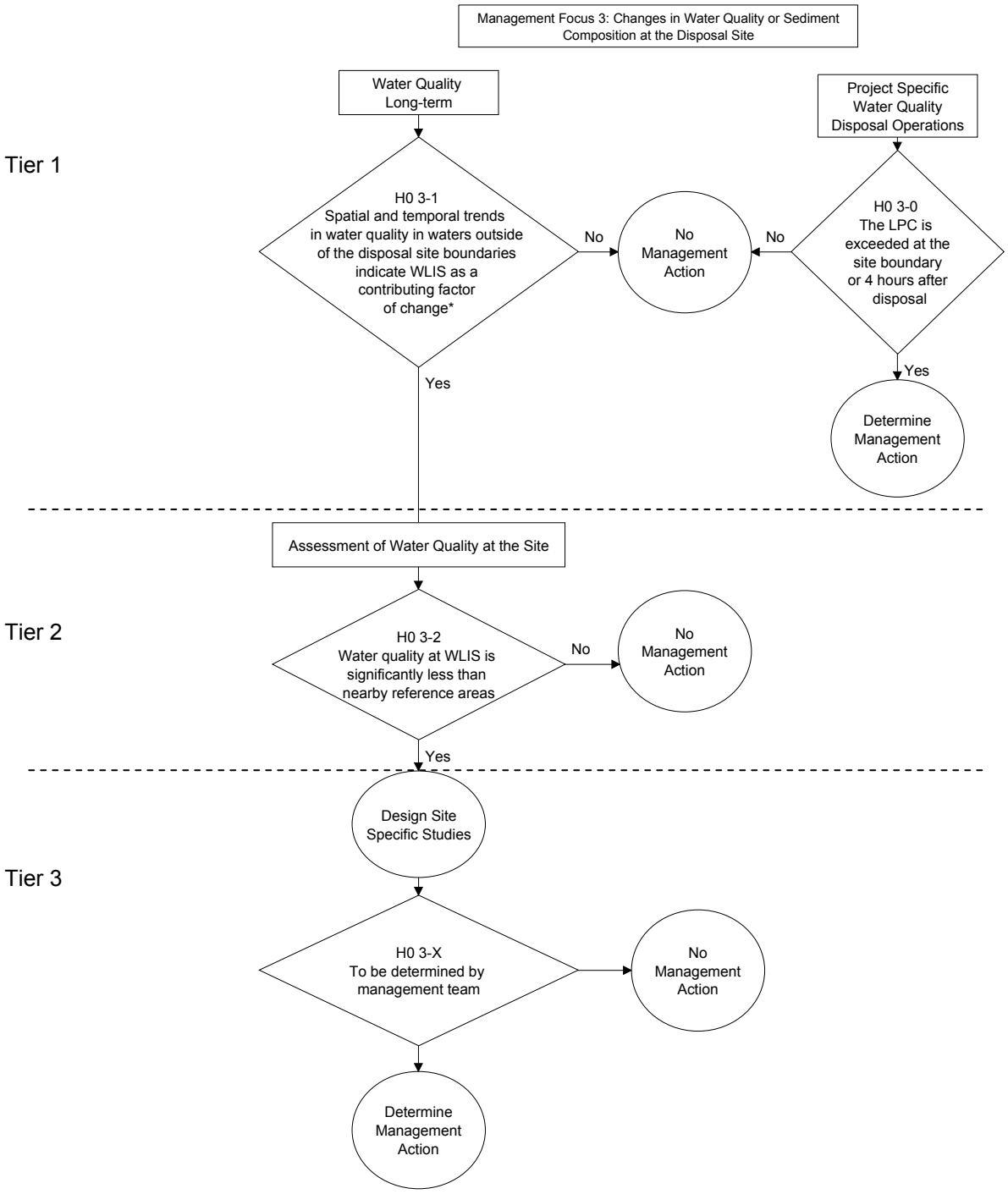
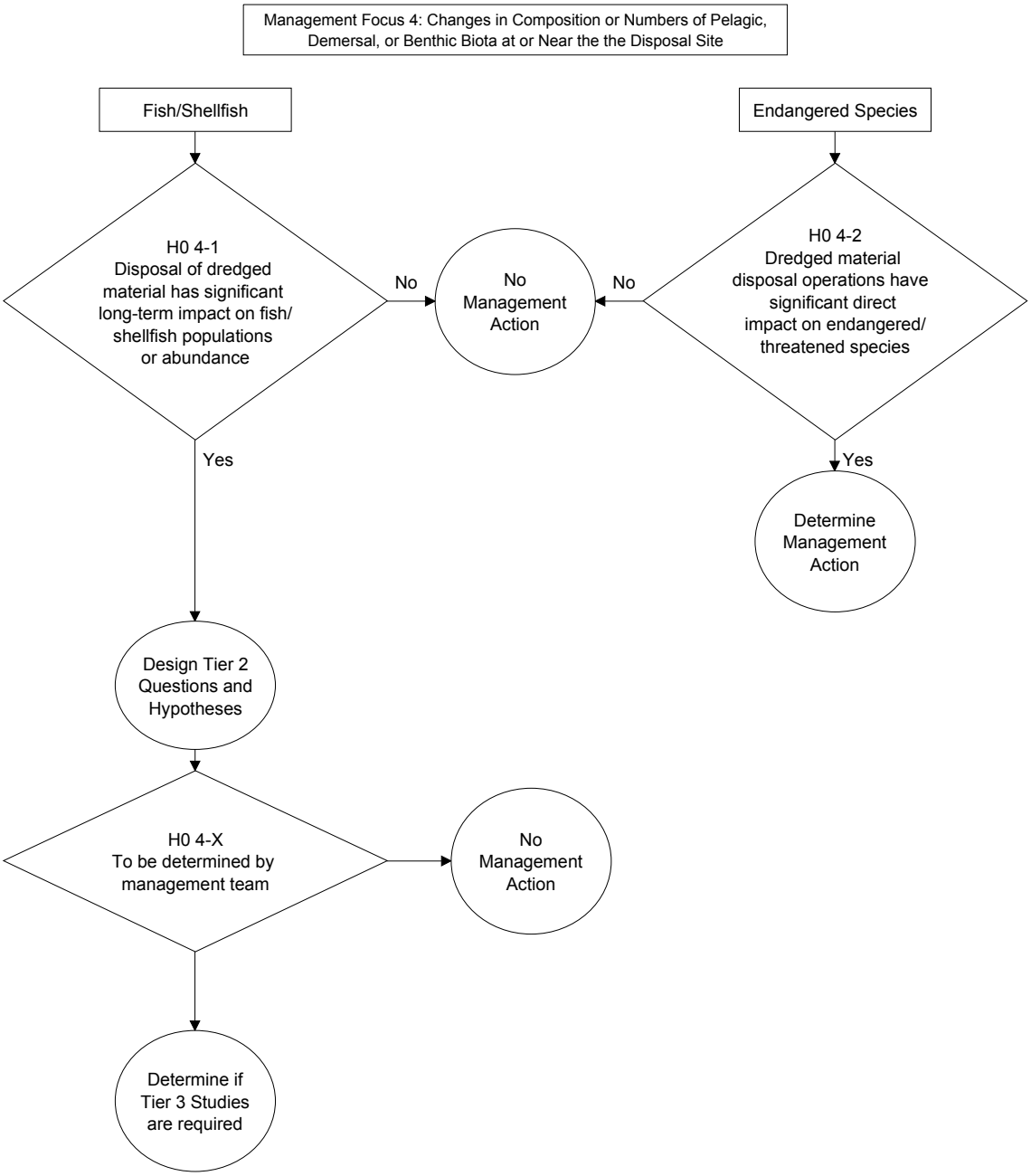

Management Focus 1: Movement of Dredged Material
Tier 1
Non-Storm
Storms
H0 1-1
Changes in elevation for any mound are greater than 0.3 meters (1.0 feet) in an area 50 square meters (538 square feet).
No
No Management Action
No
H0 1-2
Major storms (>10 year return frequency) result in erosion and loss of material from disposal mounds at WLIS
Yes
Yes
Assessment Outside the Site
Tier 2
No Management Action
No
H0 1-3a
Material lost from disposal mounds at WLIS increases the bathymetry more than 15 cm (0.5 feet) over an area larger than 50 square meters (538 square feet)
Yes
H0 1-3b
Material lost from disposal mounds at WLIS 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 WLIS boundaries results in significant decreases in sediment quality
No
No Management Action
Yes
Determine Management Action


Tier 1
Management Focus 2: Absence from the Disposal Site of Pollutant-Sensitive Biota Characteristic of the General Area
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
No Management Action
Yes
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 to reference sites
Yes
No Management Action
No
H0 2-4
The toxicity of sediment from the disposal mound is significantly greater than the reference sites
No
Yes
Determine Management Action
Determine Management Action



* Long Island Sound Study sites


Management Focus 4: Changes in Composition or Numbers of Pelagic, Demersal, or Benthic Biota at or Near the the Disposal Site
Fish/Shellfish
Endangered Species
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 disposal operations have significant direct impact on endangered/ threatened species
Yes
Yes
Determine Management Action
Design Tier 2 Questions and Hypotheses
H0 4-X
To be determined by management team
No Management Action
Determine if Tier 3 Studies are required

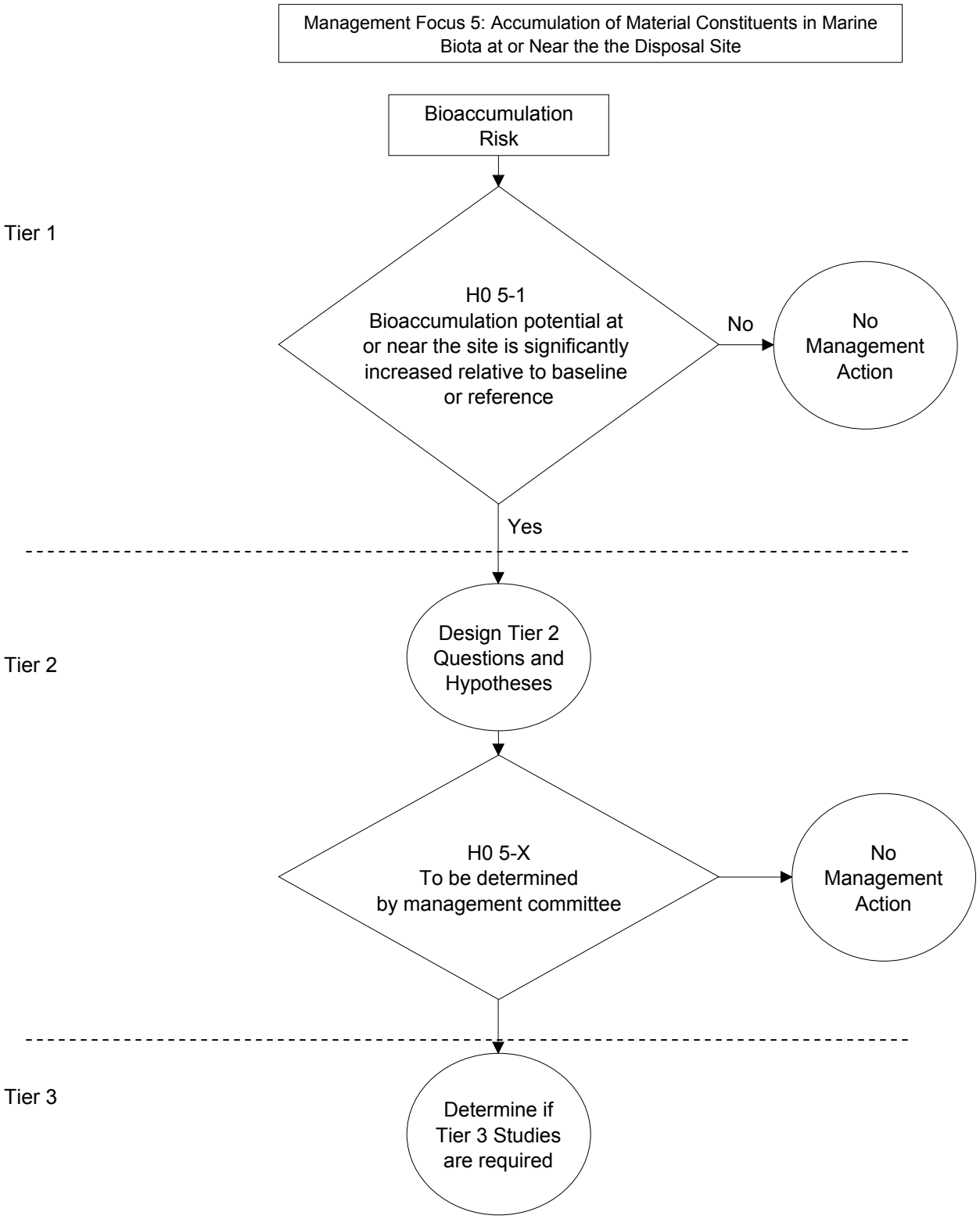

Management Focus 5: Accumulation of Material Constituents in Marine Biota at or Near the the Disposal Site
Bioaccumulation Risk
Tier 1
H0 5-1
Bioaccumulation potential at or near the site is significantly increased relative to baseline or reference
No
No Management Action
Yes
Tier 2
Design Tier 2 Questions and Hypotheses
H0 5-X
To be determined by management committee
No Management Action
Tier 3
Determine if Tier 3 Studies are required

Table C-1. Summary of Hypotheses and Leading Indicators for Each Management Focus

	Management Focus 1: Movement of the Dredged Material	Management Focus 2: Absence of Pollutant-Sensitive Biota	Management Focus 3: Changes in Water Quality	Management Focus 4: Changes in Composition or Numbers of Biota	Management Focus 5: Accumulation of Material Constituents in Biota
TIER 1					
First Hypothesis	Baseline taken after 1 yr of consolidation; entire site bathymetry performed periodically	SPI within 12-16 months of mound completion and survey of historic mounds in a given 5 yrs period.	Annual water quality measured in site vicinity (LISS Monitoring program data)	Annual CTDEP trawl survey data	Bioaccumulation potential estimated of sediments collected within site and ref. areas at least every 5 yrs
Condition(s) triggering Tier 2 monitoring:	Mound changes by > 1.0 ft w/in 5 yr interval	Significant differences between site and ref. areas	Consistent gradients in measures of long-term water quality changes in vicinity	Significant differences in community composition or abundance from baseline or contiguous areas is found	Significant increase in bioaccumulation potential relative to range of bulk chemistry measured during project testing
Second Hypothesis	Bathymetry taken ≤ 2 months after 10-yr storm	N/A.	N/A	TBD	N/A
Condition(s) triggering Tier 2 monitoring:	Mound changes by > 1.0 ft from last survey	N/A	N/A	TBD	N/A
TIER 2					
First Hypothesis	Bathymetry and sediment char. survey w/in 1 km of site boundary	SPI at site and ref. areas at least 1 km away; grain size analysis	Water quality measured at site and ref. Areas during disposal	No hypothesis but studies may include measurement of species distribution at site and ref. areas	No hypothesis but studies will involve the collection of biota from site and ref. areas
Condition(s) triggering Tier 3 monitoring:	Apex or apron bathymetry changes are > 0.5 ft in areas greater than 50 by 50 m	Widespread differences between site and ref. areas are not caused by other factors	Significant short-term WQ gradients are found	A link between reduced biota or diversity and dredged material at the site is found	Significant bioaccumulation is detected
Second Hypothesis	N/A	SPI at site and ref. areas at least 1 km away; grain size analysis	N/A	No hypothesis but studies may include species distribution at site and ref. areas	Further studies not yet determined

Table C-1. Summary of Hypotheses and Leading Indicators for Each Management Focus (continued)

	Management Focus 1: Movement of the Dredged Material	Management Focus 2: Absence of Pollutant-Sensitive Biota	Management Focus 3: Changes in Water Quality	Management Focus 4: Changes in Composition or Numbers of Biota	Management Focus 5: Accumulation of Material Constituents in Biota
TIER 2 (Cont'd)					
Condition(s) triggering Tier 3 monitoring:	N/A	Differences between in biology between site and ref. areas are not caused by other factors	N/A	N/A	Further studies not yet determined
TIER 3					
First Hypothesis	Sed. chem, toxicity, and benthic community measured where community is depressed and ref. areas	Sediment Chemistry and , toxicity measured at site and ref. Areas	No hypothesis but studies may include evaluation of sediment oxygen demand	No hypothesis but studies may include prey evaluation, bioaccumulation, succession, *etc.*	Further studies not yet determined
Condition triggering Management Action	All three measures are deemed unacceptable	All three measures are deemed unacceptable	Low dissolved oxygen at site and ref. areas is linked to dredged material	A link between reduced biota or diversity and dredged material at the site is found	A cause-effect link between sediment and higher trophic levels is detected
Second Hypothesis	N/A	Benthic community measured at site and ref. areas	No hypothesis but studies may include evaluation of sediment oxygen demand	No hypothesis but studies may include prey evaluation, bioaccumulation, succession, *etc.*	Further studies not yet determined
Condition triggering Management Action	Significant movement of material outside of the site and significantly impaired benthic community	All three measures are deemed unacceptable	Low dissolved oxygen at site and ref. areas is linked to dredged material	A link between reduced biota or diversity and dredged material at the site is found	A cause-effect link between sediment and higher trophic levels is detected

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