EXECUTIVE SUMMARY

A restoration demonstration project was conducted at the Massachusetts Bay Disposal Site (MBDS) between 2008 and 2009 by the U.S. Army Corps of Engineers New England District's Disposal Area Monitoring System (DAMOS) Program. The overall goal of the demonstration was to evaluate methods for the potential use of dredged material to restore the adjacent Industrial Waste Site (IWS).

The IWS is an area of Massachusetts Bay that has been historically used for the offshore disposal of waste including dredged material, construction debris, munitions, and hazardous waste. Beginning in 1952, the IWS was designated by the Atomic Energy Commission (AEC) as an approved low level radioactive waste (LLRW) disposal site. The single AEC licensed contractor (Crossroads Marine Disposal) collected LLRW from hospitals, laboratories, and universities; sealed the waste into 55 gallon drums encased with a 4–6 inch concrete liner; and disposed the drums at the IWS. AEC records indicate that approximately 4,000 containers of LLRW were disposed at the IWS before offshore disposal operations ceased in 1959; although pre-1952 disposals, and additional undocumented disposals, suggest that the actual number was likely much higher.

Due to the LLRW disposal history at the IWS, the site has been the subject of numerous investigations since the 1970's. Field surveys included underwater video, side-scan sonar, remote operated vehicles, manned submersibles, sediment sampling, and tissue sampling of fish and invertebrates. Side-scan sonar investigations estimated that approximately 20,000 barrel-like containers are exposed on the seafloor of the IWS, and visual inspection of these targets showed that the majority of the barrels were punctured, open, or deteriorated with the contents exposed to the environment. Despite the presence of a large number of damaged waste barrels, no sediment or tissue samples collected at the IWS have shown elevated levels of radioactivity; however, the potential risk for environmental exposure of LLRW as the containers continue to deteriorate has led to the goal of implementing a restoration plan for the site.

This restoration demonstration project was developed in cooperation with the U.S. Environmental Protection Agency (EPA) Region 1 to enable a rare opportunity to cover the historic IWS using of a large volume of sediment (about 12 million yds^3/9.2 million m^3) that will be dredged from deepening Boston Harbor, possibly starting in late 2016. The available dredged material will be primarily Boston Blue Clay, a highly consolidated glacio-marine deposit, which would otherwise be placed via split-hull barges at MBDS. The 2008–2009 project was a demonstration scale operation utilizing Boston Blue Clay from another Boston Harbor dredging project to determine if a sequenced approach to placement would minimize disturbance to assumed fragile waste containers and potentially contaminated in-place sediments if a restoration effort was attempted at the IWS.

The demonstration was performed in a portion of MBDS with no known waste containers but with a similar water depth, currents, and bottom type to the IWS. The plan involved precise placement and sequencing of disposal operations in an attempt to build a berm of dredged material that would spread laterally into the target area with minimal disturbance of the existing bottom sediments. Subsequent placement events would occur over

the berm itself, utilizing the protective berm layer to buffer the in-place sediments from the energy of a direct impact. In order for the proposed process to be practical the demonstration also had to prove that the restoration could be implemented without increased cost or time to the dredging operation.

In 2008 approximately 380,000 m^3 (500,000 yds^3) of Boston Blue Clay and glacial till was deposited in a demonstration area of MBDS to test the restoration concept. The material was placed in several different disposal strategies including individual placements on the ambient seafloor, placements on small berms of dredged material, and multiple overlapping placements. Regular monitoring surveys were conducted between disposal phases to document placement accuracy, berm formation, and disturbance to in-place sediments through multibeam bathymetry, side-scan sonar, acoustic backscatter, sub-bottom profiling, and sediment-profile imagery. A sediment coring survey was conducted in 2009 following the completion of all disposal events.

The project successfully demonstrated that standard operational procedures could be utilized to accurately place dredged material at MBDS without interfering with dredging schedules or budgets. Placement accuracy averaged 62 meters between the target point and the disposal crater which was within the scale of the split-hull barges used for disposal.

Individual disposal events of 4,000–4,500 m^3 of Boston Blue Clay formed circular craters on the ambient seafloor approximately 0.1–1.1 m deep and 60–100 m across with a defined rim surrounded by a thin berm. The berm extended several hundred meters from the impact point and gradually tapered from 0.5–0.1 m thick. Disturbance to the in-place sediments beneath the impact craters was assessed through an analysis of acoustic and sediment coring data and suggested that substantial (> 35 cm) scouring and mixing of the ambient seafloor occurred as a result of the placement process.

Similar sized placement events that were directed to an area covered by a thin (0.3 m thick) berm of dredged material formed craters that were comparatively shallower and wider than the craters formed over ambient sediments suggesting that the berm deposit was successful in absorbing some of the direct impact energy and transferring it in a horizontal direction. Analysis of acoustic and sediment coring data from these craters supported this finding as there was evidence of disturbance to the berm deposit but not to the underlying ambient sediments.

The restoration demonstration project established that accurate, sequential placement of dredged material could be achieved at MBDS without increasing the costs of a dredging project. The experiment also demonstrated that a sequential approach to placement, beginning operations outside of the barrel field to build a protective berm followed by placements on the berm deposit, could effectively protect the in-place sediments and waste barrels from impact forces and develop a cover layer over the barrels. Data generated through this demonstration project could be used to design a full-scale restoration approach for the Industrial Waste Site and eliminate the long term potential environmental and human health risk posed by the LLRW barrels still exposed at the site.