EXECUTIVE SUMMARY

A monitoring survey was conducted at the Tupper Ledge Disposal Site (TLDS) as part of the Disposal Area Monitoring System (DAMOS). The September 2003 field effort consisted of bathymetric and sediment-profile imaging surveys designed to document changes in seafloor topography, evaluate the physical distribution of dredged material, and assess the recovery of the benthic community relative to ambient sediment conditions.

The Tupper Ledge Disposal Site was selected for dredged material disposal following a baseline survey in March 2000. Between January and April 2001, approximately 50,000 m^3 of dredged material was placed at the center of TLDS, forming Mound A. A monitoring survey in August 2001 indicated inhibited benthic recolonization of the mound, attributed to elevated organic content and high sediment oxygen demand associated with decomposition of the wood particles in the dredged material. Between December 2001 and April 2003, approximately 47,000 m^3 of dredged material was placed in the southwest quadrant of TLDS. All dredged material placed at TLDS originated from the Union River, near Ellsworth, Maine.

The comparison of the 2001 and 2003 bathymetric data indicated the formation of a new mound, Mound B, in the southwest quadrant of TLDS. Mound B was conical in shape, rising approximately 2.3 m above the surrounding seafloor. SPI results confirmed the bathymetric results, indicating the thickest accumulation of dredged material near the point of disposal, and that sediment has spread in a thin apron 400-600 m from the point of disposal. Diagnostic features in many of the 2003 SPI images allowed for the clear distinction between ambient sediments and dredged material, resulting in identification of historic dredged material at locations where it had not previously been reported. A re-examination of the historic SPI images confirmed that the extent of the dredged material was somewhat underreported following the 2001 survey, in which dredged material was not reported at stations outside of the TLDS boundary. The 2003 survey indicated dredged material extended beyond the TLDS boundary in all directions, and extended farthest to the south and west.

Benthic recolonization was more advanced than initially expected, with Stage III assemblages present at the majority of the stations sampled, and no evidence of the azoic conditions that were observed during the 2001 survey. The mean RPD depth at stations within the dredged material footprint was 2.2 cm, considerably higher than that measured in the 2001 survey (0.6 cm), and lower than that measured in ambient sediments (3.1 cm). The high frequency of Stage III infauna observed within the dredged material footprint resulted in a median OSI of +8 (ranging from +4 to +10), compared to the median OSI at the reference stations of +9.5 (ranging from +4 to +11). Benthic recolonization had advanced significantly since the 2001 survey, when the median OSI

within TLDS was +2 (ranging from -8 to +8), when widespread azoic conditions and anoxic banding in the sediments were observed at several stations.

Although OSI values suggested a fairly advanced benthic community, there was persistent evidence in the sediment record that this area has been substantially influenced by the additional organic enrichment of the dredged material placed at this site. Evidence of sulfur-reducing bacterial colonies that develop only during hypoxic conditions was found at 17 stations, all but one located within the dredged material footprint. These bacterial colonies appear when boundary-layer dissolved oxygen concentrations fall into the hypoxic range, between 0-1 mg/L, and their presence in TLDS indicated that the system had experienced a hypoxic event. Banding of light and dark sediments, indicative of periods of anoxia or hypoxia, were observed both within and outside of the dredged material footprint, and provided further evidence of the stressed benthic system. The widespread presence of Stage III infauna indicated that the duration of the hypoxic event was sufficiently short such that the benthic ecosystem was not permanently degraded.

A re-examination of SPI images from the baseline (2000) survey indicated the presence of incipient bacterial colonies at the majority of the stations sampled. This discovery, combined with the size of the disposal site relative to the shape of the embayment and other results from the baseline survey (e.g., high total organic carbon, low flushing rates and a stratified water column), suggested a system susceptible to hypoxic events, particularly when exposed to high organic loadings.

Benthic conditions have improved since 2001, however the persistence of anoxic banding patterns and the presence of the sulfur-reducing bacterial colonies that largely coincide with the presence of dredged material indicated that the system may be vulnerable to hypoxia. TLDS was chosen for dredged material disposal following characterization of four sites along the coast of Maine. Sites were investigated to determine suitability for one-time or short-term dredged material disposal activities (SAIC 2000). TLDS was selected to accommodate small to moderate volumes of sediment to be removed from Union River over one to three years of dredging to maintain access in and out of the harbor for recreational and commercial use. Following completion of the Union River dredging operations, it is anticipated that TLDS will not be used for at least five to ten years. Periodic monitoring during this time will help to better understand the rate of recovery of these unique sediments.