Is the disposal of dredged sediment within an estuary a quantitatively significant source of physical disturbance and contamination? One way to address this management question is to scale the impacts of disposal relative to sedimentation from other sources. This paper compares the contribution of dredged material activities at open water containment sites in Long Island Sound to the overall sediment budget.

Three questions are addressed in this paper:

- Is the fraction of disposed sediment that may be dispersed outside of the boundaries of disposal sites quantitatively significant relative to inputs of sediments from non-disposal activities such as land runoff, industrial discharges, and waste water treatment plants?
- Are disposal sites quantitatively significant sources for the redistribution of particle-bound contaminants?
- Can disposal losses be measured accurately with existing technology, and what are future data requirements?

Dredged material dispersed from aquatic disposal sites can enter the ambient Sound in three ways: 1.) plume dispersion during release of sediment from barges, 2.) current scouring of the apex of disposal mounds during the first month or so following termination of disposal activities, and 3.) long-term losses related to the passage of hurricanes.

Long Island Sound receives, on average, 4.1×10^8 kg/yr (dry weight) of dredged material, representing about half of all sediments disposed within New England (L.I. Sound to Rockland Maine). This annual disposal into the Sound is less than half of the sedimentation rate derived from non-disposal sources (9.3×10^8 kg/yr).

Dispersal losses from plume dispersion and initial mound scouring comprise only 6% of the total annual dredged material released into the Sound and are about 3% of the annual non-disposal sediment input. Hurricanes are the single most important agents of dispersal. Hurricanes pass through New England about once every 7 years (14/century). Dispersal of dredged material from disposal mounds by a single hurricane scouring event may equal a maximum of about 16% of the annual dredged material input and 7% of the annual non-disposal input of sediment to the Sound.

Contaminants such as petroleum hydrocarbons (PHCs) entering the open Sound from dispersed dredged material are less than 3% of the PHCs entering the Sound from other sources, and particle-bound metals are estimated to be less than 1% of the total input for mercury, zinc, arsenic, lead, and copper. One cannot find gradients in sediment contaminants extending from disposal sites to the ambient seafloor because dispersed dredged material is diluted by the ambient suspended particle field, natural sedimentation, and bioturbational mixing of dispersed sediment into the ambient sediment column.

Returning to the initial questions:

- The quantity of dredged material leaving aquatic containment sites is small when compared to non-disposal inputs from runoff, industrial effluents, and waste water treatment plants.

- Disposal mounds are not significant sources of contaminants for the Sound outside the boundaries of designated dredged material containment sites. Monitoring for ecosystem effects should therefore be focused on individual mounds within disposal sites. Food chain contamination and transport is a greater potential issue than sediment transport.

- Siting criteria for locating aquatic containment sites should include factors that limit the exposure of dredged material mounds to hurricane scour (e.g., wind fetch, water depth, and kinetic energy).

- Current technology is sufficient to make reasonably accurate estimates of mass balance for dredging-disposal activities, but these candidate technologies have never been brought together to perform an "ideal" mass balance study. Future data requirements include means of obtaining accurate sediment wet weight/volume conversions to dry mass. Independent measurements are required of mound and foundation consolidation, lateral creep, and erosion in order to understand underlying processes that control changes in mound height during the first few months following termination of disposal activities.

In light of this review, the main focus of dredged material management should be on ensuring that disposal operations are controlled so that materials are confined to a footprint located entirely within the designated disposal boundary. Because potential ecological impacts are largely limited to individual disposal mounds, these mounds should be the units of surveillance. The major fisheries issue is related to prevention of food chain contamination from those species foraging on disposal mounds. The utility of monitoring outside of designated disposal areas is to compare the response of the biology and chemistry of disposal mounds to large scale events (e.g., regional hypoxia, spills, or hurricane impacts). The New England experience has been that system-wide events tend to affect disposal sites more than disposal sites affect the ambient system.