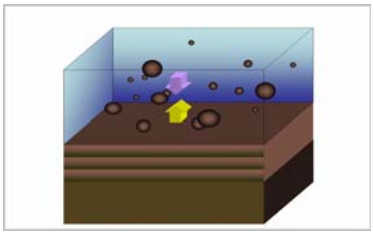
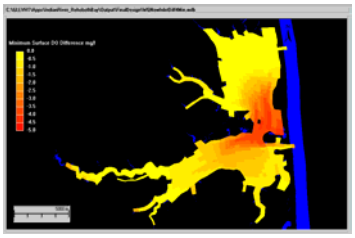
Sediment Contamination Modeling

The GEMSS-STM Model

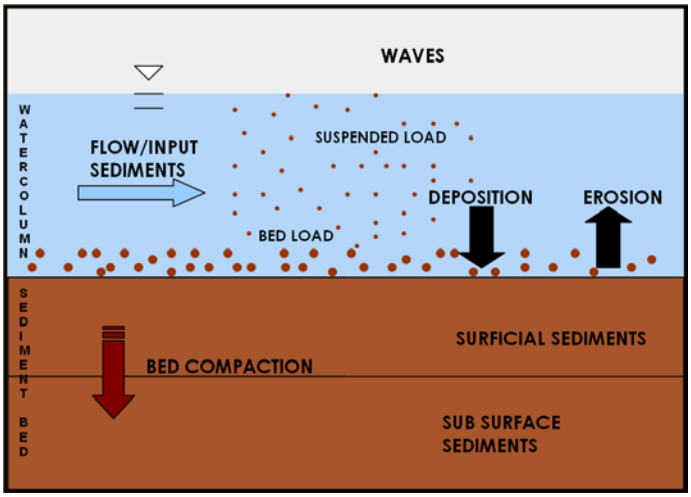




The U.S. EPA estimates that ten percent of the sediment underlying the nation's waterbodies contains sufficient contamination to pose a potential risk to humans, fish, and wildlife. Yet quantifying these ecological and human health risks is a relatively new science, and offers unique challenges to investigators. Unlike the water column, sediment sampling is difficult, historical datasets are sparse, and contaminant concentration profiles are typically not homogenous resulting in hit-or-miss field measurements. Moreover, sediments often retain the legacy of historical contaminant loads, buried and bound to particulates or dissolved within the porewater. Complex decisions for dredging, monitored natural recovery, or capping are often based on incomplete information. Determining liability for historical contaminated sediment containing a mixture from several sources may require chemical fingerprinting and hindcast simulations.

ERM's Surfacewater Modeling Group offers a powerful tool to aid in making rational decisions. Using the sediment transport module of ERM's Generalized Environmental Modeling System for Surfacewaters (GEMSS-STM), the transport and fate of contaminants in dissolved in the water column, adsorbed to suspended particulates, and deposited, buried, and resuspended from the bed can be modeled. The mass balance of the contaminants is maintained by tracking the mass into separate compartments representing the various media and phases within which they exist. This approach enables assessments of bulk sediment concentrations, porewater concentrations, and overall bioavailable fractions of the contaminants for toxicological and food-chain analyses.

GEMSS-STM quantifies the following processes for sediment contaminant modeling:



- Suspended sediment advection/dispersion
- Non-cohesive and cohesive settling
- Erosion and scour
- Sediment bed load transport
- Burial; bed compaction and coarsening/armouring
- Sediment diagenesis and contaminant flux at sediment/water interface
- Sediment bed contaminant fate (dissolution, adsorption, transformation, decay)
- Slope failure, include effects of bed slope on erosion

With this set of sophisticated modelling tools, we can

- Help identify source locations and strengths
- Assess potential for erosion under flood and storm events
- Determine dredged material dispersion patterns
- Show long-term benefits of monitored, natural recovery
- Track morphological changes to the streambed