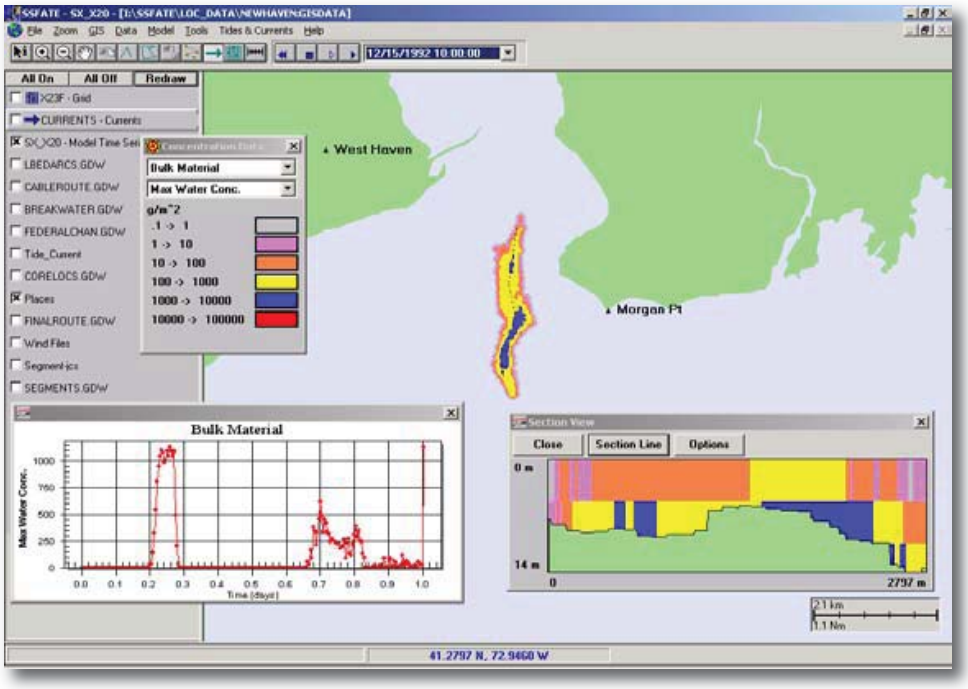
Services for Dredging Operations

ASA models the transport, fate and effects of suspended material during dredging and disposal activities as well as cable and pipeline burial. We predict the transport of suspended sediments, the redesposition of the suspended sediments and the exposure of aquatic organisms. ASA applies and develops computer models that simulate this transport and fate of sediments and pollutants in marine and fresh water environments. These computer tools predict the physical movement and concentrations of sediments and pollutants. These predictions can then be used to estimate the possible biological effects. Hydrodynamic simulations can be performed by ASA to provide currents. ASA combines these sophisticated tools with comprehensive field programs and data collection to provide customized solutions.

Suspended Sediment Fate: SSFATE

SSFATE fulfills the need for a modeling tool that can be easily customized to simulate a broad spectrum of dredging scenarios, accommodating essentially any hydrodynamic setting and most typical dredge plants. SSFATE is an integrated system combining a Geographic Information System (GIS) with a computational model that predicts the transport, dispersion, and settling of suspended sediments released to the water column as a result of dredging operations. The specification of the sediment source strength and the initial vertical distribution of these sediments is an integral component of the modeling system. The Geographic Information System (GIS) embedded in SSFATE provides a means to retrieve, manipulate and display geographic data sets, yielding access and visualization of geographic information.

SSFATE can be used as a quantitative assessment tool to define environmental time windows for dredging in sensitive areas. Environmental windows, intended to protect biological resources or their habitats, are requested during the interagency coordination process for dredging projects. Suspended sediments are a primary concern of resource agencies, as the exposure of aquatic organisms to elevated suspended sediment concentrations is perceived to be a major source of detrimental impact to those organisms. Likewise, re-deposition of suspended sediments can be a significant concern if sensitive bottom-dwelling organisms (e.g., oysters or sea grasses) are present in the vicinity of a dredging project. Accurate spatial predictions of dredge-induced suspended sediments is critical to establishing the need for protective windows.

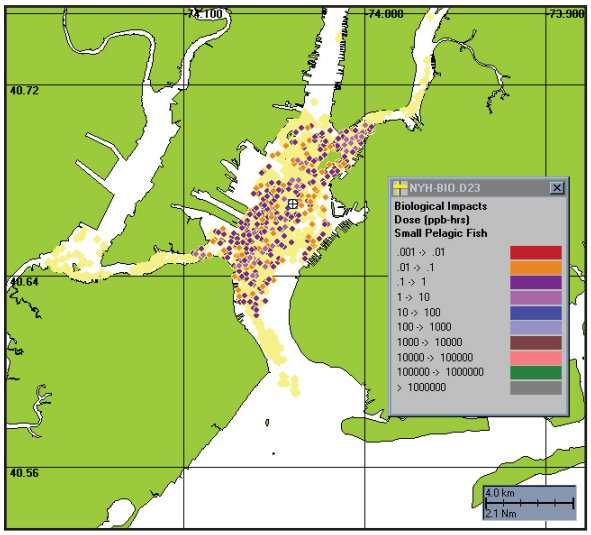


Jet plow operations can also be simulated with SSFATE.

Suspended Sediment Exposure Model: SSDOSE

SSDOSE calculates exposures of various aquatic organisms to sediment plumes resulting from dredging operations and analogous sediment releases. SSDOSE uses the output from SSFATE that includes concentration of suspended sediments as a function of space and time. SSDOSE is contained in the SSFATE graphical user interface system, allowing the user to readily work with both models to produce and view results. Using the models, the user is capable of examining alternative dredging practices and providing insights into risk minimization.

One way to evaluate potential impacts on aquatic biota and habitats marine biologists is to determine the exposure level of aquatic organisms to elevated sediment concentrations. Previous research has shown that effect is related to both concentration and duration of exposure. Thus, the SSDOSE extension for SSFATE quantifies the dose to aquatic biota.



Example of SSDOSE output showing estimated exposures of small pelagic fishes to a hypothetical suspended sediment plume in New York/New Jersey Harbor. Color coded dose concentrations are shown in the legend box.

Dose is defined as the sum over time of suspended sediment concentration times duration of that exposure. Dose is related to the location over time of the organism or habitat relative to the suspended sediment plume. Thus, the pathway of movement (if any) of the organism needs to be simulated and the exposure along that pathway summed to quantify dose. The exposure model in SSDOSE tracks the movements of organisms through the water and over time, calculating dose and mortality based on toxicity of the concentration and duration of exposure (if toxicity data are provided). Mortality is first calculated as a percent of organisms in the area. This percent loss may be multiplied by abundance to estimate biomass lost.

Within SSDOSE a variety of movement behaviors can be simulated. Categories include: passively drifting plankton (e.g., buoyant fish eggs), stationary on the bottom (e.g., demersal eggs), stationary in the bottom (e.g., benthos or plants, with exposure calculated as sediment loading or mass per unit area), pelagic non-directed movement (e.g., slow random movement of small fishes or rapid random movement of large fishes), non-directed movement just above the bottom (e.g., demersal fishes), pelagic directed movement (e.g., at a speed and path specified by the user, as could be used for anadromous fishes), and demersal directed movement (e.g., at a speed and path just above the bottom specified by the user, as could be used for certain crustaceans). Because habitat maps can be structured within the model's habitat grid, movements of taxa categories can be restricted within specified areas. This feature allows simulation of site tenacious species. SSDOSE outputs include tabulations of dose for each movement behavior category and percent mortality by each behavior category. Also produced are animated maps of the locations of exposed organisms over time and locations of mortality over time. Both types of maps depict color-coded symbols representing magnitudes of dose and mortality.

SSFATE and SSDOSE are under development with the U.S. Army Corps of Engineer Environmental Research and Development Center.

ASA has built a wide range of computer modeling applications to solve environmental problems and power generation industry challenges. Our computer tools are combined with over 25 years of service experience with issues including: water quality management, biological assessment, and oil and hazardous materials modeling.

ASA's suite of environmental modeling tools are available for licensed use and customization and include: AIRMAP, CHEMMAP, COASTMAP, HYDROMAP, OILMAP, SARMAP, SIMAP, MUDMAP and WQMAP.

ASA's clients include international governments, universities, research institutes and major energy and development companies. ASA has a proven track record in providing high quality scientific support services to these clients in support of their global operations.

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