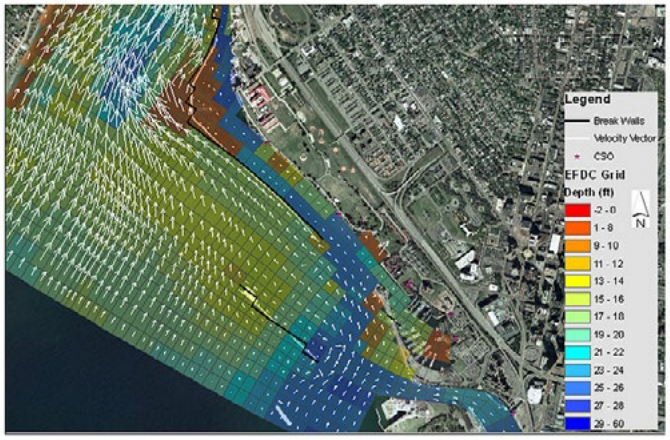
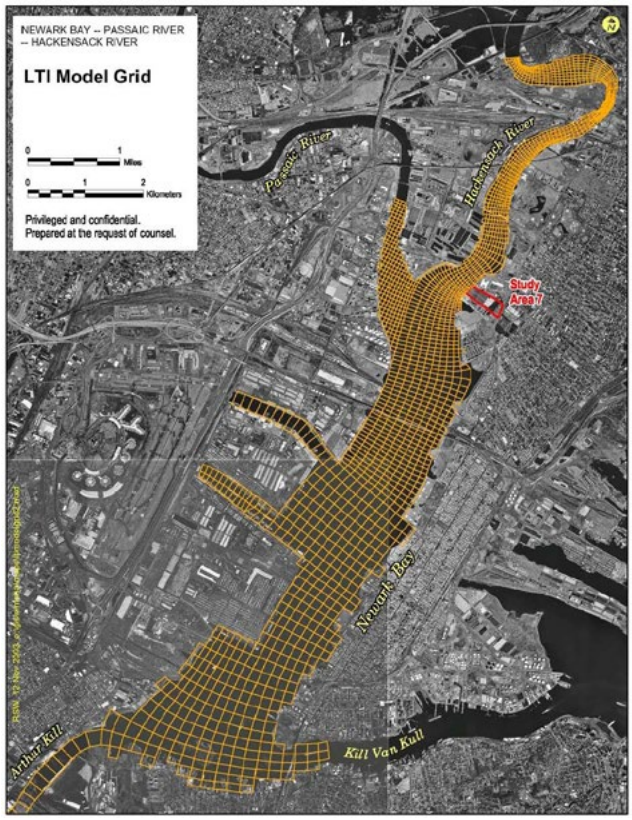
Hydrodynamic Modeling Services

Hydrodynamic forces govern the movement of water in natural systems. Understanding the fluid forces that affect flow rates, turbulent mixing, and shear stress can be critical in establishing and complying with wastewater discharge permit limits, identifying allowable mixing zones or thermal plumes, performing basin-wide wasteload allocation for total maximum daily load (TMDL) development, or analyzing transport and fate of sediment-borne contamination.

Coupled with multidisciplinary water quality and watershed modeling expertise, hydrodynamic modeling yields a more complete understanding of the environmental problem under study. Integrated models allow analysis of water body response to changes in contaminant loading or remedial strategies, resulting in targeted, cost-effective solutions.



Our expertise includes a wide variety of hydrodynamic modeling tools and approaches.



LimnoTech staff have developed specialized models to simulate the most hydrodynamically complex systems.

LimnoTech Approach to Hydrodynamic Modeling

LimnoTech has extensive experience in the theory and development of two- and three-dimensional hydrodynamic models in riverine systems, seiche-impacted Great Lakes systems, and coastal areas. LimnoTech also has expertise in the field of coupling near-shore and far-field hydrodynamic models.

LimnoTech staff members have written and implemented specialized models to simulate the most hydrodynamically complex systems, including:

- Coastal, estuarine, and tidal circulation;
- Integrated near-shore and far-field hydrodynamic regimes;
- Tracking of strong density, temperature, or contaminant interfaces in three dimensions; and
- Turbulent mixing of stratified and unstratified flow, including thermocline and salinity layers.

This expertise includes use of a wide variety of hydrodynamic modeling tools and approaches, including the Princeton Ocean Model (POM), the Dynamic Grid Adaptation (DGA) Model, EFDC, ECOMSED, the DHI MIKE suite of models, and the U.S. Army Corps of Engineers' models including UNET, RMA-2V, CE-QUAL-W2, and CH3D.

LimnoTech's Experience

Hydrodynamic modeling is a crucial element to many LimnoTech studies. Key applications have included:

- Development of a coupled near-shore/far-field model of a thermal plume in support of a cooling water discharge expansion permit on Lake Michigan.
- One- and two-dimensional models of coupled near- and far-field impacts of combined sewer overflow discharges to the Ohio River, with analysis of the impact of overlapping plumes; and modeling of the Cuyahoga River and southern Lake Erie, with analysis of the impact of thermal layer stratification between the river and lake.
- Two- and three-dimensional models of the Hudson and Fox Rivers in support of contaminated sediment fate and transport modeling.
- Hydrodynamic river modeling to evaluate seiche effects of Lake Erie on mixing for Toledo, Ohio wastewater discharge and combined sewer overflows.
- Review and synthesis of data from an existing three-dimensional POM application for the Gulf of Mexico, to support mass balance modeling of the relationship between nutrient loading and seasonal hypoxia.
- High-resolution hydrodynamic modeling and tidal time series analysis of Newark Bay, the Hackensack River, and Passaic River in New Jersey in support of contaminated sediment fate and transport modeling.
- Scientific research and model tool development, including general circulation modeling of Lake Michigan with a dynamic grid adaptive technique, mass and heat exchange modeling between the Maumee River and Lake Erie, and development of a tidal model of Puget Sound for the National Oceanic and Atmospheric Association.