Numerical Modeling of Hydrodynamics and Transport for Reverse Osmosis Discharge Dilution Analysis, Melbourne, Florida

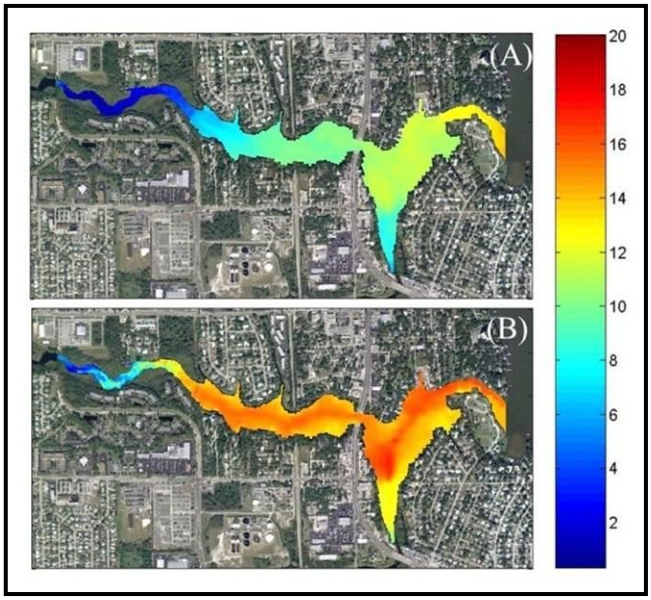
Project Characteristics

- *Tide and Current Data Collection*
- *Water Quality Monitoring and Sampling*
- *3-D Hydrodynamic and Water Quality Modeling (EFDC)*
- *Evaluation of Mixing Zone Associated with Reverse Osmosis Discharge*
- *Thermal Modeling*

The City of Melbourne Joe Mullins Reverse Osmosis Water Treatment Facility produces potable water for the City via reverse osmosis of groundwater. The concentrate water, which is a byproduct of the treatment process, is discharged through an outfall to the surface waters of the Eau Gallie River, a Class III marine water body. Woods Hole Group, Inc. was contacted to complete a dilution analysis of the concentrate discharge and to evaluate mixing zone compliance with existing State and Federal regulatory requirements.

The Eau Gallie River feeds the Indian River, which is part of Indian River Lagoon system that forms the Atlantic Intracoastal Waterway. The Eau Gallie River is a shallow, brackish water body, which is used for recreational purposes and is a habitat for variety of fish and wildlife. Permits for the treatment facility granted mixing zones for various water quality parameters including dissolved oxygen, total nitrogen, chlorides, specific conductance, pH, gross alpha activity, and combined radium (226+228). Prior assessments made by the City of Melbourne and Reiss Environmental, Inc. discovered that gross alpha and combined radium were two parameters for which permit limits were being exceeded. Woods Hole Group, Inc. conducted a comprehensive study using a phased approach to evaluate whether a mixing zone could be permitted within the existing water quality regulations.

In the project's first phase, Woods Hole Group, Inc. conducted a field data collection program and made an initial assessment of concentrate dilution within the Eau Gallie River by applying an analytical, one-dimensional, steady state model.



Results from the initial assessment showed significant stratification within the River under low-flow conditions and Woods Hole Group, Inc. recommended the application of a three-dimensional model to allow for a more accurate analysis of concentrate discharge mixing processes, including density-driven circulation and the vertical and horizontal dilution.

The Environmental Fluid Dynamics Code (EFDC) model was chosen to model the hydrodynamics and transport within the Eau Gallie River estuarine system. The model was calibrated and verified using collected field data. The model was then applied to simulate DEP specified design flow conditions to characterize concentrate dilution and the extent of mixing zones for the parameters of interest, as well as provide guidance for diffuser design. Subsequently, the model was also utilized to evaluate the mixing and temperature variation resulting from discharge of the relatively warm RO concentrate into the colder ambient river water that may be expected during winter months.

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