Final Status Report
of the
Modeling Technical Review Group (MTRG)
for
Modeling Task Statements SEGCL1, SEGDO1, SEGDO2

Savannah Harbor Expansion Project
July 12, 1999

Draft Modeling Task Statements SEGCL1, SEGDO1, and SEGDO2, were prepared by Applied Technology and Management, Inc., and presented to the MTRG for review, modification, and final recommendations. The Modeling Task Statements are for the preparation of modeling and analysis tools for use in evaluating the impacts of the proposed Savannah Harbor Expansion Project.

The following describes the MTRG review process used to develop the final recommendations for task statements SEGCL1, SEGDO1, and SEGDO2.

- April 28, 1999 – Draft task statements were posted on the MTRG website, and made available for review by all MTRG members. An email notice was sent to all MTRG members announcing the posting, and providing contact information.
- April 28, 1999 to May 24, 1999 – Written and verbal comments solicited and received by ATM from MTRG members on the draft task statements through email, letters, fax, and phone conversations.
- May 25, 1999 – A meeting of the MTRG was held in Atlanta, GA at the EPA Region IV office. The goals of the meeting were to review and discuss the draft task statements, provide additional recommendations, and develop an action plan and schedule for finalizing the Modeling Task Statements.
- June 15, 1999 – Based on the meeting discussion and comments submitted, revised task statements and a status report were prepared and posted on the MTRG website and made available for review by MTRG members. An email notice was sent to all MTRG members announcing the posting and providing contact information.
- June 15, 1999 to June 22, 1999 – Written and verbal comments solicited and received by ATM from MTRG members on the revised task statements and status report through email, letters, fax, and phone conversations.
- June 23, 1999 – A meeting of the MTRG was held in Atlanta, GA at the EPA Region IV office. The goals of the meeting were to review and discuss the revised draft task statements and provide final recommendations for the Modeling Task Statements.
- June 30, 1999 – Based on the meeting and comments submitted, finalized task statements were prepared and posted on the MTRG website and made available for review by MTRG members. An email notice was sent to all MTRG members announcing the posting and providing contact information.
- June 30, 1999 to July 12, 1999 – Written and verbal comments solicited and received by ATM from MTRG members on the finalized task statements. Comments limited to editorial changes without altering the overall scope defined under the finalized task statements.
- July 13, 1999 – Submit final MTRG recommendations to SEG.

The finalized MTRG recommendations reflect the comments and input received from the following personnel.

Bill Bailey	USACOE	912-652-5781	william.g.bailey@sas02.army.mil
Wade Seyle	USACOE	912-652-5508	wade.f.seyle@sas02.army.mil
Jim Greenfield	USEPA	404-562-9238	greenfield.jim@epa.gov
Larry Neal	Harbor Committee	770-499-6791	lneal@lawco.com
Brittany Robinson	Harbor Committee	912-238-6426	brittany_robinson@ucamp.com
Mark Dortch	USERDC-WES	601-634-3517	dortchm@ex1.wes.army.mil
James Martin	USERDC-WES	601-634-3517	martinj@ex1.wes.army.mil
Roy Burke	GAEPD	404-675-1665	roy_burke@mail.dnr.state.ga.us
Keith Parsons	GAEPD	404-675-1631	keith_parsons@mail.dnr.state.ga.us
Nancy Sullins	SCDHEC	803-898-4244	sullinnr@columb32.dhec.state.sc.us
Harvey Seim	Skidaway	912-598-2361	seim@skio.peachnet.edu
Jack Blanton	Skidaway	912-598-2457	jack@skio.peachnet.edu
John Sawyer	City of Savannah	912-964-0698	jsawyer@ci.savannah.ga.us
Paul Conrads	USGS	803-898-4244	pconrads@usgs.gov

The MTRG has provided specific recommendations relative to each of the three task statements, along with general recommendations not specifically related to the draft task statements. The following summarizes those recommendations.

General Recommendations

- The MTRG should continue review of the model development providing guidance to GPA and reporting to the SEG. The MTRG should meet on a regular basis to allow interim review of the model development and data analyses.
- The MTRG wants to have an active role in reviewing the data analyses and data interpretations prior to model input. This includes reviewing the raw data for inconsistencies and sensitivity analysis prior to model calibration as well as providing input for the model kinetic rates and modifications.
- Within the MTRG, ATM should provide updates to the group regarding the assumptions for model kinetics and analyses of the raw data. These assumptions and analyses will then be reviewed by the MTRG prior to model calibration. The raw data along with the input and output variables for specific runs will be made available to each MTRG member during this process.
- GPA should formulate task statements for the development of model application critical conditions. The MTRG should provide technical review and recommendations for these task statements to the SEG.
- GPA should provide the following formats for presentation of the field data recorded during the 1999 Field Study of the Lower Savannah River. The MTRG reserves the right to request additional formats as the study progresses.

    1. Time series of observed (measured) DO, TEMP, and SALINITY overlaid with vertical profiles for each location.
    2. Isopleths of DO, salinity, water temperature, and density based on weekly vertical profiles similar to those prepared from the 1989 and 1990 EPD data.
    3. Summary of the number of days measured DO was less than or equal to the following concentrations (2.0, 3.0, 4.0, and 5.0 mg/L), where days would equal the cumulative sum of the 15-minute records for each moored instrument.
    4. Similar summaries for temperature and salinity. For water temperature, the range of interest would be centered on the 90 deg. F state standard. The range of salinity values to be based on the sensitive life stages of striped bass and shortnose sturgeon.

SEGCL1: Develop Salinity/Chloride Correlation Model (title changed see note below)

- Place a revised version of the Task Goal that is in SEGP311 in the Task Goals of SEGCL1. The goal should state, "Develop a chloride sub-model that will allow the estimation the change in magnitude and temporal distribution of chloride levels at the City's raw water intake due to the proposed harbor deepening."
- Develop chloride sub-model above I-95 Bridge and force with elevation boundary condition at I-95 and chloride flux at I-95 to project changes in chloride concentrations at the City of Savannah Intake.
  Note: Based upon the recommendation to develop a chloride sub-model, the draft task Statement title will be changed to "Evaluate Salinity/Chloride Relationship and Develop Chloride Sub-Model."
- As with the data collection effort, the multiple model task statements reflect the development of a system of models for use in evaluating hydrodynamic and water quality impacts of the proposed deepening. There is therefore significant overlap in the three tasks. The individual tasks need to describe the overall model development steps to be taken, understanding that this global model development applies to each task.
- Utilize an elevation boundary condition at I-95 Bridge to force the chloride sub model.
- Reword sentence in Section 3.0, 2nd paragraph that states "Additionally, under this task, the hydrodynamic/salinity model will be expanded, refined, and recalibrated between the I-95 Bridge and Ebenezer Creek". Revise to state, "….will be expanded and refined between", to avoid confusion of statement including recalibrated.
- Add sentence to Section 3.1, 3rd paragraph that states that the database will be made available as an appendix to the report for this task.
- Identify that for the model calibration the existing bathymetric and geometric conditions will be utilized and not those proposed under the USACOE restoration project. Remove references to the USACOE restoration project as this will not impact model development.
- Identify that the lack of measurable chloride concentrations at the intake does not alone preclude salinity as the source.

SEGDO1: Develop Dissolved Oxygen Model

- Add the following model to data comparison methods to the task statement:

  - Vertical profiles of water quality constituents where data are available
  - Longitudinal profiles taken as a snap shot in time for dissolved oxygen at various times throughout the simulations
  - Comparison of the longitudinal and vertical structure of dissolved oxygen taken from the 10 primary EPD station data.
  - Longitudinal profiles of all other water quality parameters measured (see SEGP312 for list) averaged over the simulation period with maximum and minimum values plotted.
  - Longitudinal profiles of Mean Absolute Error (MAE) for dissolved oxygen
  - Longitudinal profiles of Mean Error for dissolved oxygen
  - Longitudinal profiles of RMS Error for dissolved oxygen
  - Longitudinal profiles of Relative Error for dissolved oxygen

- Move calibration of thermal model to SEGDO2.
- Utilize simulated temperatures in all water quality model simulations.
- Simulate temperature and salinity in both the hydrodynamic and water quality models to assure that the transport schemes in each model are working in a similar manner.

- Revise title of Section 3.5 to “Determination of Input Conditions for 1999 Dissolved Oxygen Model Calibration” and the first sentence of this section to state, “For the 1999 dissolved oxygen model calibration….”
- As with the data collection effort, the multiple model task statements reflect the development of a system of models for use in evaluating hydrodynamic and water quality impacts of the proposed deepening. There is therefore significant overlap in the three tasks. The individual tasks need to describe the overall model development steps to be taken, understanding that this global model development applies to each task.
- Add language to this task statement that says, “sufficiency of the data set to be based on the ability to calibrate the dissolved oxygen model” to appropriately address various causes of oxygen demand, e.g., navigation, point sources, non-point sources, SOD, marsh input, upstream loading, agitation dredging, etc.
- Add description of the sensitivity tests to be performed.
- Identify methods for determination of range of model coefficients.
- Put an evaluation of the potential for atmospheric deposition to impact the dissolved oxygen balance within the Lower Savannah River Estuary. Identify the evaluation as using existing data.
- Add uncertainty analyses under sensitivity analyses.
- Identify that components of the dissolved oxygen balance as modeled by the water quality model will be output and reviewed along with the 8 state variables

SEGDO2: Refine and Verify Hydrodynamic/Salinity Model

- Perform a test of the hydrodynamic model to ensure that artificial mixing is not occurring within the sigma grid. The test consists of setting up a stably stratified “dead sea” situation in the system and run with all forcing turned off. The goal is to show that under this condition the model will not produce any artificial flows or transport of salinity.
- Add the following model to data comparison methods to the task statement:
  - Graphical comparison of the model versus data for the tides, currents, flows, salinity, and temperature.
  - Longitudinal Plots of Mean Error for the tides, currents, flows, salinity, and temperature.
  - Longitudinal Plots of Absolute Mean Error for the tides, currents, flows, salinity, and temperature
  - Longitudinal Plots of RMS error analysis for the tides, currents, flows, salinity, and temperature
  - Longitudinal Plots of Relative Error for the tides, currents, flows, salinity, and temperature
  - Comparison of the primary harmonic constituents calculated from the model results and the data for the tides and currents.
  - Graphical and tabular comparison of the measured and simulated mean water level variations (non-tidal lower frequency variations).
  - Graphical and tabular comparison of the measured and simulated residual currents (non-tidal lower frequency variations).
  - Explicitly form the vertical salinity and temperature difference as a function of time for as many monitoring stations as is possible, and compare this with the model predictions.
  - Form the horizontal salinity and temperature difference between adjacent monitoring stations at the surface and bottom as a function of time for as many stations as possible, and compare this with the model output.
  - Compare measured and simulated low frequency salinity and temperature variations.
  - Compare observations of vertical shear of the horizontal currents with those predicted with the model. Show this as a contour plot as a function of time and vertical height.
  - Show some vertical profiles of salinity, temperature, and velocity from the model and from observations.
  - Plots of simulated and measured salt flux.
  - Plots of horizontal and vertical salinity and temperature gradients.

- Eliminate percentile frequency of occurrence as a direct model to data comparison methodology; utilize this solely for ecologic evaluation purposes.
- Utilize consistent turbulence scheme between the hydrodynamic and water quality model (this was the case in the first modeling effort, but was not clearly stated in the reports).
- Revisit the turbulence closure scheme to determine if it can be used to accurately project salinity intrusion and provide a more generally applicable model.
- Move calibration of temperature model to task statement SEGDO2
- In Section 3.2, 2nd paragraph, revise to state that although the marsh subroutine will be developed using field data from within the SNWR, the algorithm will be used to predict salinity levels in all marshes in the upper estuary, including those located outside of the SNWR.
- As with the data collection effort, the multiple model task statements reflect the development of a system of models for use in evaluating hydrodynamic and water quality impacts of the proposed deepening. There is therefore significant overlap in the three tasks. The individual tasks need to describe the overall model development steps to be taken, understanding that this global model development applies to each task.
- Add additional sensitivity tests:
    1. Vertical diffusivity variations greater than 10 percent.
    2. Variations in the offshore salinity concentration
    3. Time lag on river discharge.