Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
703-385-6000

Memorandum

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To: Peter Kozelka, Ph.D., US EPA, Region 9

Cc: John Craig, Steve Carter, Amy King, Tetra Tech, Inc.

From: John Hamrick, Ph.D., P.E.

Subject: Resolution of the Salinity Prediction Ability of the Los Angeles-Long Beach Harbors and San Pedro Bay Hydrodynamic and Sediment-Contaminant Transport Model

This memorandum documents the resolution of the salinity prediction ability of the Los Angeles-Long Beach Harbors and San Pedro Bay Hydrodynamic and Sediment-Contaminant Transport Model. Specifically, it provides revised results for salinity prediction during periods of high fresh water inflow (i.e., wet weather events). These results will be incorporated into a revised version of the modeling report (Tetra Tech, 2009), hereafter referred to as the 'report'. Figure 1 shows the location of 22 observation stations in the outer harbor region having significant salinity response to high freshwater inflow events. Salinity data from these stations were compared with model predictions. Results presented in the February 2009 modeling report showed poor predictive capability (Tetra Tech, 2009). Inputs to the model, including hourly observed flows from the Los Angeles River and local wind data, have since been updated . The revised results are presented below along with a discussion of various salinity scenarios performed and a description of the final modifications made to improve the salinity predictions. These results will be incorporated into a revised modeling report during the summer of 2009.

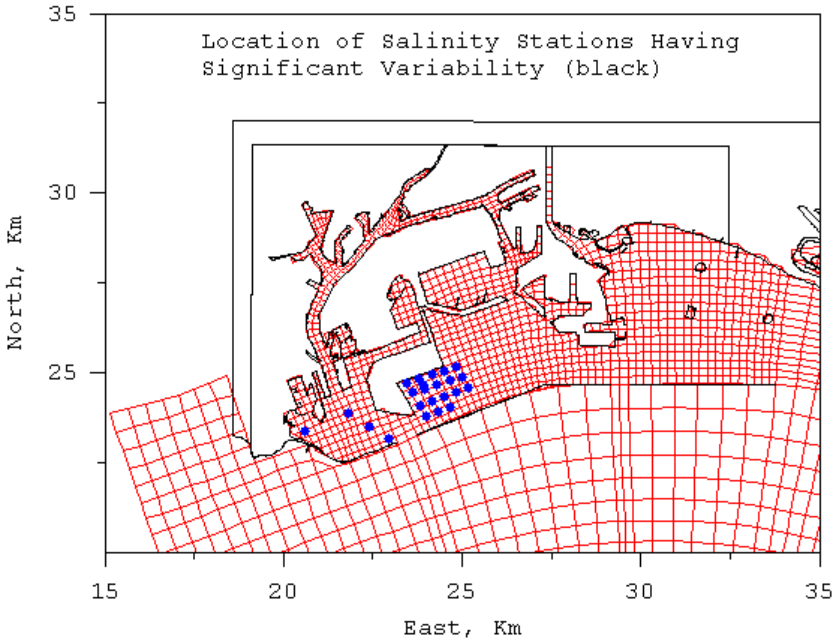

Figure 1. Location of salinity stations exhibiting significant variability (Figure 5 in Tetra Tech, 2009)

For the salinity results presented in the February 2009 report, daily average freshwater flows generated from the watershed models were used with a composite single wind field based on California Irrigation Management System (CIMS) wind data (Tetra Tech, 2009). A number of potential causes for the model's poor predictive ability in February 2009 have been investigated, including freshwater inflow and wind forcing. Specifically, a number of simulations were conducted using combinations of hourly observed (from gage F319) and watershed model predicted Los Angeles River flows. Representation of the freshwater inflow was the primary input variable modified. Additional simulations were performed by varying the wind data used for model input. The different wind observations evaluated included a single wind field based on Los Angeles International Airport, a single wind field based on CIMS wind data, and a spatially varying wind field based on the NOAA Ports wind observations. All combinations of the simulations are summarized in Table 1. As discussed below, the freshwater inflows were found to be more influential to the salinity predictions than the wind representation.

To compare the various simulation results, a consistent simulation period was selected. The currently available NOAA Ports wind data span the period between October 2004 and April 2005 (days 639 to 851 in the 1 January 2003 referenced time origin used by the model); therefore, 212 day simulations covering this period were conducted. It should be noted that this period includes major freshwater inflow event responses in late 2004 and early 2005 (shown in Figure 2). The simulations presented in Table 1 were performed and the results were compared to the observed data from the stations shown in Figure 1. Results were presented using scatter plots of predicted versus observed salinity and a time series plot at station 20 (results at this station are presented as an example; time series for other stations are similar and will be presented in the revised modeling report).

Table 1. Salinity Simulations

Simulation ID	Representative Flow	Representative Wind
WS/LAX	Hourly watershed model	Single wind field based on the Los Angeles International Airport data
WS/CIMS	Hourly watershed model	Single wind field based on the CIMS wind data
WS/NOAA	Hourly watershed model	Spatially varying wind field based on the NOAA Ports wind observations
319/LAX	Hourly observed data at gage F319	Single wind field based on the Los Angeles International Airport data
319/CIMS	Hourly observed data at gage F319	Single wind field based on the CIMS wind data
319/NOAA	Hourly observed data at gage F319	Spatially varying wind field based on the NOAA Ports wind observations

Note: The shaded simulation represents the best fit with observed data. These results are presented graphically in Figures 2 and 3.

After evaluating the various simulations (Table 1), representation of the freshwater inflow was found to be more influential on predicted salinity than the wind forcing. Simulations using the observed Los Angeles River flow resulted in a better match with observed salinity data than the watershed model-predicted flow. Representation of the wind data was of secondary importance to the salinity predictions and the NOAA Ports wind data resulted in a slightly closer match with the observed data.

Model predictions using observed Los Angeles River flow at gage F319 and the NOAA Ports wind data had the best fit with the observed data (shaded row in Table 1). These results are presented in Figures 2 and 3. When compared with the February 2009 results, the model predictive performance is shown to improve with the use of observed Los Angeles River flow and NOAA Ports wind data. Specifically, a closer relationship between observed and predicted salinity is evident in the scatter plot (Figure 3) and the time series plot is improved, illustrating stratification between the surface and bottom salinities (Figure 2).

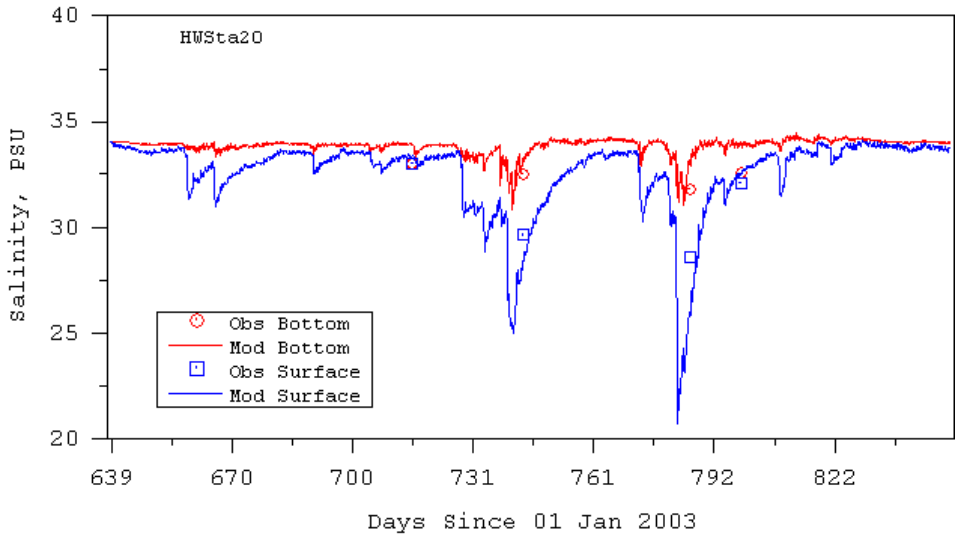

Figure 2. Model predicted and observed salinity at LAH Station 20 using hourly observed Los Angeles River flow (gage F319) and NOAA Ports wind field

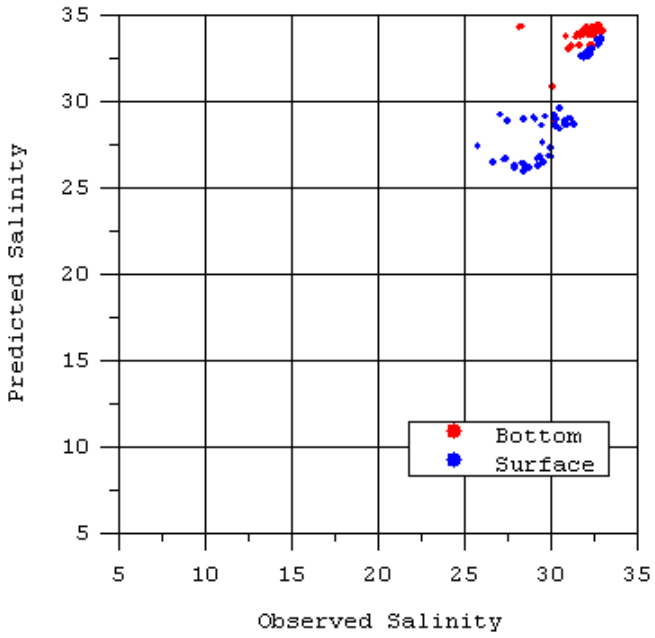

Figure 3. Predicted and observed salinity at 20 stations during four monitoring times over upper (surface) and lower (bottom) fractions of the water column using hourly observed Los Angeles River flow (gage F319) and NOAA Ports wind field

References

Tetra Tech, Inc. (2009). Los Angeles-Long Beach Harbors and San Pedro Bay Hydrodynamic and Sediment-Contaminant Transport Model Calibration. Prepared for USEPA Region 9 and Los Angeles Regional Water Quality Control Board. Draft – February 2009.