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Sent: Thursday, July 22, 2004 5:07 PM
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Subject: Status and schedule for completing Charles River eutro model

Dear Group:

The purpose of this message is to provide you with the status of the Charles River Basin eutrophication model and our current plans and general schedule for reviewing the model. As many of you are aware, completion of the model has been delayed because of complexities associated with the lower Basin and our desire to produce a model capable of simulating the proposed diffuser for Kendall Station and its resulting effects on water quality. The modeling work is nearing completion and model documentation will be available for review soon. The below schedule outlines the general timeframe that we anticipate following for reviewing the model. At the next meeting for the larger Project Technical Group, we will present the schedule for completing the TMDL which will extend well into the winter months. Below, following the schedule, is a brief description of the primary reason for the delays with completing the model and the course of action taken by the modelers.

If you have any questions/comment or would like to discuss the project with me, please feel free to email or call me at 617 918-1537. Thanks

for your patience with this project.

Mark Voorhees

Schedule

Present to end of July 2004 - Modelers complete model calibration and validation and prepare preliminary draft report.

Aug 3, 2004 - Modelers brief Expert Review Panel (made up of Dr Steven Chapra, Dr Ray Wright and Dr Ken Wagner) and provide preliminary draft report to Expert Review Panel for review.

By August 27, 2004 - Expert Panel provides comments on model to CRWA, modelers, and EPA.

By September 10, 2004 - Modelers address Expert Review Panel's comments, revise model as necessary, and provide final draft modeling report for distribution to the larger Project Technical Group.

Week of September 27- Have meeting for larger project technical group at which: (1) the modelers present the model; (2) the expert panel reports on their findings and conclusions, and (3) discuss plans for completing the TMDL.

By Oct 15, 2004- Larger Project Technical Group provides comments on model to EPA/ MADEP.

Hydrodynamic and water quality models of the Lower Charles River Basin have been developed and tested over the last year and a half, by Dr. John Hamrick of Tetra Tech, Incorporated and Richard Baker of Numeric Environmental Services, respectively. These coupled 3-dimensional, transient numerical models utilize the EFDC modeling framework. EFDC solves the governing hydrodynamic and water quality transport equations using a sigma-stretch coordinate system.

Vertical mixing predicted using EFDC has been found to be large, compared to levels suggested by historical salinity and water quality data available for the basin. This modeling problem is particularly evident during the summer months, when seawater intrudes into the basin at depth due to boat lockages at the Charlestown Dam. This results in a strong pycnocline near mid-depth and very low observed rates of exchange between surface and bottom waters. Extensive testing has been conducted using EFDC, in order to try to decrease vertical mixing to observed levels, with limited success. Based on the testing it has been concluded that the main source of artificial vertical mixing within the current EFDC application is due to its use of the sigma-stretch coordinate

system. The sigma-stretch coordinate system utilizes the same number and relative thicknesses of individual vertical layers in each horizontal cell, regardless of total water depth. If two adjacent cells have much different total water depths, as is found in the Charles River Basin, the sigma coordinate formulation can result in excessive pumping of bottom water from the deeper cell to the shallower cell which is equivalent to excessive vertical mixing. Although progress was made in reducing the amount of salinity transported to the surface by this computational artifact, the transport of inorganic phosphorous to the surface layers still results in concentrations greatly exceeding observations.

In recognition of the need to accurately predict the low summertime vertical mixing rates observed within the basin for salt, heat and water quality constituents, Tetra Tech has commenced work on modifying the EFDC modeling framework to utilize a scaled height or Z-coordinate system which behaves similarly to a traditional Z coordinate system with fixed vertical layering. Use of the scaled Z-coordinate system will allow the model to more accurately predict the low vertical mixing rates observed within the basin, under existing summertime conditions.

Tetra Tech is presently working on these major model modifications. Following conversion to the scaled Z-coordinate system, validation of the hydrodynamic and water quality model will be finalized within approximately 2-weeks.