Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh

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1 Introduction

This is the sixteenth annual progress report of the California Department of Water Resources' San Francisco Bay-Delta Evaluation Program (Work Authority 1463). This document reports progress in the development and enhancement of the program's computer models and reports the latest findings of studies conducted as part of the program.

Much progress has been made this year in the development of new computer simulation models for the Sacramento-San Joaquin Delta. The new Delta simulation model, DSM2, has three major components: hydrodynamics (DSM2-HYDRO), water quality (DSM2-QUAL), and particle tracking (DSM2-PTM). Interfaces between DSM2 components and other modeling components are presented in Figure 1-1. The hydrodynamics and water quality components are derived from the U.S. Geological Survey's FOURPT and BLTM models, respectively. It is the Program's goal to eventually make the DSM2 modeling system available to the public.

Following is a brief overview of the subjects addressed in this report. Contributing authors are noted in parenthesis. Readers should consult previous annual progress reports for additional background on each subject.

Chapter 2: Hydrodynamics. Work continued in the development of the DSM2-HYDRO model, with much of the focus on the "tide file" which links the hydrodynamics model with other models. (Parviz Nader-Tehrani)

Chapter 3: Water Quality. Several new features were added to the DSM2-QUAL model, including a diagnostic routine that tracks conservative and nonconservative mass through the Delta. The latter part of this chapter presents an application of DSM2-QUAL to simulating dissolved oxygen in the vicinity of Stockton. Dissolved oxygen modeling necessitates the simulation of temperature, nutrient cycling, biochemical oxygen demand (both in the water column and in the benthic), and algae. A number of field data and assumptions are required to drive this model. Advances in modeling multi-constituent water quality will permit better charaterization of the aquatic environment, thus allowing for more accurate predictions related to movement, growth and mortality of fish populations in the Delta. (Hari Rajbhandari & Parviz Nader-Tehrani)

Chapter 4: Particle Tracking. This chapter describes recent enhancements made to the DSM2-PTM model. One new enhancement allows the user to group channels and account for particle transport between groups. A study, conducted at the request of Dr. Jim Cowan of the University of Alabama, is reported to illustrate this feature. (Tara Smith & Chris Enright)

Chapter 5: Delta Islands. In-Delta water use and return water quality have been the subjects of a multi-year investigation. This chapter describes an ongoing joint effort with the Division of Local Assistance and the U.S. Geological Survey to measure and model Delta island diversion and return flow volumes and quality. Steps were taken to improve estimates of crop evapotranspiration, historic land use, and crop irrigation efficiency. A geographical information system coverage was developed under contract with the USGS to assign spatial information to 142 subareas in the Delta. Good estimates of Delta island diversion and return flows and quality are crucial for accurately simulating the loading and movement of organic disinfection by-product precursors within Delta channels. Furthermore, good estimates of in-Delta water use are essential for the computation of net Delta outflow. (Nirmala Mahadevan & Paul Hutton)

Chapter 6: Model Input System. Emphasis on a streamlined user interface has resulted in a new model input system described in this chapter. Fixed and time-varying inputs are separated and treated differently in the new input system. Adopting "block data" concepts for fixed input and employing the Data Storage System (DSS) developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center, an efficient input handling system has been developed to allow for fast, easy, and error-free access to the DSM2. (Ralph Finch)

Chapter 7: Artificial Neural Networks and Their Applications. This year the application of a new technology, the Artifical Neural Network (ANN), was explored. While this technology is new to the Bay-Delta Program, it is reasonably well established (more than ten years) within the civil engineering industry at large. Chapter 7 describes the fundamentals of the ANN and potential applications to the Bay-Delta. Some initial applications of ANN are described in Chapters 8 and 9. (Nicky Sandhu & Ralph Finch)

Chapter 8: Disinfection By-Product Formation. An ANN was trained to improve on the predictive ability of the Department's model for trihalomethane (THM) formation potential and speciation. (Paul Hutton & Nicky Sandhu)

Chapter 9: Carriage Water. Arguments on why an ANN is a befitting device for carriage water investigations are presented in this chapter. Initial applications of an ANN and the expected future direction of this investigation are also presented. (Nicky Sandhu & Ralph Finch)

Chapter 10: Geometry. This chapter provides on update on efforts to refine the DSM2 representation of channel geometry. Continuing efforts to extend the downstream model boundary to Golden Gate Bridge and to extend the upstream model boundary to Shasta Dam is presented. Progress in developing a refined in-Delta channel geometry is also presented in this chapter. (Ralph Finch)

Chapter 11: Data Assembly. Continued efforts on data acquisition are reported in Chapter 11. A 37 percent increase in assembled and checked data (to 16.7 million data points) has resulted from efforts during this fiscal year. Additional data sources were identified and are listed in this chapter. (Ralph Finch)

Following Chapter 11 is a short afterword about our intent to make future reports available on the World Wide Web. The WWW is undoubtedly a powerful device for disseminating information.

This report was compiled and edited by Paul Hutton, with assistance from Susan Tatayon and Nancy Ullrey, under the direction of Francis Chung, program manager for the Bay-Delta Evaluation Program.