State of California
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DEPARTMENT OF WATER RESOURCES

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

37th Annual Progress Report to the
State Water Resources Control Board in
Accordance with Water Right Decisions 1485 and 1641

June 2016

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Governor	Secretary for Natural Resources	Director
State of California	California Natural Resources Agency	Department of Water Resources


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Foreword

This is the 37th annual progress report of the California Department of Water Resources' San Francisco Bay-Delta Evaluation Program, which is carried out by the Delta Modeling Section. This report is submitted annually by the section to the California State Water Resources Control Board pursuant to its Water Right Decision 1485, Term 9, which is still active pursuant to its Water Right Decision 1641, Term 8.

This report documents progress in the development and enhancement of computer models for the Delta Modeling Section of the Bay-Delta Office. It also reports the latest findings of studies conducted as part of the program. This report was compiled under the direction of Tara Smith, program manager for the Bay-Delta Evaluation Program.

Online versions of previous annual progress reports are available at: http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/annualreports.cfm.

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Preface

Chapter 1. Initial Investigation of Inflatable Barrier in South Delta

The agricultural rock barriers constructed in the South Delta, under the Temporary Barriers Program of the California Department of Water Resources, Bay-Delta Office (BDO), are installed to provide increased water levels and improved circulation patterns in the South Delta area.

BDO is investigating the feasibility of using inflatable barriers (i.e., rubber-bladder barriers) instead of the current rock barriers. The potential benefits of the inflatable barriers are lower cost and ease of installation. This chapter provides a summary of the preliminary investigation of using inflatable barriers.

Chapter 2. A New GIS Tool for Creating DSM2 Grid and Cross Sections

DSM2 cross sections are defined using bathymetry data as a guide. The Cross Section Development Program (CSDP) was developed for this purpose and has been used extensively in the past for creating DSM2 cross sections (Tom 2001). CSDP was developed almost 20 years ago when geographic information system (GIS) tools were not very sophisticated. Since then, ArcGIS has developed many features for geospatial analysis and visualization. To leverage these capabilities a tool was proposed for ArcMap that would add cross-section drawing capabilities for DSM2. A contract was executed with Tom Heinzer, GIS Manager/Software Developer, U.S. Bureau pf Reclamation, to implement this new tool.

With the new tool as an add-in to ArcMap, users can use both standard ArcMap functions and the new tool's functions. The add-in allows users to:

- Add, remove, and edit the locations of the nodes.
- Add the flowlines of channels, which are used to determine the length of the channels.
- Cut cross sections from a Digital Elevation Model (DEM) by using a vertical plane's intersection to determine the profile.
- Edit the profiles of cross-section shapes.
- Calculate the area, width, and wetted perimeter for user-defined levels from profiles.
- Export the channel grid and cross-section data in DSM2 format.

This chapter is a brief tutorial on how to use the tool. Delta Modeling Section staff have been using the tool to develop a new refined grid and cross sections.

Chapter 3. DSM2 Extension: A GIS-Based Approach

As with other hydrodynamic and hydraulic models, DSM2 (Delta Simulation Model 2) requires boundary conditions to fully define and drive the system; upstream boundary conditions are usually provided as flow hydrographs while downstream boundary conditions are given as water-surface elevation. Additionally, boundaries are located where observed data is available and are located away from areas of interest that might influence the boundary conditions. For water quality simulations, constituent concentrations must also be provided at all boundaries. In a tidal system, such as the Delta, where most of the salinity originates in the ocean, the salt concentration at the downstream boundary is crucial because it drives the water quality conditions in the Delta.

Situated at the eastern end of the Carquinez Strait, Martinez is the location of the downstream (western) boundary condition for DSM2. While the waterways of the legal Sacramento-San Joaquin

Delta are fully contained within the DSM2 boundaries, depending on the details of a particular study, the boundary condition location at Martinez can be less than ideal.

This chapter describes the investigation of a method for extending the DSM2 grid to San Francisco Bay at the Golden Gate. The method uses a one-dimensional grid, extensive and detailed geoprocessing of geometry data, and sophisticated calibration software. The goal of this grid extension is to reflect the volume of water and salinity transported from the Golden Gate to Martinez for Delta simulations, and it is not intended to provide a detailed model of hydrodynamics and salinity in San Francisco Bay. Preliminary results show promise that the method presented in this chapter can be applied successfully.

Chapter 4. Delta Salinity Simulation with DSM2-GTM

The California Department of Water Resources' (DWR's) Delta Modeling Section is developing a new DSM2 transport module, called the General Transport Model (DSM2-GTM). Progress on this effort was previously reported in Hsu et al. (2014). DSM2-GTM employs a fixed (Eulerian) mesh rather than one that moves with flow and follows virtual parcels of water in a Lagrangian scheme. The fixed grid will make it easier for this model to interact with other models, georeferenced data, data assimilation, optimization, and visualization, as well as to couple inline to DSM2-HYDRO. It is also more straightforward to extend the new model to new physical processes, with sediment, dissolved oxygen, and mercury cycling models that are currently being developed. Because of its extensibility, DSM2-GTM is expected to replace DSM2-QUAL.

This chapter provides a detailed description of the technical background and accomplishment so far of the DSM2-GTM development.

Chapter 5. Estimating Net Delta Outflow, Summary of March 2016 Report to the State Water Resources Control Board

In fall 2015, the State Water Resources Control Board (SWRCB) requested that DWR provide technical guidance on the best available consumptive use models and, more broadly, on the subject of Net Delta Outflow calculations. DWR produced a report, titled *On Estimating Net Delta Outflow (NDO), Approaches to Estimating NDO in the Sacramento-San Joaquin Delta* (California Department of Water Resources 2016) and submitted it to the SWRCB in March 2016. This chapter is a brief outline and a summary of the report.