

Application of the 3-Dimensional Modeling System for TMDLs and Wasteload Allocations in Charleston Harbor

Parameter of Concern: low dissolved oxygen (DO) due to biochemical oxygen demand (BOD) loads

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Background

- 1990s—Charleston Harbor Project
- 2002 —Cooper TMDL, phased reductions for more study
- 2003—Ashley TMDL
- 2004-2007—3-D model study plan, data collection, model development, calibration
- 2007-present—Critical conditions model → “Size of the pie” → TMDL Calculator → allocation process → revised TMDL

Critical Conditions Model

- Previous Approach (typical)
 - Model calibrated to narrow range of conditions
 - Hot, dry weather
 - Short period of river inflows and tides (~ 1 month)
 - Model applied under critical conditions
 - Temperature and river inflow set to historical extremes
 - Theoretical tide

Critical Conditions Model

- 3-D Model Approach
 - Model calibrated to full year 2004
 - Wide range of meteorological conditions
 - Wide range of river inflow
 - Full annual tidal cycle
 - Model Application
 - Uses actual conditions instead of derived critical conditions

Critical Conditions Model

- Non-point sources
 - LSPC watershed model predicts flows
 - Concentrations determined by regression models using tributary data and landuse
 - Watershed flows and loads input as time series into 3-D model
 - Data and modeling show no significant impact due to anthropogenic non-point sources

Critical Conditions Model

- Longterm Model
 - Run January 2000 through December 2006
 - Point source dilution and DO impact
 - little variation year-to-year on the Cooper River
 - 2002 and 2004 worst for the upper Ashley River
 - Selected 2004 as critical period for TMDL

TMDL Target

0.10 mg/L DO impact applied as

- daily average
- spatial average in critical segments

Size of the Pie

Point Source DO Impact (mg/L)

Scenario	3-D Model	2-D Model
2004 Permits	0.393	0.47
Phase I	0.168	0.20
Phase II	0.110	0.14
Standard	0.10	0.1

TMDL Calculator

- Allocation tool with adjustable scenarios and instant results (Greenfield, 2002)
- Based on multiple model runs
- Critical for BCDCOG-led allocation process for 2002 TMDL
- Similar tool developed for 3-D model and current BCDCOG-led reallocation process

Questions?