Use of Science Tools in TMDL Design

David Smith
TMDL Team Leader
EPA Region 9
What are TMDLs?

• TMDL= total maximum daily load
• Clean Water Act planning program that:
  - identifies polluted waters and stressors
  - determines amount of pollutants that can be discharged and attain protection goals (aquatic life and human health protection)
  - allocates allowable pollutant loads among sources
• More than 20,000 polluted waters nationally, approximately 3,000 TMDLs completed to date
• Biggest problems are nutrients, pathogens, metals, and clean sediment
Science Challenges in TMDLs

- **Goal:** apply broad water quality standards (goals) to individual waters and fix problems

- **Physical science challenges:**
  - quantify narrative standards (e.g. nutrients)
  - estimate pollutant loads from diffuse sources
  - estimate behavior of nonconservative pollutants
  - consider dynamic hydrology, “critical conditions”
  - estimate ability to control nonpoint sources

- **Social science challenges:**
  - evaluate control costs and “equity” of burdens
  - consider public willingness to take voluntary action
Physical Science Tools (1)

• Interpret narrative standards
  - usually: literature values, reference values
  - rarely: site specific effects studies

• Estimate pollutant loads
  - frequently: simple analysis of limited data sets
  - often: dynamic watershed loading models (HSPF)

• Guess behavior of pollutants in water
  - usually: steady state models (QUAL2E)

• - increasingly: dynamic fate/transport models (WASP)
Physical Science Tools (2)

- Characterize hydrology and hydrodynamics
  - usually: critical “low flow” based on gauge data (7 Q 10)
  - increasingly: dynamic hydrology models (CE-QUAL)
- Estimate nonpoint source control effectiveness
  - usually: national literature values
  - rarely: local effectiveness monitoring
Social Science Tools

• Evaluate control costs and allocation equity
  - usually: rough State cost estimates, no benefits estimates, rough consideration of cost effectiveness (NOT required by CWA)
  - increasingly: use models to support public debate on allocation scenarios (WARMF)
  - rarely: rigorous analysis of relative cost-effectiveness or political/social acceptability (DOE-LLL project)
Needs for Better Tools

- Good existing physical models
- Most constrained by data limitations and shortage of qualified modelers!
- Need locally tailored standards for nutrients, sediments, some toxins
- Better information on effectiveness of nonpoint source management practices
- Not clear that models to assess control economics and allocation “equity” will help