

**Summary Report
For US EPA's
Water Quality Modeling to Support Management Actions
Workshop
In Baltimore, MD,
9-10 September 2008**

Prepared by

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With assistance from

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EXECUTIVE SUMMARY

US EPA convened a 1 ½ day water quality modeling workshop in Baltimore, Maryland from September 9 to 10, 2008. This meeting, entitled *Water Quality Modeling to Support Management Actions*, was coordinated with a Water Environment Federation (WEF) Total Maximum Daily Load (TMDL) conference on September 11, 2008 in Baltimore, Maryland. The purpose of the workshop was to reach out to a broad water quality modeling user community in order to address the following objectives:

- Identify current water quality modeling applications used by the TMDL, permit, and watershed planning community.
- Identify the modeling needs of TMDL, permit, and watershed plan writers.
- Identify the role BASINS plays in meeting those modeling needs.
- Identify what enhancements to BASINS would make it more useful and attractive.
- Identify what other model platforms are used.
- Identify what technical support and/or training EPA can provide to better meet users needs.

As shown in the attached Meeting Agenda, this 1½ day workshop consisted of a mix of technical presentations, presentations of relevant case studies, and open forums of questions and answers in order to develop an approach to meet the practitioner's needs. The targeted audience consisted of watershed planners, TMDL developers, NPDES permit writers and other water quality modeling practitioners (e.g., consultants and academia). The workshop provided the audience with an understanding and awareness of the wide array of available modeling tools that can be used to meet a diverse set of objectives (watershed planning, smart growth, trading, TMDL development and NPDES permitting). The main goal of the workshop was to receive feedback from the attendees to help guide future directions of BASINS and/or to help EPA deliver other modeling tools to meet both regulatory and water quality planning and management objectives.

Overall the workshop demonstrated that practitioners look to the US EPA to support their watershed/water quality modeling needs. Top needs identified by the participants were training, information exchange, and technical support. A user forum was a common suggestion, as well as a help desk. Other common needs identified by attendees included technical guidance, particularly for model selection, and case studies. Overall the comments indicated that users want some authoritative sources to turn to for support of the modeling decisions they are making. To respond to these needs, we recommend that EPA continue its commitment to providing assistance to model users in all the ways listed above. Users also expressed need for additional modeling capabilities such as linkages between different models, BMP tools, low impact development tools, and stakeholder tools, as well as the need for additional data.

This report provides an overview and summary of the Workshop, as required by the Work Assignment No. 2-03 under EPA Contract No. EP-C-06-029. Appendices to this report include the following:

- Meeting Agenda
- List of Attendees
- Summary of Presentations and Q&A
- Chart Notes
- Participant Evaluations

PLANNING AND LOGISTICS

This workshop was instigated by Jim Carleton of the US EPA, and planned by a committee including Amy Newman, Shera Bender, Wendy Drake, Jim Carleton, Ed Partington, Stuart Lehman and Michael Haire of EPA Headquarters; Molly Davis, Tim Wool and Steve Whitlock of EPA Region 4; Jack Kittle and Paul Duda of AQUA TERRA Consultants, and Lori Belangia and Linda Eichmiller of the *Association of States and Interstates Water Pollution Control Administrators (ASIWPCA)*. John Hochheimer and Clair Meehan of Tetra Tech, Inc. were brought onto the team for meeting facilitation. Doris Jean Quiring of AQUA TERRA Consultants provided administrative assistance.

The workshop was held at the facilities of the University of Maryland School of Nursing, an educational facility that provided meeting facilities for this workshop free of charge. The Workshop was well attended, with over 100 attendees present. The School of Nursing provided a lecture hall with theatre-style seating for all of the attendees, plus 2 large conference rooms for breakout sessions on the second day of the workshop. All interested attendees were admitted.

Since this workshop was sponsored by the U.S. Environmental Protection Agency, there were no registration costs, and there was travel support available for a limited number of attendees. Like the BASINS/HSPF workshops under this contract, AQUA TERRA was responsible for the entire registration process.

Project funds were used to bring in expert speakers for the case studies and for a presentation from the BASINS development team, and for facilitators from Tetra Tech, Inc. to assist with the meeting flow and note-taking.

Handouts and materials for the workshop included a workshop folder containing the workshop agenda, a copy of the lecture slides, and a final list of attendees. During the Workshop the attendees were requested to complete an evaluation form that provided space for comments and suggestions.

OVERVIEW BY DAY

DAY 1

The meeting began with welcoming remarks from US EPA's Michael Haire and a keynote address from Dr. Robert Summers, the Deputy Secretary of the Maryland Department of the Environment. Lori Belangia and Linda Eichmiller of *Association of State and Interstate Water Pollution Control Administrators (ASIWPCA)* provided a summary of ASIWPCA's recent state survey on modeling needs and outlined some of the challenges that states are facing in relation to modeling. Participants were provided an opportunity to voice their questions and concerns or post them on the wall. Participant input followed several themes:

- Interest/concern about the use of statistical (e.g., Bayesian) models
- Reducing uncertainty and error
- Relating model outputs to water quality standards and NPDES permits
- Questions about specific parameters (e.g., the relationship between nutrients, dissolved oxygen, and chlorophyll a)
- Relating TMDLs to management decisions (e.g., incorporation into MS4 permits)
- Data requirements
- Peer review

Participants also offered some of their modeling needs:

- Training (e.g., on commonly used models)
- Better guidance from EPA
- An updated HSPF parameter database
- A consistent level of support/knowledge from EPA staff
- An EPA-sponsored forum for information exchange
- New/better data
- Free processor tools (for EFDC for instance)
- Tools to help EPA/states to be able to explain TMDLs in plain language that the public can understand.

After the open discussion on state modeling needs, case studies were presented on the following topics:

- Modeling North Carolina's Neuse River
- Watershed-Level Optimization of BMP Selection for Cost-Effective Pollutant Load Reduction in the Lower Fox River Basin and Green Bay, Wisconsin
- TAM/WASP Modeling Framework: Anacostia Nutrient and BOD TMDLs
- Connecticut River Study: Model-Supported Evaluation of Potential Nitrogen Reduction Strategies
- The Beaver Creek and Grand Lake St. Marys Watershed TMDL Using the Load Duration Curve approach

A panel discussion followed. The panelists were asked what US EPA could do to provide more support. The responses emphasized the need for on-call technical expertise, user training, and mentoring.

DAY 2

The second day began with additional state case studies:

- Linking SWMM to HSPF to Simulate Canal Drainage in Florida
- Use of QUAL2K with Estimates from HSPF to Predict Temperature Improvements during Restored Baseflows in the Bear-Evans Watershed

A panel discussion after these case studies focused on the growing need for linkages between models, and better ways to simulate BMPs in models.

After the panel discussion, Jim Carleton and Tim Wool provided an outline of EPA's historical involvement in model development and pending enhancements to BASINS. Jack Kittle and Paul Duda of AQUA TERRA Consultants gave an overview of BASINS 4.0. The BASINS 4.0 presentation focused on how BASINS brings together data and models in an open-source, non-proprietary software environment, recent additions to the system, and a preview of some of the planned future enhancements to BASINS.

The afternoon session was dedicated to small group discussions to 1) identify and discuss state modeling needs; and 2) discuss how EPA can meet state needs. Participants comments centered on the following topics:

Participant-identified priorities for EPA to assist states with watershed and water quality models:

- Technical support and guidance, such as:
 - Online tutorials and webinars
 - Guidance on uncertainty analysis, public involvement
 - Compendium of modeling capabilities
 - Users guides
 - Help desk
 - Examples and case studies
- Training (e.g., more in-depth training on specific models)
- One-on-one support
 - EPA-staffed helpdesk
 - Assistance with model selection
 - Identification of alternatives to TMDLs
- Information exchange
 - Online forums, conferences
- Modifications to more popular models
- Resources for states (for model development and implementation)
- Consistent staffing/training of EPA staff
- Continued support for BASINS and older EPA models

Ways EPA can facilitate sharing of information among states:

- Listservs
- Workshops and meetings (e.g., BASINS users meeting; region-specific meetings)
- Webcasts

- Online forums
- Newsletter
- Monthly call (e.g., on specific modeling topics)
- Compilation of existing information, such as
 - List of state Web sites with modeling data
 - Inventory of what has been done
 - List of projects underway
 - List of contact information
 - Inventory of existing plug-ins for BASINS
- Case studies posted on BASINS site
- Models used in TMDLS posted to the WATERS site

Other ways EPA can support state modeling needs/Other tools:

- Tools to aide in water quality management decisions (e.g., translation of TMDLs to permit limits)
- Development of a timeline for model development—what's on the horizon?
- Tools to perform sensitivity analysis and assess error
- Inclusion of BMP and other management application optimization tools in BASINS
- Specific modeling issues (e.g., non-traditional impairments; consideration of subsurface tile drainage in HSPF)
- Public outreach

Factors that prevent meaningful results:

- Insufficient data (e.g. rain gages; lack of most current data)
- Inadequate resources
- Lack of EPA guidance, including:
 - Which models to use
 - Uncertainty analysis
 - Minimum data requirements for TMDLs
 - Implementation strategies (e.g., trading, incorporating information into permits)
 - Communication with the public
 - User manuals for specific models
- Lack of EPA policy of minimum data requirements
- Information sharing is limited
- No requirement to revisit TMDLs after new data are collected
- Lack of peer review
- Disconnect between modeling and real world applications

Obstacles to using BASINS:

- Data issues (e.g., catalog of new datasets not available in BASINS; metadata should be more visible; more local data should be used)
- Data formatting requirements
- Insufficient training (e.g., on recent updates)/trainings are too expensive
- Lack of marketing of the tool
- Lack of tutorial with the application
- More models should be added

- Users need assistance with model selection

Requested additions to BASINS:

- Mercury tools
- Loading, receiving water endpoints
- Coastal data, MS4 jurisdictional areas
- Tidal models, bioaccumulation models, stochastic models, load duration curve
- Scenario builder
- QA/QC tools
- More flexible watershed delineation tools
- Case studies
- Stakeholder interaction
- Applicability beyond freshwater systems

Participants were asked to vote on the topics that were most important to them, as well as on the primary obstacles they face. Participants identified training, information exchange, and technical support as their top issues. Lack of resources was identified as the top obstacle. Other obstacles identified were: complexity, use of non-standard data, conforming to standard file structures, and lack of continued support after training.

In the closing remarks, Amy Newman (U.S. EPA Office of Science and Technology), John Goodin (U.S. EPA Office of Wetlands, Oceans and Watersheds), and Stuart Lehman (U.S. EPA Office of Wetlands, Oceans and Watersheds) reported these major ideas that they heard throughout the workshop:

- Training needs, including webcasts and more sophisticated training
- Better ways to share information, such as a web forum
- Additional modeling capabilities such as model linkages, BMP tools, low impact development tools, and stakeholder tools
- Guidance on model selection and consistency of approaches

EVALUATION SUMMARY

The responses of the participants indicate that the meeting was successful and favorably received, with the average score for overall satisfaction exceeding 5 on a scale of 1 to 7. Out of the 118 participants, 42 completed evaluation forms were turned in at the conclusion of the meeting; the evaluations are summarized below and provided as an appendix.

In addition to overall satisfaction, the participants were asked to rate the quality of the presentations, the appropriateness and timeliness of the subject matter, logistics, and whether the workshop was a worthwhile investment of time. All of these categories scored an average of over 5 out of 7, except for the logistics item that scored just under 5. Comments from those who scored the meeting low on the logistics category were critical of the host hotel's distance from the conference, along with the limitations in the physical facility's audio capabilities and breakout rooms.

(While the location of the hotel relative to the facility was not ideal, the planning team did find it to be a reasonable choice given that with several major conventions in the City of Baltimore on these dates there were few available hotel rooms. Several of the participants walked the one-mile distance between the workshop and the host hotel each day. Similarly, with regard to the physical facility, it was provided free of charge and was within a short walk of the WEF TMDL conference the following day.)

Many attendees critiqued the synthesis of the comments from the breakout sessions, suggesting that the rush to provide attendees with the ability to vote may have led to some important ideas being lost. It would have been better if this synthesis could have occurred during a substantial break such as a lunch break or overnight, which would have avoided this rush to identify major threads from hundreds of comments.

Overall the responses reflect that the participants found the meeting very worthwhile. Ideas often cited as being particularly useful were the networking opportunities, the case studies, breakout sessions, and the updates on the status of BASINS.

RECOMMENDATIONS

Comments made throughout this workshop clearly indicated that participants look to EPA for support of models and other tools useful for watershed assessment, TMDL development, and other regulatory needs. Near the end of the workshop, as participants were asked to vote on the topics that were most important to them, participants identified training, information exchange, and technical support as their top issues. A user forum was a common suggestion, as well as a help desk. Other common needs identified by attendees included technical guidance, particularly for model selection, and case studies. Users expressed the desire to have some authoritative sources to turn to for support of the modeling decisions they are making, and these types of technical documents would provide some of that.

As the needs for training, information exchange, and technical support were so often cited, we recommend that EPA continue its commitment to providing these types of assistance to model users. Beyond the technical guidance and support, users also expressed need for additional modeling capabilities such as model linkages, BMP tools, low impact development tools, and stakeholder tools. The need for additional data sources was often cited as well.

APPENDICES

APPENDIX A: MEETING AGENDA

**Water Quality Modeling to Support Management Actions
A Workshop to Be Convened in Baltimore, Maryland
September 9 -10, 2008**

Location: University of Maryland School of Nursing
655 W. Lombard Street, Room 140

Agenda

Day 1: Tuesday, September 9

1:00 to 5:40

A. 1:00 to 1:15

Introduction

- a. Purpose and vision of the workshop
- b. How the workshop will be conducted
- c. What we hope to accomplish
 - i. Take home message
 - ii. EPA action plan to meet State modeling needs

B. 1:15 to 1:30

Keynote Address

The role of computer modeling in the management of State water quality: “The good, the bad and the ugly” – Dr. Robert Summers, Deputy Secretary, Maryland Department of the Environment

C. 1:30 to 2:00

Water Quality Modeling from the States’ Perspective

- a. ASIWPCA survey results and state modeling needs
- b. What are the typical modeling approaches being employed by the states
- c. Which models are states most frequently using
- d. When and why states choose to develop models:
 - i. In-house
 - ii. Using a consultant

D. 2:00 to 2:20

Open Discussion—State Modeling Needs

E. State Case Studies

NOTE: Case studies subject to change.

a. 2:20 to 2:50

North Carolina’s Neuse River

Presenter Kathy Stecker, North Carolina Division of Water Quality

- b. 2:50 to 3:20
Wisconsin's Green Bay Fox River Project
Presenter Laura Blake, The Cadmus Group, Inc.

Break: 3:20 to 3:50

- c. 3:50 to 4:20
The Development of Nutrient/BOD TMDLs for the Anacostia River
Presenter Ross Mandel, Interstate Commission on the Potomac River Basin
- d. 4:20 to 4:50
Modeling Nitrogen from Various Sources in a Long Island Sound Tributary Using
GWLf and BMP Tools
Presenter Barry Evans, Penn State Institute of Energy and the Environment
- e. 4:50 to 5:20
The Beaver Creek and Grand Lake St. Marys Watershed TMDL Using the Load
Duration Curve Tool
Presenter Trinka Mount, Ohio EPA, Division of Surface Water
- f. 5:20 to 5:40
Panel Discussion on Presentations and Wrap Up

Adjourn: 5:40

Day 2: Wednesday, September 10

8:30 to 5:10

- A. State Case Studies (continued)
 - a. 8:30 to 9:00
Linking SWMM to HSPF to Simulate Canal Drainage in Florida
Presenter Tom Jobes, St. John's River Water Management District
 - b. 9:00 to 9:30
Modeling of Temperature during Baseflow Using QUAL2K with Loadings from HSPF
Presenter Sinang Lee, Washington State Department of Ecology
 - c. 9:30 to 10:00
Panel Discussion on Presentations

Break: 10:00 to 10:30

- B. 10:30 to 11:00
Water Quality Modeling from EPA's Perspective
 - a. What is the agency's role
 - b. What models do we support – what types of support
 - c. What are the current training and technical support activities

- C. 11:00 to 11:30
Current Development of EPA Water Quality Models
 - a. What's new
 - b. Introduction to MapWindow
 - c. Introduction to new tools/models in BASINS

- D. 11:30 to 12:00
Environmental Data and Information for Modeling
 - a. What types of data do you need
 - b. Where do you and how do you get this data
 - c. Problems and solutions for accessing data

Lunch: 12:00 to 1:30

- E. 1:30 to 2:30
Breakout session: Identify and Discuss State Modeling Needs
 - a. Support
 - b. Priorities
 - c. Information sharing

Break: 2:30 to 3:00

- F. 3:00 to 4:00
Breakout session: Discuss How EPA Can Meet State Needs
 - a. Support
 - b. Priorities
 - c. Information sharing

- G. 4:00 to 4:30
 - a. Reconvene and Report Back to Group
 - b. Summarize Group Recommendations
 - c. Open Discussion

- H. 4:30 to 5:00
Next Steps

- I. 5:00 to 5:10
Closing Remarks

Adjourn: 5:10

APPENDIX B: LIST OF ATTENDEES

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APPENDIX C: SUMMARY OF PRESENTATIONS AND Q&A

Keynote Address—Robert Summers

Dr. Summers provided welcoming remarks to begin the meeting. He outlined his experiences at the Maryland Department of the Environment and discussed issues related to TMDLs, such as model selection. Dr. Summers also highlighted the modeling work that has been done for the Chesapeake Bay.

Question and Answer

Q: What tools are available to relate loading data back to the source?

Summers: There are not many good tools. With modeling work for the Chesapeake Bay, the state tried to “turn off” some of the source portions of the model to see how much influence different source factors had on water quality. Understanding of model is critical, as is having good data. Point sources are easier to monitor and control than nonpoint sources. Controlling nonpoint sources might be more effective, but nonpoint source controls might not be as cost effective as we’d originally thought. Caution is needed when evaluating large systems. In the Chesapeake Bay, in order to meet water quality standards, we didn’t have to worry about monitoring—the sources are everywhere. We have to push nutrient and sediment controls in all sectors in order to meet the WQS. Those are critical.

Q: Everything in the model [i.e., coefficients, input parameters, etc.] is based on monitoring information (runoff, rainfall, etc). What kind of uncertainty is involved?

Summers: There is a huge amount of uncertainty in the models, even without data. In the Chesapeake Bay Program, we spent a lot of effort to get accurate characterizations of the sources and related issues. Immediate source monitoring [i.e., point of discharge] is critical. We have data on point sources because they are required to report, but nonpoint sources are not as easy to estimate. It is often difficult to differentiate among sources (point and nonpoint).

Water Quality Monitoring from the States’ Perspective—Lori Belangia and Linda Eichmiller

Ms. Belangia summarized the results of ASIWPCA’s state survey. She discussed a list of the models reported in the survey as being used by the states, the factors that influence state decisions to develop models, and states’ needs (e.g., training and technical support). Ms. Eichmiller outlined future challenges states will face due to climate change.

Case Study -- North Carolina’s Neuse River—Kathy Stecker

Ms. Stecker presented modeling work done on the Neuse River. Several models (the Neuse Bayesian Ecological Response Network, CE-QUALW2, EFDC/WASP) were used in TMDL development, and nutrient targets were set. To date, although the desired load reduction has not been achieved, this modeling has helped the state use adaptive management to work toward water quality goals.

Question and Answer

Q: Are there watershed permits on the Neuse?

Stecker: Yes, there is a group permit for all dischargers. If the group is in violation, then we look at individual contributions/exceedences.

Q: Is the group load the same as the sum of individual loads or some other number?

Stecker: I’m not sure. It is calculated in terms of transport factors for all. As long as the group is in compliance overall, the individual contributions are not reviewed.

Q: The Albemarle and Pamlico sounds are joined and have a long residence time. Do pollutants trapped in the sounds contribute to loads within the tidal portion of the river? Can such loads be separated from influent loads from the river?

Stecker: This effort is limited to the Neuse estuary, I think. If loads are not coming from the watershed, it's internal. We are not seeing the same problems further out into the estuary.

Q: How was the 40 µg/L target set?

Stecker: That value is the state-adopted WQS. It is not specific to the Neuse. The state is reevaluating whether this is a good standard. Overall, we'd be happy to see the Neuse below 40 µg/L most of the time

Q: There are lots of issues, for example consideration of the growing season vs. the non-growing season. A new report is coming out that will address the standard.

Stecker: The state uses adaptive management to control pollutants.

Q: How does the state regulate agricultural sources?

Stecker: Half the state is covered under a nutrient management strategy (by basin). This is an effort that has included the environmental management commission and the legislature. It was controversial, but it has been accepted and is working. Once we have designated nutrient sensitive waters, there is the regulatory authority to regulate agricultural sources.

Case Study -- Watershed-Level Optimization of BMP Selection for Cost-Effective Pollutant Load Reduction in the Lower Fox River Basin and Green Bay, Wisconsin—Laura Blake

Ms. Blake described the ongoing modeling of the Lower Fox River Basin and Green Bay in Wisconsin. Through this work the state will develop and implement a TMDL, including identifying cost-effective combinations of BMPs and point source facility upgrades that will achieve the TMDL. The state has used SWAT and OptiMod in this effort.

Question and Answer

Q: What is the timeframe for the implementation?

Blake: For meeting the TMDL? That is unclear—the future timing has not been specified. DNR might come up with something, but it's very complicated. Also, until we finish optimization, we're not sure what will be happening. Wisconsin has some ways to handle nonpoint sources, for example using BMPs. This also assumes that BMPs will be implemented.

Q: Was modeling mostly edge of stream, or did it consider erosion in TSS? For the scenarios you considered, did you consider feasibility before deciding to adopt that implementation?

Blake: For sediment, the values are mostly edge of field. For urban areas this is tricky. Another model is being used for urban stormwater (SLAMM)—we are trying to figure out how to use SLAMM and SWAT. We are not doing a full feasibility analysis, but we will use social indicators data. The state would like to involve stakeholders.

Q: How were the BMP removal efficiencies developed?

Blake: I can't say how they were developed for all BMPs. For some it's simple, such as looking at reductions in phosphorus content of dairy feed by 25%.

Case Study -- TAM/WASP Modeling Framework: Anacostia Nutrient and BOD TMDLs—Ross Mandel

Mr. Mandel outlined TMDL development efforts in the Anacostia River Basin. TAM/WASP (including modifications for the sediment diagenesis module) was used to model the segments for TMDLs in Maryland and the District of Columbia, one for nutrients and one for BOD. These TMDLs were approved by EPA in 2008 and the edge-of-stream loading rates are being incorporated into the U.S. Army Corps of Engineers Anacostia Restoration Plan.

Q: The sediment TMDL was on one of the slides—what was the target and how was it related back to the clarity standard?

Mandel: For Maryland and DC, the numeric standard is based on secchi depth.

Q: How did you apportion it [sediment]?

Mandel: The model was run with the percent reductions anticipated by the Chesapeake Bay Program. Then the results were used to find the level of sediment reduction required to meet the WQS. Sediment was reduced to try to meet the water clarity standard; however, reducing sediment causes algae to increase. Additional nutrient reductions were also required with the sediment reductions. The two TMDLs were done sequentially. It might have been better to do them together.

Q: In terms of the DO existing condition, have you estimated the percent contribution from different sources? For instance, what is the DO consumption from SOD, BOD, etc.?

Mandel: The dominant source of oxygen demand is from sediment.

Q: Is the water column sensitive to reduction of BOD from the watershed during the summer?

Mandel: Yes. We called for a 58% reduction in BOD. During some of the years the river is anoxic. We probably need to move the standard up 3 mg/l.

Q: We're also developing DO TMDLs in FL. Is it worthwhile to cut back BOD by improving DO?

Mandel: Yes, we're calling for at least 3 mg/l.

Q: Did you look at the breakdown in sediments from various sources (e.g., construction, urban, forested)?

Mandel: We have some estimates. For the Anacostia, it's mostly built out. The loads from new construction are pretty low. There is infill, but it's not significant.

Note: EPA's upcoming release of AQUATOX will have a diel DO reporting capability—this is a new feature. WASP 7.1 has had that capability as well. Version 7.3 [of WASP] takes care of the whole laundry list.

Q: For a point source with no loading, do you prefer to use WQS or TMDL limitations?

Mandel: This is more of a regulatory issue—I'm not sure.

Case Study -- Connecticut River Study: Model-Supported Evaluation of Potential Nitrogen Reduction Strategies—Barry Evans

Dr. Evans shared the results of a modeling effort using AVGWLF. This study quantified current nitrogen loads to Long Island Sound from the Connecticut River Basin; estimated potential reductions in nitrogen that might be achieved using various point and nonpoint source control strategies; and estimated the costs associated with implementing those control strategies.

Much of the Connecticut River Basin has reverted back to a more natural state in the last century—80% forested, wetlands, water. An advisory group is looking at cost data and trying to decide on next steps.

Q: How do you factor future growth into the cost curve?

Evans: We were asked not to consider that. Probably because future land cover changes are not known.

Case Study -- The Beaver Creek and Grand Lake St. Marys Watershed TMDL Using the Load Duration Curve—Trinka Mount

Approximately 900 TMDLs have been completed in Ohio. For the Beaver Creek and Grand Lake St. Marys TMDL, a load duration curve was used to estimate existing and allowable loads, and the BATHTUB model was used to assess potential impacts of reducing total phosphorus and nitrate loads to the lake. If the TMDL reductions are achieved, there could be significant improvements in the water quality of Grand Lake St. Marys.

Q: What is the purpose of geotextile tubes [mentioned in the presentation]?

Mount: They are used to filter, basically. Water seeps out.

Q: Do the people who live in watershed know that the farms there equate to over 1 million people living in that area in campgrounds?

Mount: They don't care.

Q: Don't the CAFO regulations require federal minimum standards?

Mount: We're told that animal feeding operations don't discharge.

Q: What is the issue – they are not applying manure properly?

Mount: Most of the complaints that our CAFO staff receive are related to this watershed.

Q: Are there any reports of illness from swimmers on lake?

Mount: Not that I'm aware of. There is so much algae.

Panel Discussion

Q: Some presenters talked about revising models and revising code—where is there QA?

Evans: We did a calibration and described the calibration results in a report. It is up to the reader to decide whether we provided adequate support. If you have observed data you can use it to calibrate most models. In some cases we're trying to come up with the best estimates, given available data. In many tmdls, we have no observed data. For AVGWLF, we calibrated regionally—but with observed data you could tweak further to get better results. If you document changes to the code, it is up to experts to make sure it was done right. Most models are public domain—and people report on how it was tweaked. It is up to user to decide on significant documentation.

Blake: Not enough peer review is done—it's a resource issue. But EPA approves the TMDLs—do they look at the models?

Q: When doing TMDLs with a margin of safety that's implicit, you're making well documented conservative assumptions.

Stecker: If you're looking at the implications of the TMDL, it might not matter—sometimes you have to try to get things going, applying BMPs, etc. In North Carolina, we had a group of people develop the model, and it's transparent. Stakeholders know that the model is the best it can be. They also know the limitations and assumptions.

Q: It seems like it's all done on a case-by-case basis. We've started requiring modeling assurance plans—it's still a work in progress. The same thing goes with calibration and validation.

Evans: If you're doing calibration, there are statistics to document what you've done.

Mendel: things have to be done on a case-by-case basis. It depends on the studies available.

Carleton: There's the potential for multiple versions of models—where people are making modifications rather than coming together to update models collaboratively. Generally it seems like good practice to do external peer review to evaluate changes.

Q: It might be helpful for agencies to let users know when there are plans for modifications. We notice that with SWAT when trying to model a huge watershed. We had to change the code. But the problem also happened when we looked at really small areas. HSPF has the same problems. It would be nice for someone to improve model components—the users would be happy to use them.

Q: We haven't talked about error at all today. And, significant digits in the results are not being realistically reported. In one case study researchers predicted a 57.2% reduction rather than a 57% reduction. It's hard to admit that models have error. Has that been addressed beyond margin of safety?

Evans: Most models don't have that kind of capability to predict error. In Pennsylvania, we have explicitly built in a 10% margin of safety. The number of significant decimal points may just depend on how we use Excel.

Stecker: I'm nervous talking about error with some audiences—they don't know what it means, so it sounds like you're making excuses. Many stakeholders want you to be certain.

Mendel: I don't think we have the technical understanding to do appropriate sensitivity analyses with error bars.

Q: People are developing tools to do that [evaluate error]—but it's going to take some experience.

Mendel: I think it would take several years of runs. It is not ready to be made routine.

Evans: We're will never satisfy everyone. We have to ask ourselves what modeling is for. It used to be that we did models because it was too expensive to do field work. But maybe it's getting too expensive for models. We should spend more money tackling problems.

Q: There's error in the monitoring data, error in setting the WQS to protect uses and water quality. Models simulate—but there's error in the process all the way. But we still have to decide how to manage water resources and protect against impairment.

Mount: We don't talk about error in the reports we write—but we do talk about it in public meetings.

Overall, although we may not get there tomorrow, let's get started with reductions.

Haire: In a situation where you've knitted together 17 models, does it make it harder to address error?

Mendel: Yes. It's hard to figure out. You have to use professional judgment.

A recommendation: it would be nice to have something similar to a listserv for specific models or a website or ftp where people could post modifications to models and get feedback.

Q: We are satisfied with a certain level of accuracy in our models, but when look for a model that fits much better than another we should compare the features of the model that let it fit so well, and see why such models work.

Evans: This is done in academia—you can look in the literature—but there's probably no central repository with that.

Note: On error: we're frugal because we have to be. It's a good topic but you have to evaluate specific scenarios and see what is the best we can do with conservative assumptions and margin of safety. We try to capture error.

Hochheimer: What could EPA do to help you move forward or enhance what you're doing?

Mendel: It would be helpful for EPA to provide some technical expertise—someone on call to answer questions as problems arise. A support desk.

Evans: I've often tried to find training and can't. EPA might be able to do a better job to make training available at low cost.

Blake: EPA is paying for our study—they are doing a good job of supporting the state—even for the implementation. DNR recognizes this. It helps to work with the state to see what needs are in terms of resources.

Stecker: I echo all 3. Training and technical support would be helpful. Rather than more introductory courses, it could be helpful to look at case studies with experienced modelers.

Mount: Electronic training would also be helpful since travel is difficult.

Carleton: The BASINS team does put on 2 classes a year—but it's expensive. Your comments are good to hear, though. We've lost expertise/staff. We would love to provide in-house expertise on BASINS-related models, but right now we have to rely on contractor support. How important is better BMP simulation? Would that be useful?

Evans: You have to simulate those things because they are going on already. We try to account for those things.

Carleton: There is much basic research that needs to be done so that better algorithms can be designed to predict the performance of various BMPs. HSPF can be used to simulate some kinds of BMPs, as can some other watershed models, but most weren't designed with this purpose in mind. Expertise with the models is often required.

Case Study -- Linking SWMM to HSPF to Simulate Canal Drainage in Florida—Tom Jobs

Water resource managers in the in the St. Johns River Water Management District used HSPF, SWMM, and AdICPR to predict hydrologic and hydraulic performance in a drainage system. The management district is seeking to re-divert canal drainage so that it can be treated prior to discharge, and costs of several scenarios were estimated. Several management options are being considered on the basis of the modeling effort.

Q: We have a similar project where we did a 1-year test of the model—did you apply SWMM alone and compare to HSPF?

Jobs: No, the 1-year test looked at the linkage. We didn't have a long-term calibration for the parameters for the runoff block, so we didn't want to do a full calibration on SWMM. Also, we wanted to stay compatible with other district models

Q: SWMM can only handle lateral inflow from 1 point.

Jobs: We didn't put it into every SWMM—just the major nodes in a given subbasin where laterals or sublaterals came into the mainstem. That seemed to avoid the problem.

Case Study -- Use of QUAL2K with Estimates from HSPF to Predict Temperature Improvements during Restored Baseflows in the Bear-Evans Watershed—Sinang Lee

Ms. Lee described a modeling effort in the Bear-Evans watershed that considered how much cooler stream temperatures would be with more shade and by restoring summer baseflows. The QUAL2Kw model was used to consider these questions and the results predict an almost 7 degree decrease in temperature with both more shade and restored baseflows and predict that an increased percentage of each river would comply with water quality standards for temperature.

Q: Is it possible that the WQS for temperature is set a bit low?

Lee: Yes, we recognize that. It's for all creeks draining to a lake in the state. It's optimal for salmonids. We are trying to make progress toward that goal

Q: Are there salmon runs?

Lee: Yes, although I'm not sure whether the fish are wild or hatchery raised. The overall habitat is high quality, but downstream the river is warmer—so this provides a cooling effect

Q: What exists that still causes cooling?

Lee: Local jurisdictions have to have a critical areas ordinance. They have 150-foot riparian buffers. We are recommending 150 to keep with those local ordinances.

Q: Are there process water discharges?

Lee: No. There are no point sources except stormwater MS4s.

Q: In Maryland there is a lawsuit for a WWTP that is leading to warming.

Lee: If there was a wasteload allocation, there would be pollutant limits.

Q: Does temperature go into MS4 permits?

Lee: We discussed that, and there is a push for it. We are focusing on critical summer months. We don't expect storms during the hottest times. We are considering what happens in the fall—that may lead to a wasteload allocation. We know that there are limitations to the Hartley study. We need more studies looking at groundwater interactions with streams.

Q: Has there been any talk of trading?

L: Not yet—but it's a good idea. In talking with the water district, they are encouraged to do restoration projects rather than curtail projects.

Q: How does Washington quantify amount of shade?

Lee: We have an in-house model that uses GIS to estimate the maximum amount of shade. The BASINS program has QUAL2K and HSPF but lacks the shade component (this may be a recommendation to EPA).

Q: What about climate change scenarios?

Lee: That will impact temperatures in the stream basin. We estimate a 0.3 degree temperature increase each decade. But right now we're limited to historic and current temperatures.

Panel discussion

Q: How do both models address future allocations? Many TMDLs don't account for that. If you didn't do it, how would you deal with it in the future?

Lee: We're talking about what would happen if we use the TMDL to limit the effective impervious area—that's something we'll look at in future. Because the area is developed, there's not a load for future growth. We're considering that for other areas.

Jobes: Future conditions are a concern. The western half of the study area doesn't have houses. The northwest is still rural and will develop one day. The monitoring program is focused on different water quality behaviors for development vs. undeveloped areas. Can we predict future loads to the treatment wetland? The interim plan allows for a certain amount of pumping, but it's unclear how much we can handle.

Q: When will the HSPF module be available for release to all?

Jobes: We will be coordinating with AQUATERRA and EPA's BASINS team. When it's ready for beta testing, we might put out a patch for BASINS to test. (Unless we get full peer review and EPA wants to revise the model.)

Carleton: We're very interested in these kinds of innovations, and the potential of adding additional capabilities to HSPF. A peer review might be needed at some point.

Q: In the Washington study, what does the "w" stand for in QUAL2KW?

Lee: There is an additional feature for shading.

Q: I didn't realize that "effective impervious area" was a term. It would be useful for pollutants other than temperature. Is anyone else using that? The "effective" part considers connectedness.

Q: In Washington is 16 degrees the standard year round?

Lee: It's a 7 day average.

Hochheimer: What could EPA do to help you with this kind of activity?

Jobes: The SWMM linkage is an issue—is EPA working on putting SWMM into BASINS?

EPA: Yes, on the input side.

Jobes: Time series would be helpful. Model linkage is a huge issue.

Lee: Resources. Also, adding the shade model into BASINS. We are trying to move beyond using QUAL2K. As a resource manager, I rely on modelers to suggest models. We could also use policy support from the regional office to look at questions beyond the TMDL requirements. Things like that will guide management strategy. It's hard for stakeholders to understand load reductions. They want technical information.

Water Quality Modeling from EPA's Perspective—Jim Carleton and Tim Wool

Mr. Wool outlined EPA's role in water quality modeling from the 1980s through the present. EPA's Modeling Team created BASINS to help regulators, watershed planners, and other users to meet the goal of protecting and restoring the nation's waters. Mr. Carleton described recent changes to BASINS and expected future enhancements to the model.

Q: Where does the BASS program fit in?

Wool: BASS is a bioaccumulation model used mostly for mercury and PCBs. BASS is linked with part of WASP, but not within BASINS.

Carleton: Some tools lend themselves to use in a GIS environment, and some don't.

Q: Has EPA considered web-based training?

Wool: It would be ok, but it's hard to do for a specific tool. Interaction is critical. However, resources aren't available to develop materials for training.

Q: There were some public domain models, but people might not know about those.

Wool: There is no EPA-approved model.

Q: Is there any easy way for people to get knowledge and share?

Wool: Not really. If you need information from me, send me an email.

Q: I've heard about the Data Quality Act and about speculation that it will make it easier to sue over imperfections in models. Is that on EPA's radar?

Carleton: I don't know much about this. We mostly just make tools available, not design them ourselves. All models are approximations of reality—there's no such thing as a perfect model.

Wool: It is on my radar. They say that model results are considered data, and should meet requirements of the Act. I'm not sure how to do that. We can't guarantee that people who make modifications are correct. We have a QA/QC process internally, but we make an effort when we change code. We're supposed to develop a QAPP for model development.

Q: What is going on in terms of uncertainty analysis (e.g., in the context of the Neuse TMDL)?

Wool: Uncertainty is important, but we need to know how to do that. How far back do we probe the error-back at data collection? Or just for the model?

Current Development of EPA Water Quality Models and Environmental Data in BASINS—Jack Kittle and Paul Duda

Mr. Kittle described BASINS 4.0 and how the software can be used for TMDL development. He described the new MapWindow GIS interface and other tools and updates. Mr. Duda and Mr. Kittle explained some of the planned future enhancements to BASINS.

Q: What doesn't it [the new GIS interface] do that ArcView does?

Kittle: Things related to graphics capabilities such as print quality mapping.

Q: Can't we get this data online at any given time?

Duda: A lot of data has been preprocessed. For instance, recorded air temperature is collected as a daily maximum/minimum and the model wants hourly information.

Jobs: It would be nice to get the raw data.

Kittle: It used to be accessible only to those from the government or academia.

Duda: It's something we can discuss further.

Jobs: Maybe BASINS could do some of that preprocessing.

Q: You mention that AQUATOX will be distributed separately.

Duda: There is a separate EPA website for downloading that. There is a link from the BASINS page.

Jobs: It would be helpful to have a direct link.

Kittle: One goal is to take PEST and use in FRAMES.

Q: Is HSPF still limited to 500 operations?

Duda: It does have a 500 operation limit, but we could add more.

Kittle: Five hundred operations to evaluate input/output is plenty—within a single model run. If there's a demand, we can add more.

Q: How do you account for cloud cover if there is no data?

Kittle: Sometimes solar radiation is used.

Q: Any plan in future to update national landcover data?

Duda: I'm not sure.

Q: Does it do the allocation?

Kittle: No. There are scenario generation capabilities.

Q: Is PEST already in windows?

Kittle; For HSPF. There's a link within winHSPF.

Q: What is the timeframe for SWSTAT integration?

Kittle: We are testing it now, and we will send it to USGS in the next few months. You can ask to be a tester.

APPENDIX D: CHART NOTES

Breakout Session 1:

1. What additional modeling tools or modeling-related assistance would help you do your job more effectively?

- TMDL
 - Training for beginners/modelers similar to watershed academy.
 - Online training and tutorials e.g. USDA winters
 - LTHIA – NPS model to be added to BASINS
- Models or tools – capable to evaluate implementation plans/scenarios
- User-friendly tools
- Multi-scale evaluation (watershed sub-watershed parcel/site)
- Tools to translate TMDLs (WLAs/LAs) to permit limits
- Helpdesk for BASINS
- Tools to support permit developments
- Central inventories for plug-ins for BASINS
- Training on data additions to BASINS
- More money to develop technical TMDLs, less resources for implementation
- Funding sources, general questions
- Web-based model development timeline – what’s on the horizon? – expected dates of release
- Improve data accessibility
- Tool to aid with reference conditions, establishing reference sites.
- Removal of gauging stations? USGS?
- Level of collaboration inter-agency especially – academia?
- Model “champions”
- Subsurface tile drainage in HSPF
- Surface tile inlets – HSPF
- Atmospheric deposition (esp. nutrients)
- Groundwater particle/ lag
- Reverse engineering (using model to identify data gaps)
- Off field sediment contributions – how to quantify (Region 4 has worked with NSL to estimate sediment loads from bank and bed) – spreadsheet – based, instream concepts? (need for larger scale watershed)
- Better backup (EMCs, export coefficient) to support source level loads for simple models (e.g. PLOAD) – better than default.
- Modeling to address non-traditional impairments (benthic, turbidity)
- Assistance selecting data
- Translate model results to laymen
- Generating rainfall data from radar or other data to increase resolution of rainfall data
- AGNPS support, technical support
- EPA regional modeling team for support and development
- Sediment transport model support upland loading and instream
- Technical training for TMDL tools
- Public Outreach (about TMDLs) (better communication)
- More attention to probabilistic tools (simple tools)
- Modeling webcasts – not just for modelers
- Better representation of spatially distributed stormwater management practices
- More linkages (like BASINS)
- Include BMP and other management applications optimization models in BASINS.
- Clearinghouse for measured rates, coefficients, updated anytime.

- Tools to perform sensitivity and error analysis.
- Mercury tools
- Loading, receiving water endpoints
- Automatically identify and activate all applicable software/ modeling tools
- Cost of trainings (free vs. fee)
- MS4 jurisdictional areas added to basins
- Coastal data/analysis
- Flexibility in delineation tool
- Missing models – tidal models – bioaccumulation models – stochastic models – load duration curve
- Scenario builder (what-if capabilities)
- QA/QC tools because it feels like a black box
- Tool to delineate mixing zone
- Arc Hydro capabilities
- More case studies / stakeholder interaction
- Proof of application training
- Recognition of successful BASINS applications
- Limited to freshwater systems (rivers)
- Standard file (to be more modular to include other models)

2. What inconsistencies/gaps prevent meaningful results?

- Guide to define natural background
- How to design monitoring program that ties back to TMDL/implementation
- Sustain USGS flow gauges
- Real-time data collection/downloads
- Funding
- EPA's acceptance on models developed by others
- Guidance on specific system: modeling/estimations
- Define tidal water/guide
- Policy on minimum data requirements for TMDLs
- Role of 208 plans in TMDLs
- Policy on affected tributaries after TMDLs/previously not listed
- Models made to separate MS4/non-MS4 loads
- Model selection guide (updated compendium of tools)
- Model use / quality of results
- Availability of guidance/documentation on models?
- Documentation /guidance lacking – out of date
- No set criteria for nutrients – inherent difficulties surrounding national guidance
- A lot of resources expended to develop regional, local criteria, and means of expressions
- Lacking guidance on varying model inputs
- Guidance on MS4 jurisdiction
- Guidance by example, i.e. case studies
- Usefulness of existing case studies? – out of state applicability
- Need guidance on implementation strategies – like for trading
- Guidance involving efficiencies of scale
- Optimal/minimum data required for different models
- More on model selection (also whether you even need a model)
- Model uncertainty
- Changes in point sources, land uses, and other data
- Inconsistency between programs
- Need to be more proactive in sharing info

- Need info about selecting best model for situation
- Listing approach inconsistent
- Need timely response to questions inquires from state
- Identify monitoring data gaps
- State to state TMDL development
- EPA's pace numbers (lots of bad TMDLs)
- Stressor identification process bypass criteria development
- No requirement to revisit TMDLs that have collected new data
- Guidance on implementation modeling results into permits
- Guidance on model selection (tiers of complexity)
- Make available a peer review process (TMDLs and non-TMDL models)
- Real world context/applications (post on webpage)
- Widen audience beyond TMDL

3. Do you find that BASINS is a useful tool? Is this the direction you would like EPA to go?

- BASS incorporated into BASINS
- Like to see comparison of different models in BASINS – like HSPF, SWAT, SWMM
- Help selecting most appropriate model in BASINS
- Catalog of additional datasets not available in BASINS
- Case studies showing successful application of the models in basins
- Metadata needs to be more visible
- Septic tank failure data, BMP effectiveness
- Electronic training material with application – tutorial
- Lack of QA/QC protocols for models
- More than what's needed for basic WLA (small segments)
- No recent training (don't know present capabilities)
- Not enough monitoring data (HSPF)
- Selected model not in BASINS yet
- Hard to implement BMPs within the model (HSPF)
- Lack of marketing of BASINS
- Lack of knowledge about plug-in capability and flexibility
- Expand data(BASINS) availability to US territories/Alaska, Hawaii
- Bringing local data into BASINS
- Data formatting requirements

Breakout Session 2:

1. In what ways can EPA support your modeling needs?

- Training tailored to specific TMDLs/Watershed types
- Make training available from model developers – training before or after existing conferences (WEF, NALMS...)
- Webcasts on specific subjects – mid to upper level trainings/refreshers
- Make commitment to address reported bugs (separate listserv)
- Clearinghouse for new TMDL and modeling approaches (state sharing)
- Support clips on 'YouTube'
- Webcast – targeted to users: beginners/moderate/advanced and type of application: TMDL/permit
- Watershed modeling academy
- EPA helpdesk/live portals?
- Model expertise in regions for support
- Similar to circuit riders

- FAQ/post message/categorize
- Guide on model parameters/coefficients
- EPA HQ needs to be rotated to regions/state/local gov. for understanding
- Discussion tree model selection
- Compendium of tools to be updated (web-based)
- Compendium of characteristics of models
- GEOMORPH type open source tools – stream assessment

2. What should EPA's priorities be when providing assistance to states in development and use of watershed and water quality models?

- Make resources available for implementation phase
- Alternatives to TMDLs?
- Increased outreach explaining regional capabilities
- Proper staffing
- Regional consistency
- Assistance in finding funding
- Add models – AGNPS
- Tech support
- Online tutorials
- Webinars
- On-site mentoring
- Information sharing/case studies
- EPA apply/set up models
- Technical guidance
- Online forum/listserv
- Example successful applications of models
- Include models used in TMDL database
- Process for peer review of the model
- Updated basins training (registration fee?)
- Continue to bring states together to share experiences
- More improvements to the more popular models, not the lesser used ones.
- More guidance for which models to use/case studies.
- Continue to make available older models and documentation
- Guidance on uncertainty analysis/presentation to public
- Continue to support basins
- Compendium of model capabilities (document to find the balance between need vs. data availability)
- Step-by-step user guides
- Help desk – regional if possible

3. How should EPA facilitate sharing of watershed and water quality modeling information among states?

- Acknowledge previous failings
- Establish centralized information system
- Ensure national knowledge ability of EPA support staff.
- Accessibility of TMDLs
- Using forum (includes archives – ensure usefulness of responses – moderator needed)
- Listserves – tool/model specific
- Continued workshops/meetings – more role specific, i.e. modelers meeting vs. TMDLs coordinators meeting
- Keep meetings/workshops more regional specific – focuses needs
- Become less reliant on EPA – more state initiative to facilitate information

- EPA should help states recognize efforts like this that already exist
- Email addresses included on attendance list for EPA meetings/workshops
- Upload TMDL documents to ATAINS
- Archive model inputs and outputs
- List of state websites with modeling data (TMDLs)
- Newsletter on updates and developments, monthly, quarterly
- EPA sponsored blog/forum (EPA not responsible for content – communities (by model, application, TMDL type))
- Webcasts/webinars – improved tutorials
- User-friendly inventory of what has been done (web)
- What is underway as well with contact info
- Email announcements of new developments in modeling
- RSSFeeds (email alerts)
- Monthly conference calls/webcasts (different topics, examples)
- BASINS users meeting (annual/bi-annual/regional)
- Forums – web-based
- Posting case studies on BASIN apps (TMDLs...) (region wide or watershed)
- Add models used/parameters used in TMDLs to TMDL web (WATERS)
- Guide to develop factsheet to translate model techs to layman language

Voting on most important ideas:

- Training – 22
- Forum for users – 16
- Lack of data – 13
- Help Desk – 10
- Case Studies – 8
- Documentation of modeling updates – 6
- MS4s – 6
- BMP modeling – 6
- Model selection guidance – 6
- BMP optimization – 6
- Collaboration – 5
- Modeling scale – 5
- Monitoring gaps – 4
- Interpretation of results – 4
- Levels of expertise with models – 4
- Long term planning – 2
- Probabilistic tools – 2
- Stressor ID – 1
- Implementation guidance – 1
- Monitoring programs – 1
- Nonpoint source applications – 1
- Who is responsible for TMDL modeling – 0
- Understanding uncertainties – 0
- Tools to aid in reference conditions – 0
- Reverse engineering - 0
- Non-traditional impairments - 0

Obstacles

- Resources – 6

- Complexity – 2
- Non-standard data – 2
- Open source software – 2
- Standard file structures – 2
- Continued support after training – 2
- Keeping up to date – 1
- Data inputs to BASINS – 1

APPENDIX E: PARTICIPANT EVALUATIONS

Scale 1 to 7 with one being poor and 7 being excellent

Overall Satisfaction	Quality of Presentations	Appropriateness and timeliness of subject matter to functioning of your program	Logistics	Workshop worthwhile investment of time	
6	6	6	6	5	7
5	5	5	5	6	5
6	6	6	6	6	6
6	6	6	7	3	6
5	6	6	4	5	5
4	5	5	4	4	5
6	5	5	7	6	7
4	4	4	4	5	5
4	4	4	4	4	4
5	5	5	2	2	3
6	6	6	6	6	6
5	5	5	5	5	6
5	5	5	4	6	5
6	6	6	7	4	7
5	5	5	5	5	5
7	7	7	7	7	7
4	4	4	6	3	5
6	6	6	5	2	7
6	5	5	6	3	6
5	3	3	5	5	5
4	5	5	5	5	5
6	6	6	7	5	7
6	4	4	6	6	5
5	5	5	5	4	5
5	5	5	5	6	6
5	5	5	5	3	5
5	6	6	6	2	5
7	7	7	7	7	7
6	5	5	5	5	
6	7	7	6	7	6
6	6	6	4	6	6
5	4	4	5	7	5
5	6	6	5	4	4
6	6	6	6	7	6
5	6	6	4	5	6
5	5	5	6	6	6
4	7	7	5		4
5	5	5	5	5	5
6	5	5	7	5	7
3	4	4	4	5	3
5	5	5	5	5	4

What did you find most useful and why?	What area could use improvement?	Other suggestions/comments?
Discussion of future needs for BASINS and EPA Modeling support	Breakout groups need separate rooms	
1) Issues with using models for TMDLs 2) Evident that work remains on model results being used appropriately 3) Breakout sessions	1) More information on modeling needs in presentations 2) Case study presentations focus should have been on actual modeling (what could have been improved, what they needed from EPA to improve it)	Breakout session after 1st day to process information
BASINS presentation provided information on what was included		
		Hotel should have been closer to the meeting location
Temperature TMDL		
1) Sinang Lee's presentation 2) Tim Wool's history explanation, explains today's situation 3) face-to-face interaction with states, EPA regions and EPA HQ	1) Location- difficult to access; hotel should be within walking distance of meeting location 2) Break while discussion comments were summarized on second day	1) Lots of interest in uncertainty and error 2) Need time for facilitated discussion on good language the states can use in TMDLs, and in response to questions from public, academia, and regulated community 3) Some people expected hands-on training
Needed general knowledge of models; 3 case studies which apply TMDL models to better understand problems within my work	Need more time for Q/A	
1) Opportunity to network 2) Breakout sessions	1) Provide tools for non-technical audience such as brief comparison chart of WQ models 2) Better to have history/current state of models earlier in meeting	
Case studies	1) List of websites for accessing information on watershed modeling	A list of EPA websites for watershed permitting
1) Discussion on experiences, pros & cons, and reasons for using specific models 2) Good start and see lots of improvements	1) Not much applied to participants state or program, so need better state representation 2) Meeting location should be closer to hotel or provide shuttle service	1) Need more emphasis on other types of models such as NPS, in-stream, and riparian models 2) No one mentioned AgNPS or CONCEPTS 3) States with young TMDL programs or fiscally limited TMDL programs were well represented 4) Needed some ag based NPS TMDLs or prairie/plinas based TMDLs or models discussed during workshop

		5) Good start and hope to see more
What did you find most useful and why?	What area could use improvement?	Other suggestions/comments?
Exposure to various models, particularly BASINS updates		
Modeling needs discussion	better planning	Rooms/sound/AV system
1) Case studies and follow up discussions 2) Update from EPA on model development efforts	1) Better presentations with better modeling background - some presentations	1) First session Tuesday afternoon too long 2) Expected more from survey of state needs 3) Good job keeping time 4) With limited funds EPA should house a sharing/forum website
Discussions and future directions	Planning and logistics (from state's perspective)	1) More time by developers going over comparisons/contrasts between models
1) Haven't found any workshops, training classings, etc for 2008 on topics presented 2) Learned a lot about modeling efforts 3) Contacts made will be invaluable	1) Method for condensing breakout session summaries inefficient and sloppy; some good thoughts may have been omitted or too fragmented to be meaningful	1) Need more workshops like this to stay information about what is going on nationally 2) As new models developed, the applications should be discussed
1) Open source versions of BASINS 2) Networking	1) PPTs hard to see 2) Should have used microphone for questions	1) Would like more hands on training 2) EPA should continue to support similar forums
1) Case studies 2) Summary of BASINS improvements/plans	1) Compiling breakout session ideas poor use of time	1) Hotel too far away 2) No secure place for luggage 3) Email compilation of feedback and voting
Panel discussion and breakout session gave a good idea of challenges faced by other states	1) Presentations good; however, data slides difficult to read on screen and in hand-out 2) Recommend more presentations on data in graphical form (bar and pie charts)	
1) Hearing from state and local government examples and feedback	some presentations seems off-target	
Seeing where states and EPA are in	Emphasis on proper model calibration, curve-fitting is not a proper calibration	

modeling development		
Sharing with modelers/EPA case studies	Summarizing results from discussions, would like to have this information	
Overall state of modeling in TMDL from other states and agencies perspective	Selection of case studies/presentations	1) More appropriate if case studies covered models identified and why, model issues faced (QA/QC and calibration), and how public participation/out reach on modeling
What did you find most useful and why?	What area could use improvement?	Other suggestions/comments?
Information on BASINS, what's new and coming soon	1) Sound system (mobile microphone) 2) Later hourse 10 to 6	
1) meeting key players 2) get an idea of what other states face, TMDL program size, and how they operate	1) Presentations with more topics such as mine drainage, sediment, habitat, and hydroelectric 2) Would be nice to see pre-TMDL, post-TMDL, and post-remediation presentation	More information on enforcement and implementation
1) Discussion of needs and priorities	Too rushed at end, need to look at group sheets before voting	1) If known refreshments in morning, wouldn't have eaten breakfast 2) Location of meeting and hotel
Hearing about issues from other states and regions		
1) Interaction and open discussion of EPA, states and consultants 2) EPA efforts are commendable	1) Presentations could have addressed drawbacks/advantages of using a particular model 2) The presentation by Laura, the mention of problems associated other than presenting results would have been more useful	
1) Meeting other modelers, BASINS developers 2) Sharing experiences with different models 3) Case studies 4) Providing feedback on BASINS models		
1) Interchange of possible approaches 2) Identifying flaws and problems shared in common among states 3) Opportunity to hear about these problems	Case study presentations	Operation of models and use of the results may be the real limiting factor i.e. inconsistency and decision making, guidance focused on this desperately needed and not recognized as a limitation

Case studies of TMDLs being developed around the country	Case studies associated with BASINS; how prevalent is BASINS being used	Break out session questions should have been less convoluted
Case Studies		
1) Open discussion, tracking, listing 2) Small group discussions on Wednesday		1) Agenda item - model output to implementation for example, how to handle/create management decisions from model outputs
What did you find most useful and why?	What area could use improvement?	Other suggestions/comments?
Opportunity to see what other people in the field are dealing with	Breakout sessions were good but the synthesis in room 140 was a mess; a lot of valuable discussion that came from these discussions was lost	1) At least one case study presentation on a stochastic model; the work was only geared towards deterministic models, which are more expensive in time and resources. Stochastic models could be a solution to modeling under limited resources
Case study presentations; however, as a planner and not a modeler, would have liked to see how the allocations within other states TMDLs are presented (i.e., MS4s, stormwater WLAs)	1) Workshop was well organized, when things started to get off track, the organizers brought the focus back. 2) Would have like more focus on planning side	Free workshop for planning side of TMDLs parallel with this workshop for modelers
1) Case studies 2) Learning from others	Breakout sessions	
Status of BASINS development, not sure what was useful beyond this point	1) Clear statement of expected outcomes 2) Summary of breakout sessions and multi-vote was absurd/preposterous waste of time and ultimately hugely ineffective - bulleted phrases were incomplete and indecipherable	1) Audience seemed poorly selected 2) Workshop seemed intended to get input on modeling from modelers; ended up in a group with non-modelers clammering for training that they would never use and telling war stories about TMDLs 3) Too many consultant style case studies; Tom Jobes and Laura Blake presentations were poor 4) Poor execution of voting; the use of the voting for those that stayed to the end (diehards) is flawed to define the consensus 5) There will be lots of votes for more data, resources, and training, so the really interesting suggestions will get lost among the remaining votes 6) Heard

		<p>a lot of calls for "training" but no clear articulation of what kind of training is needed? What's insufficient with BASINS, SWMM tutorials, for example 7) Do you really need a 5-day BASINS workshop? 8) With all states nodding agreement, still not sure what that STATES need most 9) If outcome of workshop is that EPA concludes a group of mid-level managers and permittees, and consultants who are not modelers want more training, webinars, and blogs, I think this will be a colossal failure</p>
What did you find most useful and why?	What area could use improvement?	Other suggestions/comments?
<p>Interaction with other programs and hearing about what other regions are doing</p>	<p>Maybe targeting to multiple audiences such as local governments vs. state vs. EPA vs. modelers vs. TMDL coordinators</p>	<p>1) Presentations good; some were a bit data intensive and probably overkill 2) History lessons were helpful but it seems like EPA may need to seriously reevaluate how they conduct business; it seems like it really isn't coordinate and people are working in vacuums with less staff; it sounds like EPA is moving in this direction with BASINS work; I'd like to see more of that and potentially more staff at the regional level; their state has been through 5 coordinators in 7 years. Each time the level of expertise for reviewing TMDLs has gone down with more and more requirement, which means it takes more time from the state to effectively train the new person and leaves EPA open to litigation for not approving TMDLs in a timely fashion (there are several TMDLs submitted by one state that have been there for close to a year)</p>
<p>1) Learning about different modeling tools from other states/local governments 2) More aware about what BASINS can do 3) Group discussions were helpful to share information</p>	<p>Focus of workshop how modeling can support management actions, so there should have been more focus on that and not so much details and issues of modeling development</p>	<p>1) Worthwhile workshop and comfortable environment to express opinions 2) Good having program officers from EPA conclude; helps us know what management took from our discussions</p>

