Integrated Water Resources Science and Services
Potomac River Basin Stakeholder Report
February 6, 2013

Executive Summary

On February 6, 2013, the NOAA National Weather Service (NWS), in cooperation with the Interstate Commission on the Potomac River Basin (ICPRB), and in coordination with the IWRSS Federal partner agencies, convened a group of 30 representatives from national, regional, state and local organizations at the USGS Water Science Center in Baltimore, MD, for a one-day forum. IWRSS Federal partner agencies include the U.S. Geological Survey and the U.S. Army Corps of Engineers. Over the course of the day, participants engaged in discussions and brainstorming sessions focused on learning about hydrologic services IWRSS can provide, identifying key gaps that IWRSS might fill to inform water resources decision making, and discussing possible demonstration projects to build capacity for integrated water resources management in the Potomac River Basin.

In advance of the meeting, participants were polled to determine the highest priority resources issues for the basin. This poll indicated that the top three issues of greatest interest were: water availability and use, flows and water quality, and drought management. At the meeting, a fourth priority – flood risk management – was added.

During the meeting, participants were divided into issue-based groups to identify key decisions, questions, and gaps that IWRSS could address. The most commonly identified gaps involved (1) data needs followed by (2) models and forecasts, and (3) decision support tools. Data needs centered on data for localized or small scales and at un-gaged sites, historic records, gage accuracy, water withdrawals, and interbasin transfers of water. The modeling and forecast needs included extreme events, hindcasts, and downscaled modeling. Needs involving decision support tools related to water resource decisions and infrastructure management. In addition, communications needs were identified, including public engagement, awareness, and information accessibility.

Each group proposed a pilot project that would demonstrate how some of these key information gaps could be filled to address priority issues. The four pilot projects are summarized below.

Project #1: Develop a high-resolution hydrologic model to better understand future water-resources impacts at small scales. This project would help address cumulative impacts between and across jurisdictions, improve prediction of extreme flows, and inform decisions involving allocations, conservation, and long-term sustainable use.

Project #2: Create a nested monitoring and modeling system to better quantify and understand sediment processes. Potential benefits include more informed decision making on Best Management Practices (BMPs) and Total Maximum Daily Loads (TMDLs), and increased public confidence in modeling and monitoring data.

Project #3 and #4: Develop (1) a model to demonstrate prediction techniques for low-flow scenarios and (2) a tool to improve decision making for city water supplies. Benefits include

more informed water-release decisions and improved management of city water systems during times of drought.

Project #5: Create a static flood-inundation map library for the Potomac River in the Washington, DC metro area. Key benefits of this project include reductions in flood-related losses, improved public awareness, and better emergency management response coordination.

Potomac River Basin

On February 6, 2013, the NOAA National Weather Service (NWS), in cooperation with the Interstate Commission on the Potomac River Basin (ICPRB), and in coordination with the IWRSS Federal partner agencies, convened a group of 30 representatives from national, regional, state and local organizations in Baltimore, Maryland, for a one-day forum. IWRSS Federal partner agencies include the U.S. Geological Survey and the U.S. Army Corps of Engineers. Over the course of the day, participants engaged in full-group discussions and breakout group brainstorming sessions. Together they sought to achieve the following objectives:

- Learn about hydrologic services that can be provided by IWRSS for the Potomac River Basin (IWRSS presentation and discussion).
- Identify key gaps that IWRSS might fill to inform water resources decision making for priority water resources issues in the Potomac River Basin.
- Discuss possible demonstration projects to build capacity for integrated water resources management in the Potomac River Basin and explore the benefits of such projects.

Following is a summary of the discussion and recommendations from the forum.

Priority Water Resources Issues in the Potomac River Basin

Based on a review of ICPRB resources and discussion with ICPRB staff, suggested priority water resources issues were shared with participants prior to the forum. Participants were asked to indicate their top three highest priorities (with the option of writing in additional suggestions). Results of the participant poll were summarized and used to focus the discussion on the four issues of greatest interest (water availability, flows, drought, and floods). Each issue, along with the number of votes it received (indicated in parentheses) is presented below:

Water Availability and Use (22)

- Availability of surface water and groundwater under current and future conditions.
- Cooperative interstate water use.
- Maintenance of environmental flows.
- Source water protection.
- Land use impacts on availability and use.

Flows and the Impact on Water Quality (19)

- Point and Non Point Source Pollution, including Total Maximum Daily Loads (TMDLs), land use impacts, and wastewater treatment plant discharges and other point sources.
- Stormwater and Impervious Cover, including nature, extent, and impact of impervious cover and stormwater management efforts to control water quality and quantity impacts.

Drought Management (14)

- Geomorphic, ecological, and human impacts associated with droughts.
- Preparedness and response.
- Flow prediction during low flow periods.
- Quantification of risks.

Flood Management (10)

- Geomorphic, ecological, and human impacts associated with flooding.
- Preparedness and response.

Climate Change (9)

- Effects of potential climate change on water availability and use, extreme events, and water quality.

Potomac River Ecosystem (3)

- Harmful impacts on the aquatic ecology resulting from human and natural sources.

During the plenary session, Dr. Thomas Graziano (Chief, NWS Hydrologic Services Division) and Carlton Haywood (Executive Director, ICPRB) laid the groundwork for the day by providing an overview of IWRSS and Potomac River Basin priority issues, respectively.

Following is a summary of the breakout group discussions. For the first breakout session, each group was asked to take on the following task: Identify up to three key decisions or outstanding questions (event-driven, high impact or important routine decision/question) that "keep you up at night." For each question/decision, identify key information gaps that need to be filled to inform these decisions (keeping in mind projected capability of IWRSS).

For the second breakout session, each group was asked to develop a demonstration project for their focus area as a potential pilot project for IWRSS. For each project, the groups were asked to provide a short narrative describing the project, identify key benefits of the project to help make the business case, and determine what partner organizations and agencies would need to be involved.

Participants in each group are listed below.

- Water Availability and Use: Robert Shedlock, Stacy Boyles, John Smith, Ernie Wells, Ellen Schmitt, Heidi Moltz, Don Cline, Greg Prelewicz, Sam Allin

- Flows and Impact on Water Quality: Dave Davis, Joe Sieber, Carlton Haywood, Kate Abshire, George Onyullo, Karl Berger, Mark Bennett, Angelica Gutierrez

- Flood Risk Management: Patti Wnek, Doug Curtis, Kyle Schilling, Stacey Underwood, Tom Graziano, Jon Dillow

- Drought: Cherie Schultz, John Schaake, Stu Schwartz, Grantley Pyke, Ross Mandel, Mary Mullusky, George McKillop, Anne Kitchell

Water Availability and Use

Key Decisions/Questions and Gaps that IWRSS Could Fill

Question 1: How do we model broad areas in high resolution?

Gaps:

1. Localized data at ungauged sites
2. Consumptive use
3. Ground to surface water transfers
4. Recharge variability
5. Climate change scenarios
6. Population and land use changes
7. Cumulative impacts

Question #2: How can we gather and combine data across jurisdictions and beyond reported withdrawals?

Gaps:

1. Policy barriers/reporting requirements
2. Flow estimation methodologies
3. Interbasin transfers
4. Standard formats for tracking data
5. Water equity between jurisdictions and user groups
6. Access to information
7. The ability to fill in or estimate data gaps

Question #3: How does water quality impact water availability and use?

Gaps:

1. Spatial and temporal water quality data (e.g., nitrates and emerging contaminants)
2. Environmental flow restrictions

Potential Pilot Project, Benefits, and Partners

Pilot Project: Develop a high-resolution hydrologic model using existing data in a representative watershed to understand the future impacts along the Potomac River basin at small scales.

- Gaps and data needs for the model:
  - Climate change scenarios using downscaled climate models
  - Population and land use change forecasts in the watersheds
  - Localized data at ungaged watersheds
  - Recharge variability
  - Interbasin transfer
  - Unreported withdrawals
  - Cross-jurisdictional data

Benefits of Pilot Project:

- Address cumulative impacts between and across jurisdictions (e.g., changes in flow regime)
- Better ability to predict and determine the impacts of extreme flows
- Define long-term sustainable use and future planning for allocations and conservation
- Public awareness

Partners:

- USGS – estimates in ungaged locations (stream flow)
- NOAA, USACE
- Nature Conservancy
- State – Maryland Department of the Environment (MDE), Maryland Department of Natural Resources (DNR), Maryland Geological Survey (MGS)
- Cities and counties
- Land trusts

Flows and Impact on Water Quality

Key Decisions/Questions and Gaps that IWRSS Could Fill

Question #1: With respect to land use development impacts, how can we better manage development to control the impacts on flow and water quality? Will low-impact development (LID) and wetlands restoration solve these problems? How to allocate agricultural vs. urban loads?

Gaps:

1. Pre- and post-monitoring data at multiple scales

2. Understanding sedimentation dynamics and processes

Question #2: Can we demonstrate stream recovery when stormwater is controlled? (Effectiveness of stormwater controls and benefits.)

Gaps:

1. Monitoring data at sufficiently small scales and over sufficiently long periods (10 years) to better determine the effectiveness of Best Management Practices (BMPs) and develop the business case for them

2. Models downscaled for smaller areas, including climatological scenarios for design effectiveness

Question #3: Where is sediment load coming from? This will help properly locate BMPs to most effectively reduce sediment loads. Information on nutrient contribution sources: sediment tracking, loadings, and dynamics (both phosphorus and turbidity TMDLs).

Gaps:

1. Improve understanding of sediment dynamics and processes - where sediment goes and what happens to it at all orders of streams within the watershed

2. Pre- and post-monitoring data; scales are too large right now

3. There is both a monitoring and a modeling gap of backyard and small models, including climate change scenarios

4. We can't model it because we don't understand it in the geophysical realm (i.e., where it comes from, where it goes, changes in characteristics)

5. We are unsure which BMPs are most effective

6. What are the impacts of very large events and floods?

Bottom line: Ensure that we maintain the existing USGS data collection network that we already have. Build on that with targeted studies to answer the questions above.

Potential Pilot Project, Benefits, and Partners

Pilot Project: Integrated/Nested Sediment Monitoring and Modeling System

- Ø Demonstrate improved understanding of sediment dynamics at more localized scales under real-world conditions. Overall, this is a monitoring study coupled with a new model to help explain what we're observing with monitoring data so that we can extrapolate it to other locations.

- Ø Suggest two locations to show the range of sedimentation issues. Focus on watersheds that are already known for sediment. Potential locations are watersheds which encompass streams on the 303(d) list (EPA designated "impaired and threatened waters"), are located in both the coastal plain and the Piedmont, have a mix of BMPs, and which can show the differences between new development (especially Low Impact Development or LID) and existing urban areas that may be retrofitted. This will allow the monitoring to account for watershed location, pre- and post-development, BMP type and maintenance. Suggest Anacostia watershed and Four Mile Run as good locations to demonstrate.

- Ø The project consists of two parts: a forecast model and a decision model. The decision model would map the forecast and provide benefits information to inform BMP decisions. This model would accurately describe physical processes and predictive effectiveness of controls, taking into account the BMP type and location. The system would be designed with nested sites to reflect a variety of land uses; BMP type, ages, and levels of maintenance; and a range of stream orders.

Benefits of Pilot Project:

- Ø Reducing sediment and nutrients is the biggest cost item for Chesapeake Bay restoration.

- Ø Return on investment for each BMP for TMDLs, in terms of $/lb of phosphorus or sediment, is used to determine investment cost effectiveness.

- Ø System of BMPs that provides location-specific results under actual conditions. The project will provide better info on effective BMPs by better understanding of sedimentation dynamics.

- Ø Demonstrate value of maintenance investments to optimize cost-effective maintenance (based on the assumption that BMP effectiveness goes down over time if they are not well maintained).

- Ø Public health

- Ø Ecosystem benefits – the ultimate goal

- Ø Public confidence – currently public confidence in models and monitoring data is low

Partners:

- Local governments currently on the hook for Municipal Separate Storm Sewer System (MS4) permits
- State
- Federal: Environmental Protection Agency (EPA), NWS, and USGS (a natural partner for stream and sediment monitoring)
- Watershed groups and associations

Drought

Key Decisions/Questions and Gaps that IWRSS Could Fill

Question #1: Short-term low-flow forecasting (1 to 9 days) in the Washington Metropolitan Area (WMA) – Should we make a reservoir release? How do we manage the 9-day window, which is the approximate travel time, under low flow conditions, for upper basin reservoir releases to reach users in WMA? If we had better real-time low-flow forecasting from 1 to 9 days with better simulation of physical processes, it would improve our ability to make informed reservoir release decisions and better optimize use of storage.

Gaps:

1. Improve the accuracy of low-flow forecasts:
    a. Upstream water use and discharge data
    b. Better simulation of groundwater contributions during low flow
    c. Better simulation of water losses (riparian losses) and evaporation

Question #2: Mid-range probabilistic forecasting (6 months/WMA focus) – When is a drought going to end? Is it going to extend into the winter? Answering these questions requires planning for restrictions and similar water decisions. Should we consider water use restrictions? Should we advise less use of reservoirs, even if other sources are more costly? How do we integrate dam releases to ensure that upstream reservoirs fill?

Gaps:

1. Need to incorporate longer-term records that include the drought of record in 1930
2. Need more stream gauges
3. Bring in climatological information (climate change)
4. Need for site-specific as well as regional levels
5. Hindcasts (through 1930) and longer-term historic records. Because droughts are a lot less frequent than floods, a longer historic record is required for modeling.

Question #3: Long-term drought planning (next 20 years/basin-wide focus) - How much more future storage is needed and do we need to build new reservoirs? What do upstream municipalities need to do for reliable supply? This strategic planning requires going beyond the forecasts and looking at climate and population changes across the basin.

Gaps:

1. Historical and future land use and population change
2. Uncertainty information and predictions using consistent performance measures

3. Water use and discharges (potential to link with USGS water census)

4. How do you bring climate change and other issues into these decisions?

Additional discussion item: The quality of the forecast is different than the value of the forecast to users. The value of the forecast is different for operators, forecasters, scientists, and management. There is the need for statistical analyses to help make the best use of model results and to quantify uncertainties. There is a need for partnership between producers/forecasters and the users to ensure the same performance measures. There is also a need to align the NOAA verification system with a user's verification system.

Potential Pilot Project, Benefits, and Partners

Project #1: Build a low-flow model that demonstrates proven techniques for predicting future low flows in the Potomac River. This model will help optimize and inform decisions about timing and quantity of water release from reservoirs.

Benefits:

- Ø Increase reliability and decrease uncertainty of water supply for the Washington Metropolitan Area during times of low flow.
- Ø More effectively use the knowledge and experience of federal agencies in coordinating low-flow operations and helping to maintain required flow levels.
- Ø Infrastructure benefits, including reduced pumping costs and potentially postponing the need for construction of a new reservoir or other costly capital improvements.
- Ø Decreased ecological risk.

Partners:

- Ø Washington Suburban Sanitary Commission; Fairfax County Water Authority and the USACE Washington Aqueduct Division
- Ø ICPRB
- Ø USACE, NOAA, USGS – participate in building the decision support system

Note: There was much discussion by the experts in the group as to whether or not this demonstration project could be done accurately enough to be useful to the practitioner. ICPRB has begun work on this issue that could be dovetailed.

Project #2: Improved decision making tool for city water supplies. Perform a case study of the Baltimore water supply system to demonstrate how forecasts that predict the probability of restrictions can guide decisions on how much to water to pump (interbasin pumping) before and after a drought to optimize water quality and minimize costs.

Benefits:

- Costs to develop the model would be offset by improved reliability for the water supply system.
- Reduced treatment costs by pumping when the river is higher.
- Providing information to minimize uncertainty in pumping costs.

Partners:

- City of Baltimore; Susquehanna River Basin Commission (inter-basin transfer)
- Maryland Department of the Environment
- NWS, USGS

Flood-Risk Management

Key Decisions/Questions and Gaps that IWRSS Could Fill

Question #1: What is the water going to do?

Gaps:

1. More flow and precipitation gauges to allow modeling for smaller and coastal-zone basins
2. Faster models to provide timely forecast information
3. "Better" (more real-time) weather (precipitation) forecasting capability
4. Better definition of forecast-model error
5. Complete LIDAR (Light Detection and Ranging) data collection in "vulnerable" areas
6. Need inundation mapping in all "vulnerable" areas

Question #2: How do we effectively interact with decision makers?

Gaps:

1. Provide a single and consistent source of flood inundation maps that are accessible in real-time which depict the areal extent and depth of flood waters.
2. Construct a comprehensive list of decision-makers with appropriate contact information.
3. Provide technical assistance for data and forecast information.
4. Develop media awareness and contacts so the flood inundation maps, data and forecasts are widely broadcast and accessible to the public.

Question #3: How do we ensure that communities are prepared for, and respond effectively to, a flood?

Gaps:

1. Develop a better understanding of the flood-related needs of emergency managers.
2. Expand outreach and training to communities to ensure that decision makers can readily access flood inundation maps and understand there utility and limitations thereof.

Potential Pilot Project, Benefits, and Partners

Pilot Project: A static flood-inundation map library for the Washington DC metropolitan area for Potomac River flooding (alternate locations can be considered).

- The library is developed:
  - Using consistent standards for mapping and modeling
  - By IWRSS partners in coordination with stakeholders
  - With maps and information provided to the public on a single-source website, possibly maintained at the National Water Center, to provide one-stop shopping for the public

Benefits:

- Visibility of the DC metropolitan area
- Improved info for evacuation planning
- Reductions in loss of life, property, and critical systems (e.g., infrastructure)
- Improved public awareness
- Improved emergency management response coordination
- Reduced cost of service through single-source maintenance

Partners:

- USACE, USGS, Federal Emergency Management Agency (FEMA), and NOAA NWS
- Also ICPRB, “States”, National Park Service (NPS), “Media”
- Communities (e.g., utilities, planners, emergency management, transportation)