



2015 BOSC Review

## FY16-19 Watershed Sustainability Project Posters

### Summary of Posters

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#### **1. Assess, Map and Predict the Integrity, Resilience, and Recovery Potential of the Nation's Water Resources**

This project will provide knowledge and adaptive management techniques to both maintain healthy waters and to improve degraded systems. It will provide scientific support for the National Aquatic Resource Surveys. Results will provide a basis for informed decision making and tools applicable to EPA program office and regional needs at national regional, and local scales. The research products, tools, models, and maps produced will be an excellent means to communicate management options with stakeholders.

#### **2. Water Quality Criteria for Human Health and Aquatic Life**

Collaborative effort with the Office of Water to provide science in support of the development and implementation of new or revised ambient water quality criteria for microbial and chemical contaminants for human health and aquatic life. The research also addresses implementation needs such as conversion of new technologies for field deployment for use by stakeholders, such as EPA Regions as well as state and local governments.

#### **3. Protecting Water While Developing Energy and Mineral Resources**

This project will provide the basis for informed decision making to evaluate the impacts of wastewater discharges on aquatic life for specific regions of the US and determine how acute and chronic effects from ion mixtures can be modeled and/or addressed. It will contribute to new risk management options during the permitting process that will protect subsurface sources of drinking water in underground injection scenarios.

#### **4. National Water Quality Benefits**

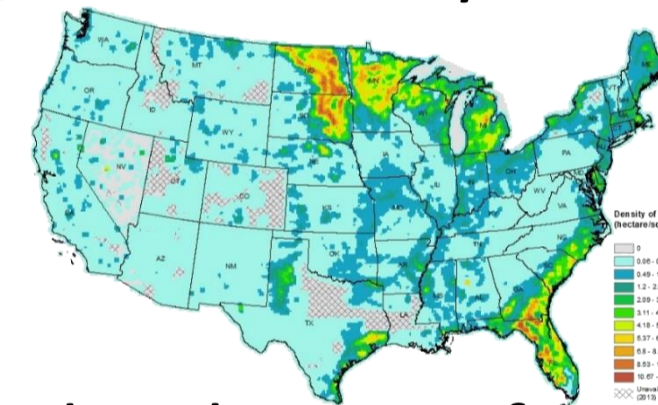
This project will provide the basis for advancing the goal of producing tools in support of quantifying and valuing changes in water quality for EPA regulations. It will also identify specific data and modeling gaps and improve benefits estimation for more complete benefit-cost analyses, and to better inform senior decision makers and the public about the benefits to society.



### Problem Summary and Decision Context

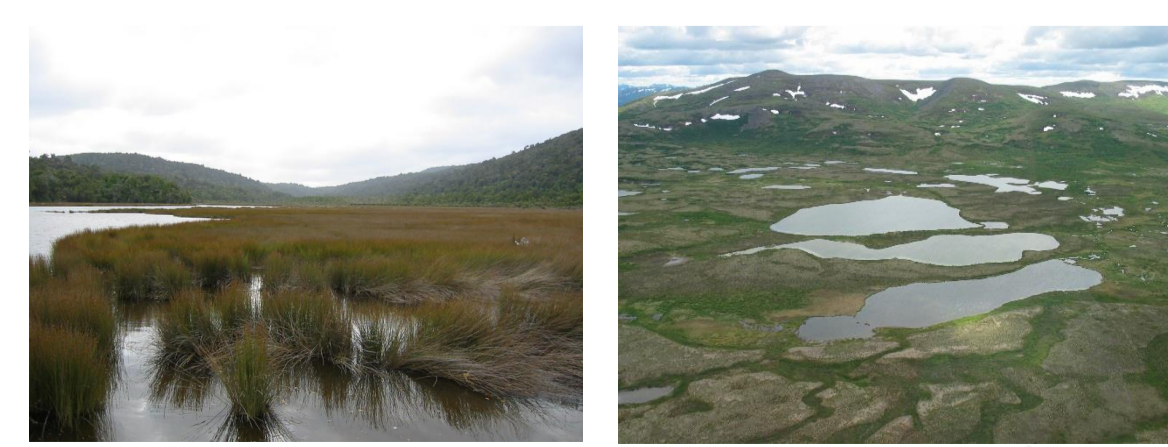
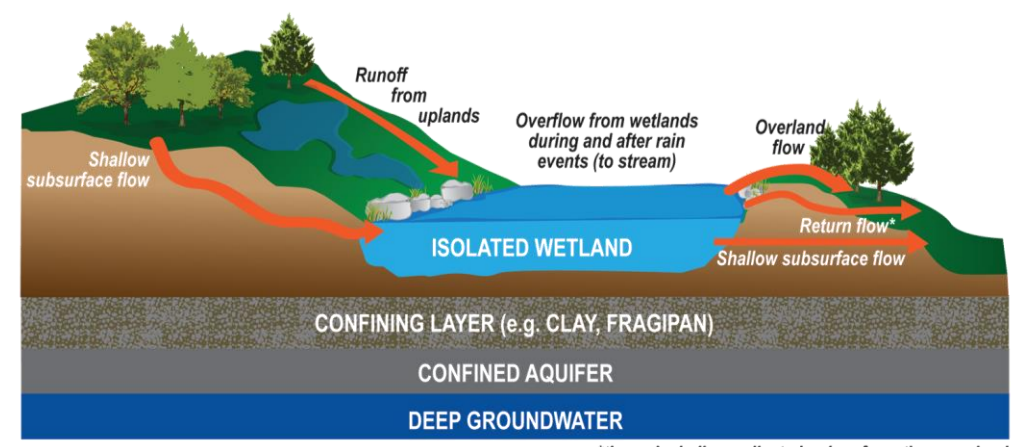
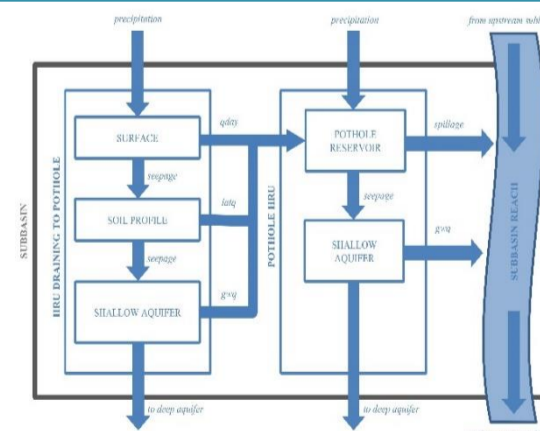
The Clean Water Act requires the EPA to report the condition of the Nation's waters. To comply with this mandate, the EPA must have the capability to determine the integrity of watersheds and aquatic systems therein, including estuaries and coastal systems. The outputs of this research provide knowledge and adaptive management techniques to both maintain our healthy waters and to improve degraded systems. ORD watershed research will improve our management of water resources, by

1. addressing complex scientific questions quantifying aquatic system and watershed integrity, resilience, and recovery potential,
2. providing maps and scientific products to communicate Agency research results,
3. developing and reporting tools, models, and techniques for adaptive management of water resource integrity, and
4. leveraging external research opportunities through the EPA STAR program.



### Utility to Agency

- Providing scientific support for the National Aquatic Resource Surveys (NARS).
- Scientific products from this research provides a basis for informed decision making and tools applicable to EPA Program Office and Regional needs at national regional, and local scales.
- Lastly, the research products, tools, models, and maps produced will be an excellent means to communicate management options with stakeholders.



### Tasks and Projected Outputs

The ORD research program **develops** and **delivers** scientific tools for multi-scale assessments of multi-media effects on the integrity, resilience, and sustainability of the Nation's waters.

#### Major Deliverables:

- National Map of Watershed Integrity and Report
- Assessment of Coastal Water Integrity Based on Coastal Watershed and Estuarine Interactions
- Report Quantifying Connectivity of Aquatic System Components
- Report Predicting Resilience and Recovery Potential for Multiple Waterbody Types

There are seven tasks working across ORD to achieve these deliverables, linking to **SHC**, **CSS**, and **ACE** throughout the following Tasks:

- **Task A:** Technical Support and Research on Enhancement of OW National Aquatic Resource Surveys (Steve Paulsen, NHEERL-WED)
- **Task B:** Estimating and Predicting Water Resource Condition and Watershed Integrity (Scott Leibowitz, NHEERL-WED)
- **Task C:** Watershed Resilience, Recovery Potential and Sustainability (Charles Lane, NERL-EERD)
- **Task D:** Modeling for Watershed Sustainability and Improvements from Policy or Management Shifts (Ken Forshay, NRMRL-GWERD)
- **Task E:** National Priority: System-based Strategies Addressing Water-Quality Impacts Related to Drought and Wildlife (Ben Packard, NCER-PRD)
- **Task F:** Extreme Event Impacts on Air and Water Quality with a Changing Global Climate (STAR, Mike Hiscock, NCER-ASD)
- **Task G:** Quantifying Gradients of Wetland Connectivity at Watershed and Local Scales (Laurie Alexander, NCEA-DC)



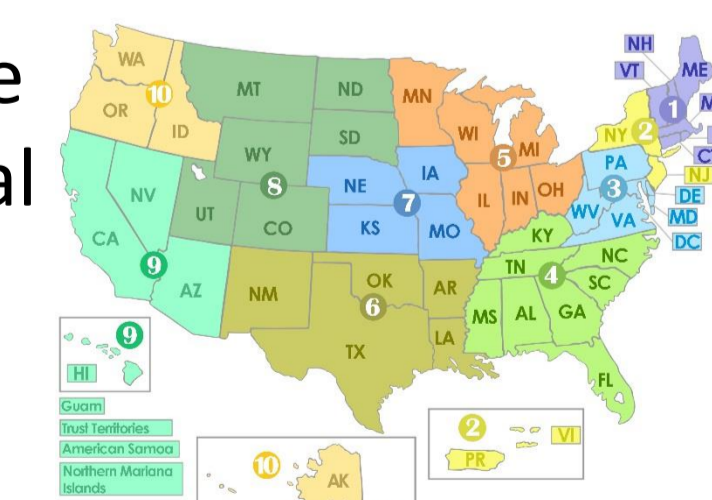
### Future Directions

Active ORD watershed research in this project will provide the following (**with examples noted**):

- 1) Support and Further Current Broad-scale Monitoring and Assessments (**e.g., NARS technical support and indicator development**).
- 2) Expand Interpretability of Large-scale Assessments to the Integrity of Watersheds and Watershed Components, Including Estuarine Systems (**e.g., a national map of watershed integrity will be developed**).
- 3) Quantify Resilience and Restoration Potential at Multiple Spatial and Temporal Scales (**e.g., national map of watershed resiliency will be produced**).
- 4) Develop Models and Scenarios Supporting Policy and Management Alternatives to Improve the Integrity of the Nation's Watersheds and Aquatic Components (**e.g., decision-support tools for watershed management with climate change developed**).
- 5) Integrate Environmental, Social and Economic Science in a Common Model of Watershed Integrity and Sustainability (**e.g., modeling and decision-support tools for adaptive management created**).

### Partner Engagement Opportunities

- Internal partners already identified include OWOW, OST and OWM; we seek additional EPA Regional and Office contacts and partners.
- External partners can leverage our results and are welcome (e.g., USDA, USGS, etc.).
- This project will be hosting quarterly update webinars, providing ample opportunity for engagement and interactions.





## Problem Summary and Decision Context

- Collaborative effort with the Office of Water to provide science in support of the development and implementation of new or revised ambient water quality criteria (AWQC) for microbial and chemical contaminants for human health (HH) and aquatic life (AL).
- Research also addresses implementation needs such as conversion of new technologies for field deployment for use by stakeholders such as the Regional Office as well as State and local governments.
- Need for translating predictive toxicology tools into criteria development.
- Research contained in this project for microbes includes efforts supported through Recreational Water.

## Utility to Agency

- Provide Office of Water with the scientific basis to strengthen existing or advance new methods for microbial and chemical contaminants and stressors to be addressed under the Clean Water Act (CWA).
- Provide Regions, States, Tribes and other stakeholders with the science and tools to support the implementation of criteria. The research contained in this Charter supports HH and AL applications of the CWA.

## Tasks and Projected Output

### Output

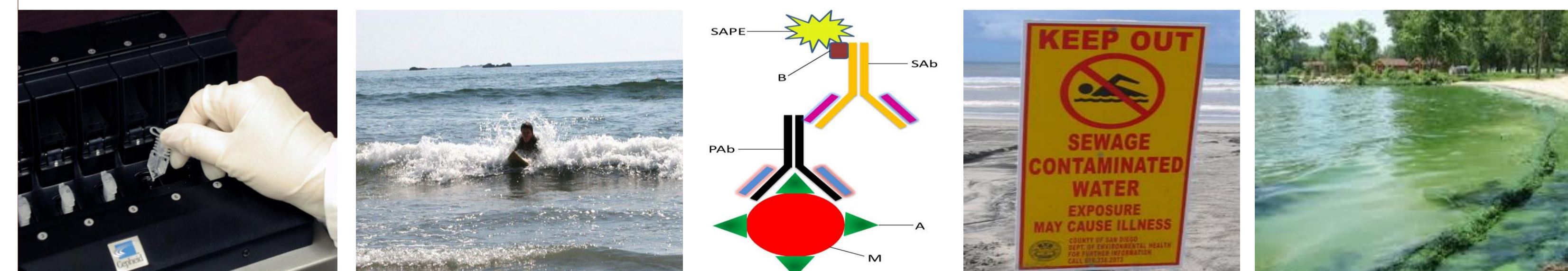
Scientific basis and tools for expanded water quality criteria capability to protect human health (HH) and aquatic life (AL).

### Tasks

- Research to develop and improve HH ambient water quality criteria (AWQC) for pathogens and contaminants.
- Research to advance the derivation AWQC for the protection of AL.
- Development of innovative advanced tools and technologies to identify and quantify exposure to and/or effects of CECs for future HH and AL criteria.

### Major Deliverables

- Research to establish new or revised criteria for microbial AWQC.
- Methods, tools and supporting data for HH chemical AWQC.
- Contaminant grouping and multi-route exposures.
- Methods for improved derivation of AWQC for the protection of AL.
- Development of innovative tools and technologies to determine bioassay/bioactivity for AL effects of selected microbial and contaminants of emerging concern in fresh and marine environments of the United States.



## Future Directions

- Research supporting new tools to support microbial AWQC including new fecal indicator targets including phage, source identification, identify pathogens associated with exposure and illness, and development of models to predict recreational water quality.
- Chemical contaminant research focus areas include methods for identifying and quantifying contaminants, groups of contaminants or bioactivity, multi-exposure route and bioactivity-based criteria as an alternative approach.
- Toxicity testing, data analysis, and method development to support improvements in AL AWQC derivation procedures including chemical group-based extrapolations to address limited data, chemicals of emerging concern, improved descriptors for assemblages of species, multiple routes of exposures, and uncertainty.
- Next generation methods to support HH and AL criteria for microbial and chemical contaminants
- Chemical contaminant collaboration/ coordination with CSS.

## Partner Engagement Opportunities

- Office of Water (HECD) conference in September of 2015 identifying potential new tools for Aquatic Life criteria development.
- Continued engagement with HH pathogen and chemical criteria development methodologies.



### Problem Summary and Decision Context

- Clean Water Act (CWA) provides for protection of surface water resources and sources of drinking water, while the Safe Drinking Water Act (SDWA) authorizes regulatory programs, such as Underground Injection Control (UIC) and Wellhead Protection, for protection of ground water resources.
- Existing, emerging, and unknown potential impacts to surface and subsurface water resources due to increasing demands for energy and mineral resources
- Assessment and mitigation tools needed to address independent impacts as well as cumulative effects in different geographic and climatic regions to aquatic ecosystems.
- Risks and benefits of wastewater discharges, water withdrawals, and storing water for future uses (aquifer storage and recovery) and to sequester polluted waters (underground injection).

### Utility to Agency

- Scientific products/tools from Ecological and Cumulative Effects research will provide the basis for informed decision making to evaluate the impacts of wastewater discharges on aquatic life for specific regions of the US and to determine how acute and chronic effects from ion mixtures can be modeled and/or addressed.
- Scientific products/models from Underground Injection and Aquifer Exemption research to better understand the fate and transport of potential contaminants in ground water downgradient of the aquifer exemption boundary, thereby contributing to new risk management options during the permitting process that will protect subsurface sources of drinking water in underground injection scenarios.

### Tasks and Projected Outputs

**Output:** Proactive approaches to assessing risks to watershed integrity and sustainability associated with current, transitioning, or emerging technologies and practices, including water use, for the life cycle of conventional and unconventional energy, minerals, and other materials.

**Ecological Effects (TL Dave Mount, NHEERL):** Assessing and predicting the ecological effects of wastewaters associated with energy and mineral extraction technologies.

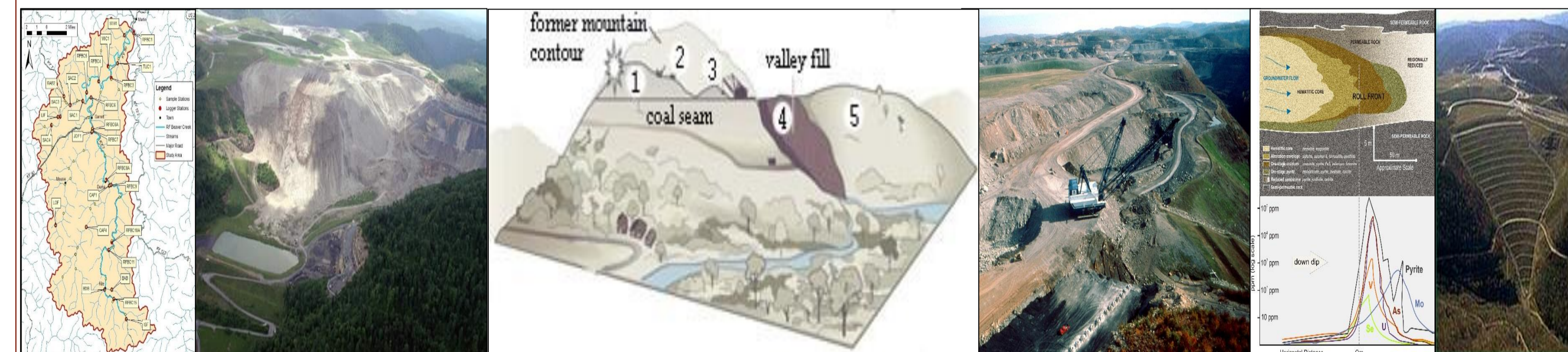
- Understanding the interactive effects of major geochemical ions on aquatic organisms across multiple levels of biological organization, leading to an integrated assessment approach for high conductivity discharges.

**Underground Injection/Aquifer Exemption (TL Rick Wilkin, NRMRL):** Assessing challenges to sustainable water resource management from underground injection practices: aquifer storage and recovery, aquifer exemption, and area of review modeling.

- Underground Injection Control permitting decisions for aquifer storage and recovery and aquifer exemption waivers for protection of existing underground sources of drinking water.

**Cumulative Effects on Aquatic Life (TL Brent Johnson, NERL):** Evaluation of cumulative impacts of energy and mineral extraction activities on aquatic life from changes in land use, water quantity and quality, and habitat availability.

- Region 4 comparison of ecological integrity across watersheds with varying degrees of resource extraction activity and mitigation efforts.
- Decision Support Tools -- Evaluate and coordinate decision support needs, relevant sources of scientifically-sound information, and existing and emergent decision support tools.



### Future Directions

#### Ecological Effects:

- Develop and refine models to predict the responses of aquatic organisms to high conductivity waters regardless of ionic composition.
- Explore the physiological and community responses to elevated ion concentrations to better link observed changes in field communities to better link effects observed in laboratory and field.

#### Underground Injection/Aquifer Exemption:

- Methodology to evaluate ground water quality downgradient of the aquifer exemption boundary (RARE Project – R8/ORD).
- Natural attenuation processes important for uranium downgradient from in-situ recovery sites.
- Capture zone modeling applications for aquifer exemption determinations.

#### Cumulative Effects on Aquatic Life:

- Evaluation of novel modeling approaches for assessing cumulative effects in mined watersheds.
- Spatial contiguity to assess impacts of land use on stream chemistry and biota.
- Coordinate EPA needs in facilitating decision support tool development through the Multiagency Collaboration on UOG research.

### Partner Engagement Opportunities

- Ecological Effects** – OW, USGS Columbia Environ. Research Center, Illinois Natural History Survey, Regions 3, 4, & 5
- Underground Injection/Aquifer Exemption** – OW, DOE Los Alamos National Laboratory, Region 6, 8, 9
- Cumulative Effects on Aquatic Life** – OW, Regions 3 & 4
- Decision Support Tools** – DOE, USGS, OW, Regions 3, 5, 6, & 8



# National Water Quality Benefits

Matt Heberling, Project Lead | Michael Papenfus, Deputy Project Lead

## Problem Summary and Decision Context

- Office of Air and Radiation has modeling capability for quantifying air quality benefits to support most Clean Air Act regulatory programs (i.e., BENMAP), Office of Water (OW) does not have similar modeling capability.
  - Difficult to show water quality benefits from EPA regulations greater than costs.
- ORD, Office of Policy (OP), and OW have formed a collaborative team to develop a national water quality benefits modeling framework.
  - Each office contributing substantial financial and in-kind (staff) resources.
  - Focus is on five main water body types.
- Results must be useable by OW and defensible under Office of Management Budget review.

## Utility to Agency

- Provide basis for advancing the goal of producing tools in support of quantifying and valuing changes in water quality for EPA regulations. It will also identify specific data and modeling gaps.
- Improve benefits estimation for more complete benefit-cost analyses, and to better inform senior decision makers and the public about the benefits to society.

## Tasks and Projected Output

**Output: Provide economic analyses, water quality models, and knowledge to program offices, to support the economic valuation of changes in water quality, water availability, and related ecosystem services, at appropriate scales for the Nation's main water body types.**

- ORD's contribution to effort includes three task areas:
  - 1) Place-based economic and water quality studies (Marisa Mazzotta, NHEERL).
  - 2) Optimal water metric indicators to use in economic analyses (Michael Papenfus, NHEERL).
  - 3) Water Quality Benefits: STAR Grant RFA (Angela Page, NCER): Advance knowledge of how changes in water quality can be valued at appropriate spatial scales using state-of-the-art non-use valuation methods. Encourages interdisciplinary collaborations between economists and other scientists. Funding for 5 proposals (≈\$4 million).
- Use revealed preference studies (in-house) as well as stated preference and/or revealed preference studies (ORD STAR Grants)

**ORD Project Development Team Members:** Marisa Mazzotta (NHEERL), Brenda Rashleigh (NHEERL), Hale Thurston (NRMRL)

**OW contacts:** Julie Hewitt, Joel Corona

**OP contact:** David Simpson



## Future Directions

- Working with OW and OP to identify current gaps within the body of existing studies.
- ORD will start with place-based studies for Northeastern US Estuaries, Midwestern Stream Systems, and Puget Sound.
- Considering how information can be transferable to similar areas (i.e., benefit transfer approaches) for national framework.
- Workshops will provide outlet for research and advancing the modeling framework.
  - 1<sup>st</sup> workshop topic is benefit transfer: November 2015

## Partner Engagement Opportunities

- Will inform Regional partners about place-based studies.
- This project may not address full scope of work needed to quantify changes in endpoints in response to regulatory actions (e.g., water quality model outputs).
  - Watershed Sustainability, Nutrients, and Green Infrastructure describe tasks that could improve our abilities. We are talking with leads across these Topics.
- Coordinating with Air, Climate, and Energy (ACE) projects and research efforts outside of ORD (e.g., HAWQS modeling platform).