National Water Monitoring News

NWQMC

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The National Water Quality Monitoring Council brings together scientists, managers, and citizens to ensure information about the quality of our water resources is accurate, reliable, and comparable. The Council fosters collaborative and cost-effective approaches to improve and advance the science of water-resources monitoring.

John Clune, PA Water Science Center, Collecting an emerging-contaminants bed-sediment sample at the Susquehanna River at Danville, PA. *(Photo by Collie Loper, USGS)*

National Water Quality Monitoring Council

Working together for clean water

Words from the Council Co-chairs

Welcome to the 10th edition of the National Water Quality Monitoring Council's Newsletter!

The 10th edition newsletter coincides with the release of the "Save the Date" announcement of the 10th National Monitoring Conference on May 2-6, 2016 in beautiful Tampa, Florida (see page 4). It is a testament to the success of the Council and the hard work of past and current members that we have reached this milestone of 10 conferences almost two decades after the Council was formed. We offer our heartfelt thanks to Jeff Schloss (UNH, NALMS) who worked tirelessly to secure Tampa as the location and all council members, past and present, whose efforts make these conferences a success.

In other news we are pleased to announce the release of the first fact sheet in the series "Water Quality Monitoring Design: A Guide for Informed Decision Making" (see page3). Dave Chestnut (SC DHEC) volunteered to write up the first fact sheet and we'd like to thank him and the current Water Information Strategies(WIS) work group chair Mary Skopec (IA DNR) for persevering through several rounds of review to reach the finish line. Additional fact sheets in this series include fixed station trend networks and targeted monitoring designs.

We are equally pleased to announce the release of the National Network of Reference Watershed (NNRW) website. The NNRW is a multipurpose network of watersheds and related monitoring sites that have been minimally disturbed by human activities. Early leaders of this collaborative effort included Bill Wilber and Jeff Deacon (USGS) who proposed the project to the Council in 2010 and engaged Rich Haeuber and Ellen Tarquinio (USEPA), Neil Kammen (VT DEC), Jeff Ostermiller (UT DEQ), Greg Petit (OR DEQ), and Doug McLaughlin (NCASI). Bill and Jeff published a short fact sheet describing the goals and Mike McHale (USGS) took on development of the current website. We invite your review and additional contribution to this new website.

In closing, we are pleased to deliver the Spring 2015 edition of the newsletter to you and hope you find the information presented of use in your water-quality monitoring work. As we look towards the next year's National Monitoring Conference in Tampa, we invite you to submit your water-quality news, announcements, successes, challenges, and findings to our newsletter editors for the Fall Newsletter. Last, please note we've included a number of the water-themed haikus that were submitted at the 2014 National Monitoring Conference in the newsletter, both to highlight our participants' passion and creativity, and to get folks thinking of the haikus they'll want to submit at the 2016 Tampa conference.

On behalf of the entire Council, we thank everyone who has contributed to this newsletter. We hope you enjoy it and we encourage your continued input and participation!

Best Regards,

Gary Rowe, USGS Co-Chair
glrowe@usgs.gov

Susan Holdsworth, EPA Co-Chair
holdsworth.susan@epa.gov

National Council Highlights

National Network of Reference Watersheds Webpage Launch

Big Thompson River watershed in the Rocky Mountain National Park. (*Photo courtesy of Mike McHale*)

Water Quality
Measure Continuously
Help the Environment!
~ Andy Ziegler, USGS

In May 2015, the National Water Quality Monitoring Council (NWQMC), in cooperation with the U.S. Geological Survey and the Environmental Protection Agency, will launch a new web resource called the National Network of Reference Watersheds (NNRW). The NNRW is a collaborative and multipurpose network of watersheds and monitoring sites that provide quality-assured data and information to understand the effects of land use change, water use, atmospheric deposition, and climate change on freshwater ecosystems. This web-based system allows users to search a database of reference watersheds by defining watershed characteristics and to access water-quality data by linking to the NWQMC's Water Quality Portal (www.waterqualitydata.us).

The NNRW includes a set of "core" reference watersheds that are the most pristine watersheds in the network. The core watersheds' conditions were determined based on land use and hydrologic disturbance parameters defined by the NWQMC Reference Watershed Workgroup.

The NNRW is envisioned as an expanding resource open to all Federal, State, and local government agencies as well as Tribes, universities, and non-governmental groups. Membership in the network is voluntary and is open to individuals and institutions interested in participating in monitoring and (or) research in minimally disturbed and pristine watersheds. If you are interested in contributing watersheds to the network, contact Mike McHale mmchale@usgs.gov.

Water Quality Portal to Serve Aquatic Biomonitoring Data

For the first time, USGS and EPA STORET aquatic biology data will be available from one place – unified and ready to use. On April 7, 2015, the U.S. Geological Survey (USGS) awarded special new funding for the project. This project will integrate over six million biological records from USGS BioData and EPA STORET and serve it through the Water Quality Portal. The Water Quality Portal (Portal) is a significant national water data distribution node co-sponsored by the USGS, the Environmental Protection Agency (EPA), and the National Water Quality Monitoring Council (NWQMC). Currently, the Portal integrates and serves over 250 million physical-chemical water quality data records supplied by the USGS National Water Information System (NWIS); the EPA Storage and Retrieval (STORET) data warehouse; and the United States Department of Agriculture, Sustaining the Earth's Watersheds, Agricultural Research Data System (STEWARDS). The EPA and USGS biological data will be integrated using the Water Quality Exchange (WQX) data exchange standard. Contact Pete Ruhl (pmruhl@usgs.gov) or Charles Kovatch (Charles.Kovatch@epa.gov) for more information.

Updates from Council Workgroups

New Webinars Released

Visit our YouTube channel (www.youtube.com/user/NWQMC) to watch recordings of our past three webinars:

- The Water Quality Portal (with a demonstration of how to use the Portal)
- Monitoring for Extreme Events (droughts and floods)
- The Ohio River Nutrient Trading Program

Webinars are hosted frequently and cover a broad range of topics. New webinars are uploaded to this site shortly after the initial broadcast, and the older webinars are being added gradually, as staff resources allow. To subscribe to our Webinar Announcement Listserv, email chopkins@usgs.gov.

Upcoming Webinars - Mark Your Calendar!

Groundwater Contamination (NAWQA Results Cycle 1 and 2)
June 16, 12 PM Central Time

Microplastics in Great Lakes Tributaries
July 14, 12 PM Central Time

Need Help Explaining Water Monitoring to a Non-Technical Audience? *Water Quality Monitoring: A Guide for Informed Decision Making* Fact Sheet Series Can Help You

Have you ever encountered a decision maker who is confused by the myriad water monitoring program designs, and the seemingly competing components of your water monitoring program? The Water Information Strategies workgroup recently completed the first in a series of fact sheets intended to help explain and clarify differences in water-quality monitoring program designs. The fact sheets answer common questions: "what types of questions does this network/program design answer?" or "when is this particular design appropriate?" and "what are the limitations of this design?" The fact sheets also provide links to more in-depth information. Examples of how various network/program designs have been implemented across the country are included, but the fact sheets are constructed to allow the user to customize the documents by inserting examples from their own state, region, or program. The first of the fact sheets highlights statistical (probabilistic) surveys and will be available on the NWQMC website by the end of May 2015. Future fact sheet topics will include *"Targeted Monitoring," "Continuous vs Discrete Sampling," "Remote Sensing," "Water Quality Indices and Report Cards," "Uncertainty in Monitoring," "Monitoring for Program Effectiveness."*

Solving water woes
requires cooperation
and wearing waders.
~ Nancy Lawler, Musconetcong Watershed Association

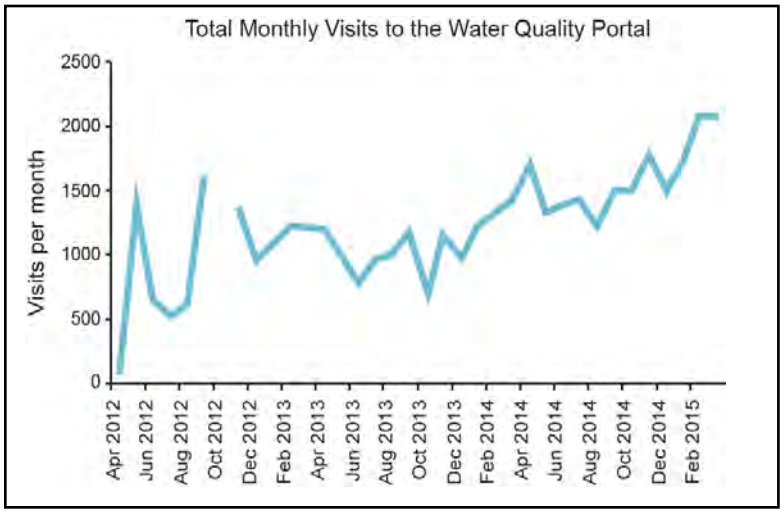
Problem? Pollution.
Solution? Innovation.
Result? Clean Water.
~ David Hayson, XCG

Join our LinkedIn® Group

The Council now has a "group" page on LinkedIn®, which will be used for announcements, promotion of Council publications, and water quality discussions. Please find us on LinkedIn® and join our group!

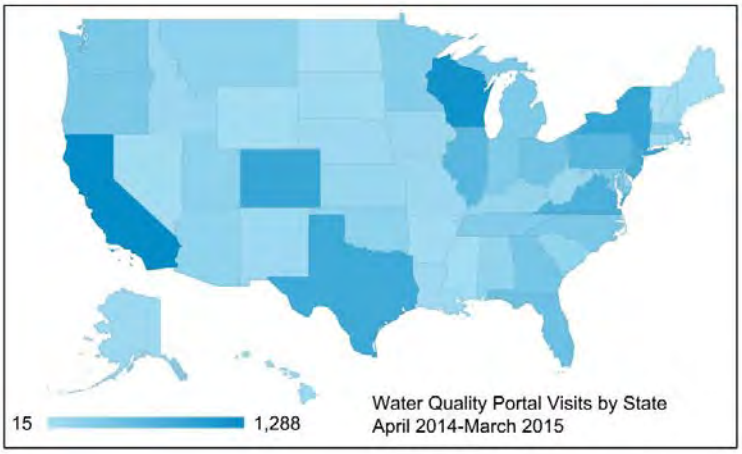
Water Quality Portal Usage Steadily Increasing

The last year has seen steady growth for the Water Quality Portal (Portal) in both holdings and use. The number of result records in the Portal now exceeds 255 million, from over 2.2 million sites, which is over 100 million more records than when the Portal was launched in April of 2012. The Portal has seen a steady increase in visitation and use, with March 2015 marking the first time visitation has exceeded 2,000 visits per day, a 45% increase over March 2014. During those visits, users generated 615 different web maps on the Portal page while downloading over 500 million discrete result records and another 70 million station records. In addition, another 109 million station records and 162 million results records were downloaded via direct web service calls to the Portal. The Portal is starting to be a major source of water quality information for users all over the country.



The Water Quality Portal has seen a steady increase in visitation since its launch in April 2012.

In the coming months, the Portal development team will be releasing more robust versions of the current services to meet current and future demand, new web mapping services, and will be expanding to the Portal's scope to serve the greater than 5 million biological collection data records currently available in STORET. Users can also expect to see an expansion in training materials and additional tools to more easily make use of data available through Portal services.



Water Quality Portal Visits by State.

The Water Quality Portal (www.waterqualitydata.us) is a cooperative effort by the U.S. Geological Survey (USGS), the U.S. Environmental Protection Agency (EPA) and the National Water Quality Monitoring Council to bring together chemical, physical and microbiological data from USGS's National Water Information System (NWIS) the EPA's Storage and Retrieval Data Warehouse (STORET), and the USDA STEWARDS database.

SAVE THE DATE!

2016 NATIONAL MONITORING CONFERENCE

May 2-6, 2016

Join us in beautiful and vibrant Tampa, Florida, for the
10th National Monitoring Conference – Working Together for Clean Water.
Visit the Council Website at acwi.gov/monitoring for conference information!

Spotlight on States

Quick Look: Oregon's Domestic Well Safety Program

Approximately 23% of all Oregon residents rely on private wells for their drinking water. In October 2013, the Oregon Domestic Well Safety Program (DWSP) was established by the Oregon Health Authority's Public Health Division. Funded by the Centers for Disease Control and Prevention, the DWSP works to promote domestic well safety throughout the state. The program focuses on data, partnerships, and prevention. It is making environmental data available, revealing areas with wells at greater risk from contaminants. Data is primarily collected under Oregon's Domestic Well Testing Act, which requires testing for nitrates, coliform bacteria, and arsenic at the point of a real estate transaction, and the disclosure of results to both the prospective buyer and the state agency.

DWSP also works to strengthen partnerships with a variety of stakeholders and distributes small funding opportunities to local public health authorities each year, allowing for increased capacity at the local level. DWSP prevention activities center on education and outreach. Educational materials are available for the general public on a variety of domestic well topics and presentations are conducted on a regular basis to realtors to increase compliance with the Domestic Well Testing Act. For more information about the DWSP, visit www.healthoregon.org/wells, or contact Curtis Cude at curtis.g.cude@state.or.us.

Invasive Plants and Water Chemistry in Connecticut Lakes: Developing a Risk Assessment Tool

Through surveillance and monitoring, the Connecticut Agricultural Experiment Station (CAES) is quantifying the presence of invasive aquatic plants in Connecticut's lakes. CAES provides one of the most complete aquatic plant and water chemistry databases available. The database contains information from aquatic vegetation surveys of 214 lakes and ponds and analyses of water samples for pH, temperature, dissolved oxygen, clarity, alkalinity, conductivity, transparency and total phosphorus.

Approximately 60 percent of the surveyed water bodies contain one or more invasive plant species and some lakes contained as many as four invasive species. The most common invasive plants are Eurasian watermilfoil (*Myriophyllum spicatum* L.), variable watermilfoil (*Myriophyllum heterophyllum*), minor naiad (*Najas minor*), curlyleaf pondweed (*Potamogeton crispus*) and fanwort (*Cabomba caroliniana*). Less common are water hyacinth (Eichhornia crassipes), water shamrock (*Marsilea quadrifolia*), hydrilla (*Hydrilla verticillata*) and water chestnut (*Trapa natans*).

Using water chemistry and plant presence/absence data from the lakes, CAES developed a risk assessment model. Eurasian watermilfoil, minor naiad and curlyleaf pondweed often coexisted and had different water chemistry preferences than fanwort and variable watermilfoil, which also coexist. Alkalinity, conductivity, pH and total phosphorus concentration can be used to assess their risk of invasion (Table 1). Water chemistry in lakes containing fanwort/ variable watermilfoil had significantly lower conductivities, alkalinities, and pH's than lakes inhabited by Eurasian watermilfoil/minor naiad/curlyleaf pondweed. When the lakes are grouped based on the presence/absence of fanwort/variable

Group	Species	Alkalinity mg/L $CaCO_3$	Conductivity µS/cm	pH	Phosphorus µg/L
1	Fanwort Variable watermilfoil	0 - 28	39 - 107	5.6 - 7.0	1 - 27
2	Curlyleaf pondweed Euarasian watermilfoil Minor naiad	17 - 77	108 - 232	6.3 - 8.1	0 - 85

Table 1. Water chemistry preference range of invasive aquatic plants in Connecticut.

watermilfoil (Group 1), and Eurasian watermilfoil/minor naiad/curlyleaf pondweed (Group 2) the presence of the non-native aquatic macrophytes can be predicted with near 80% certainty. Statistical analysis of the water chemistry in lakes that currently do not have the invasive plants predicted that 40% were likely to support plants in Group 1 and 30% were likely to support plants Group 2.

For more information, contact gregory.bugbee@ct.gov or 203-974-8512 or www.ct.gov/caes/IAPP.

Success Story: Three Rivers QUEST Addresses Sulfate Salts

In 2009, the West Virginia Water Research Institute (WVWRI) at West Virginia University began monitoring the quality of Monongahela River. In December 2010, the Pennsylvania Department of Environmental Protection (PADEP) declared the Monongahela River impaired for potable water use due to the presence of sulfate salts. While sulfate compounds generally do not make water unsafe for humans, they can affect taste and interfere with industrial processes that require cleaner water.

Jason Fillhart, technician, samples the Monongahela River. *(Photo by Glenn Waldron)*

Noticing a strong correlation between low river flows and high sulfate levels, WVWRI called for collaboration with the coal industry because their high output treatment facilities were making significant contributions to the river's sulfate levels and thus to total dissolved solids (TDS) concentrations. A novel problem-solving approach, spearheaded by WVWRI, combined water science with stakeholder collaboration and sought to restore the river in less time than the traditional regulatory process. Coal industry officials willingly shared water quality and quantity data (discharge volumes and TDS concentrations). Using this data in combination with a computer program showing maximum discharges for each treatment plant derived from the river's flow, a collaborative and strictly voluntary discharge management system was implemented. By 2010, the program was in effect, and sulfate concentrations in the Monongahela River began to decrease. As a result, the U.S. Environmental Protection Agency approved PADEP's decision to remove the Monongahela River from the "impaired for potable water use" listing in late 2014.

Monongahela River *(Photo by Melissa O'Neal)*

The data necessary for the implementation of this program, as well as the validation of its success, is part of a voluntary, science-based, non-regulatory, watershed-wide program known as the Three Rivers QUEST (3RQ). This program, largely funded through the Colcom Foundation and the U.S. Geological Survey, includes bi-weekly monitoring throughout the Upper Ohio River Basin. Current monitoring partners include Duquesne University, Wheeling Jesuit University, and the Iron Furnace Chapter of Trout Unlimited. Local organizations enhance the dataset tremendously through their field or continuous monitoring efforts by providing conductivity data on tributaries feeding into the Monongahela River.

For more information contact the 3RQ Program Manager, Melissa O'Neal (moneal@mail.wvu.edu) or visit 3riversquest.org/.

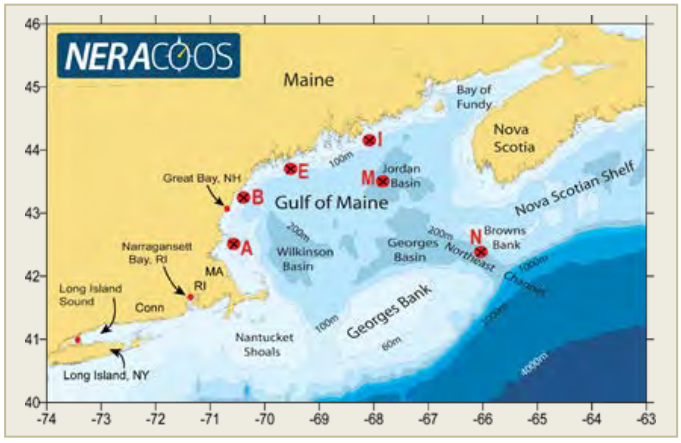
Water sustains life
Understand, protect, restore
You are part of life
~ Marie Filteau, Mat-su Borough

Automated Coastal Nutrient Observatory Launches in Northeast U.S.

The largest automated coastal nutrient observatory in North America will be deployed by the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) and its partners over the next three years (2015-17) in the Northeastern United States. Funded by an award from the Integrated Ocean Observing System (IOOS) Ocean Technology Transition program, this system of automated nutrient sensors will deliver high-frequency, quality-controlled nutrient data to scientists, managers, and policy makers to help understand natural and anthropogenic influenced coastal nutrient dynamics throughout the region.

NERACOOS will deploy PO_4 (phosphate), NH_4 (ammonium), and NO_3 (nitrate) sensors on buoys in Great Bay (NH), Narragansett Bay (RI), and Long Island Sound. NO_3 sensors will also be deployed at multiple depths on a number of buoys in the Gulf of Maine (see graphic). Nutrient data from these sensors will be integrated with other regional ocean information through a nationally consistent data management framework with established QA/QC processes and delivered on the NERACOOS website, www.neracoos.org. Throughout the project key stakeholders will be engaged to ensure the design and operation of the observatory addresses their needs.

The mission of NERACOOS is to produce, integrate, and communicate high quality information that helps ensure safety, economic and environmental resilience, and sustainable use of the coastal ocean. Project collaborators include organizations in the Northeast, WETLabs, and Salantic. To learn more about the progress of this project, sign up for the Listserv at www.neracoos.org/nutrients, or contact Cassie Stymiest at cassie@neracoos.org.



The red dots show the approximate location of buoys that will carry nutrient sensors.

Two Decades of Systematic Water-Quality and Streamflow Monitoring for the Upper Clear Creek Watershed, Colorado

Beginning in 1994, the Upper Clear Creek Watershed Association and the Standley Lake Cities designed and implemented a multi-faceted water-quality monitoring program. This program consisted of systematic water-quality monitoring at up to 18 sites throughout this 394-mi^2 watershed; ten of these sites include daily streamgaging records.

The term "systematic water-quality monitoring" refers to a sampling schedule designed to characterize ambient seasonal variability. Surveys are conducted bimonthly during the low-flow winter season (October- early April) and monthly during snowmelt runoff and summer storms when flows are higher and more variable (May - August). This sample-interval strategy yields equal sample sizes for both high-flow and low-flow seasons. These seasons exhibit significant differences in water-quality characteristics that are important for assessing the effectiveness of stream standards as well as year-to-year variability resulting from a range of snowpack conditions and storm events over time.

Data collected are being used for a wide range of applications, including stream-standards regulatory hearings, protection of beneficial water uses, and assessment of the effectiveness of mine-related remedial actions. Various stakeholders support the program with in-kind sampling and laboratory services as well as database management and assessment. This basic program has proven to be both sustainable and indispensable for many information purposes, especially when combined with shorter-term or spatially-limited special assessment projects requiring water-quality and flow data with Clear Creek serving as the receiving stream. For more information, contact Timothy D. Steele, Ph.D., President, TDS Consulting Inc., Denver, CO (TDSConsult@aol.com).

Chesapeake Bay Program Monitoring Networks Underway

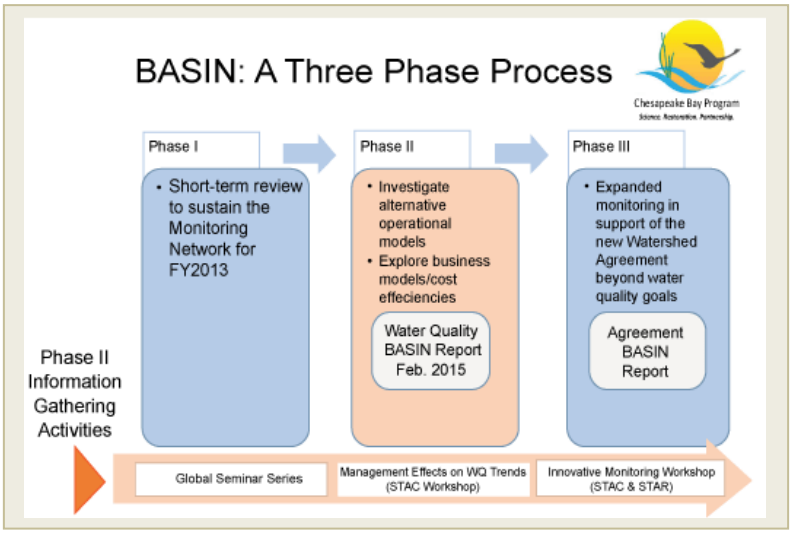
Effective monitoring programs evolve and develop in response to new information and new questions. Periodic reviews of the Chesapeake Bay Program (CBP) help to ensure that the monitoring network adapts to meet restoration priorities of the CBP partnership. Building and Sustaining Integrated Networks (BASIN) is a discovery process that is coordinated by the CBP's Scientific, Technical Assessment and Reporting (STAR) Team. The BASIN process was initiated in the summer of 2013 and focused on the CBP Water Quality Monitoring Networks.

The first phase of BASIN was a short-term review of the tidal and nontidal water quality monitoring networks to recommend possible cutbacks to accommodate a funding shortfall. Phase II of BASIN was designed to look for efficiencies and recommend steps to sustain and grow the water quality monitoring program. Considerations were given to the issue of funding uncertainties (e.g., inflation, rising fuel costs, budget changes, new science, management priority shifts, incorporating advances in monitoring technology) while sustaining a long term monitoring network. Phase II included a global webinar series to share program management insights from monitoring programs around the world. The discovery process continued with topical workshops and internal meetings to connect the lessons learned to monitoring program management options and opportunities for the CBP partnership.

The STAR team's recommendations from Phase II of the BASIN process included the greater application of citizen science, recognizing that there is tremendous potential for enhanced monitoring program integration. However, additional investments to support training and coordination are necessary to efficiently combine the work of existing and new partners.

Phase III of BASIN is a broader review of diverse monitoring programs of the CBP Partnership (e.g., oyster restoration tracking, fish habitat, land conservation, stewardship, public access, diversity, forest cover, brook trout populations) that will support the accountability and tracking framework of the new Chesapeake Bay Watershed Agreement (2014). The 2014 Agreement has 10 management goals and 31 outcomes that integrate water quality into the ecological and economic sustainability vision for a restored Chesapeake Bay and its watershed.

For more information on BASIN, visit: www.chesapeakebay.net/basin, or contact the authors, Lea Rubin (lrubin@chesapeakebay.net) and Peter Tango (ptango@chesapeakebay.net).



Building and Sustaining Integrated Networks (BASIN) is a three phase process to look for efficiencies and recommend steps to sustain and grow the water quality monitoring program. This diagram displays the clear pathway of the BASIN review process.

Collaboration
Improves Odds of Programs
Continuation
~ Peter Tennant, ORSANCO

New Water Quality Maps of Western North Carolina Published on Web

The Environmental Quality Institute (EQI) announces the release of a new interactive online map, showing the results of water quality monitoring at streams across Western North Carolina (WNC). The launch of the web map (maps.eqilab.org) marks 25 years of chemical and 10 years of biological testing of area waterways.

EQI worked with Resource Data (resourcedata.net) in Asheville, NC, to compile results from the Volunteer Water Information Network (VWIN) and the Stream Monitoring Information Exchange (SMIE) stream monitoring programs into one searchable map. Every month, dedicated VWIN volunteers collect stream water samples for certified laboratory analyses by EQI. SMIE volunteers show their commitment by sampling for benthic macroinvertebrates each spring and fall. The map includes information about the streams that are sampled as well as their water quality ratings. For additional information about our projects, visit eqilab.org or contact Ann Marie Traylor, Executive Director, at amt@eqilab.org.

African Citizens Monitor River Health: the Stream Assessment Scoring System

The Issue

In southern Africa, water quality, quantity and access are reaching crisis conditions because human activities are using up and degrading water resources at an alarming rate. A biomonitoring stream assessment has been developed to help people understand water issues and manage resources better. Known as miniSASS (the Stream Assessment Scoring System), this technique can be used to develop a River Health Index. miniSASS was developed in partnership with GroundTruth (a Water, Wetlands and Environmental consultancy), the Wildlife and Environment Society of South Africa (an NGO), and the Water Research Commission (a government agency). The technique is also supported by the Department of Water and Sanitation and the Department of the Environment. By identifying just 13 common macroinvertebrates that live in streams and rivers, miniSASS enables people, including school children, to calculate a River Health Index to monitor their own water systems. In addition to government officials, various civil society groups including Traditional leaders, Women in Water, Eco Rangers and hundreds of school children have received training and are using and experimenting with this technique. The British High Commission, based in Pretoria, is also supporting this approach.

Sharing data: Globally, live and for free!

Once the macroinvertebrates have been identified, users work out a score using a simple reference sheet (which is also downloadable). The results can be uploaded via the www.minisass.org website on Google Earth as live data. Data then appears on the map as a coloured icon (a crab) which represents the score – a blue crab means a healthy stream while a red crab represents modified or poor conditions. Because these families of macroinvertebrates occur all over the world, people in Zimbabwe, Ethiopia, India, Australia and Canada have uploaded data on the miniSASS system. miniSASS appears to work on virtually any perennial river or stream in the world.

A group of government officials using miniSASS on Mthinzima River,

Research is underway to improve the local river health index. This work includes the development of a field-based mobile phone "app," supported by the Department of Science and Technology, to help with recording the site and identifying the macroinvertebrates. We would like to encourage all who care about our precious water resources to help develop the concept and share it more widely. Any advice or further research is welcome – working together we can all help understand and secure our waters for a more sustainable future! For more information, contact the Wildlife and Environment Society of South Africa: Tembeka Dambuza at Tembeka.Dambuza@wessa.co.za and Jim Taylor at jt@wessa.co.za.

Charles River Volunteers Track Improved Water Quality

As an urban river that runs through New England's largest and oldest city and the surrounding suburbs, the Charles River has felt the effects of water pollution, channelization, and damming for centuries. In 1995, the first year of the U.S. EPA grading program, the Charles River received a "D" grade. In 2014 the Charles River received an "A" grade, a landmark accomplishment pointing to water quality improvements in the Charles that have been made in the past 20 years.

U.S. EPA relies heavily on data collected by individuals who participate in the Charles River Watershed Association's (CRWA) volunteer monthly monitoring program to assign annual water quality grades. Although CRWA regularly trains new volunteers, many participants have been volunteering for CRWA for more than 10 years; some have even been volunteering since the first monitoring event in 1995! In the first year of monitoring, less than 20% of water quality samples met the Massachusetts *E. coli* water quality standard for swimming, and less than 40% of samples met the state's *E. coli* water quality standard for boating. By 2013, water quality in the river had improved such that more than 50% of samples met the swimming standard and 92% of samples met the boating standard. For more information about CRWA's volunteer monthly monitoring program, visit: www.crwa.org/field-science/monthly-monitoring.

A volunteer collects a sample on the Charles River.

High School Students Assess Water Quality Using Diatoms

In 2010, a student program involving eight high schools conducting diatom monitoring for water quality started thanks to a grant from the National Oceanic and Atmospheric Administration (NOAA). Now in its fifth year, this program teaches diatom biology to more than 12 teachers and 2,000 students.

Students visit the field in the spring and fall. They take physical and chemical water measurements such as dissolved oxygen, alkalinity, stream flow, temperature, etc., and collect five fist-size rocks. Students rub the rocks with brushes, collect the diatoms in distilled water, and prepare the diatoms for viewing. The methods used complement the biology curriculum and introduce students to the concepts of water quality, biodiversity, classification, trophic levels, geographical basins and ecological integrity.

For additional information on methods, contact Alberto Mimo at nenaturals@sboclobal.net. A full-length article is available at naturalhistorynotes.blogspot.com.

Students from Newtown High School collecting samples and their data. Their teacher is Stephany Ramsey.

Fish, Inverts, Algae
Habitat and Chemistry
Indicators, All
~ Cathy Tate, USGS Ecologist (Retired)

Clean Lakes Alliance's Near-shore Citizen Water Quality Monitoring

Clean Lakes Alliance (CLA), a non-profit organization located in Madison, Wisconsin, has launched a citizen water quality monitoring program with a near-shore focus to compliment the in-lake and in-stream monitoring historically performed throughout the Yahara River watershed. CLA is working to improve the water quality with a focus on reducing phosphorus inputs into the five lakes that comprise the Yahara chain. In 2013, CLA launched the pilot program with nine volunteers. During the summer of 2014, the second year of the program, 44 volunteer teams performed almost 1,000 sampling events at local beaches, piers, and public access points, providing an unprecedented level of detail about the lakes' near-shore environments.

Volunteers collected end-of-pier data for water clarity, air and water temperature, total phosphorus, and visual observations, such as presence of algae or waterfowl. The data revealed the dynamic and complex nature of the lakes, which can change rapidly in both time and space. Despite the unpredictable nature of the lakes, volunteers were able to track the growth and movement of a number of potentially harmful algal blooms and other conditions that interfere with recreational use of our waters where most people use them: by the shore.

While most volunteer programs require access to a watercraft, CLA monitors simply sampled off of a pier or waded to a depth of three feet. Information collected will help researchers at UW-Madison track the formation and movement of blue-green algal blooms. CLA also launched a mobile-ready website (ccw.cleanlakesalliance.com), allowing volunteers to record and share observations, providing real-time information that the public can readily access. This tool provides the public with beach closure and near-shore water quality information, which can help lake users choose which beach to use on any given day. Through an Adopt-A-Beach component of the program, CLA also sampled *E. coli* daily at a local beach on Lake Mendota. CLA observed conditions warranting beach closures that otherwise would have gone unnoticed, demonstrating that the frequency of monitoring matters. Performing more rigorous sampling can help minimize the risk and increase the confidence of beach users.

A CLA staff member trains a volunteer on how to measure water clarity using a turbidity tube. *(Photo by Katie Van Gheem)*

CLA will continue to investigate financially feasible, targeted monitoring strategies that anticipate high bacterial levels and keep beach users informed and safe. In 2015, CLA hopes to add more volunteers to cover the largest lengths of shoreline that are currently unmonitored. Visit www.cleanlakesalliance.com/renew-the-blue/citizen-monitoring/ for more details, including 2014 results and a map of 2015 target locations, or contact Katie Van Gheem at Kathryn.vangheem@cleanlakesalliance.com.

Your time and effort.
Sweet Volunteer Monitor
Our Lakes are Grateful
~ Melanie Trost, Matanuska-Susitna Borough
Volunteer Lake Monitoring Program

Tribal News

Proper Functioning Condition: A Tool for Ecosystem Managers presented at Tribal Meeting

Proper Functioning Condition (PFC) is defined as a condition that meets certain expectations important for handling the forces of moving water, and an assessment process focusing on the physical functioning of riparian ecosystems.

Terrestrial and aquatic ecosystems produce multiple goods and services. Streams transport water, nutrients, minerals, sediments, and organic matter within a watershed. The appropriate level of transport and deposition can differ broadly within a watershed and between stream reaches. Properly functioning stream and wetland riparian areas are able to sequester pollutants through the physical process of energy dissipation. This process allows for deposition of sediment and suspended material, creating aquatic and riparian habitat complexity, and improving water quality. Impairment of riparian functions changes hydrologic, vegetative, and geomorphic interrelationships, which may trigger cascading environmental effects having long-term consequences. Maintaining healthy aquatic and riparian habitats depends on management allowing for, and facilitating natural recovery of, riparian functions after a natural or anthropogenic disturbance.

Daniel Mosley, Sherman Swanson (University of Nevada-Reno) and Robert Hall (USEPA Region 9) presented "Proper Functioning Condition – Connecting Ecosystem Functions to Water Quality" at the National Tribal Water Council meeting, November 3-7, 2014. The goal of the presentation was to provide resource managers a tool to more effectively manage and monitor water quality. To view the presentation and learn more about PFC, visit www.epa.gov/esd/tribal/tribal.html.

Tools and Technology

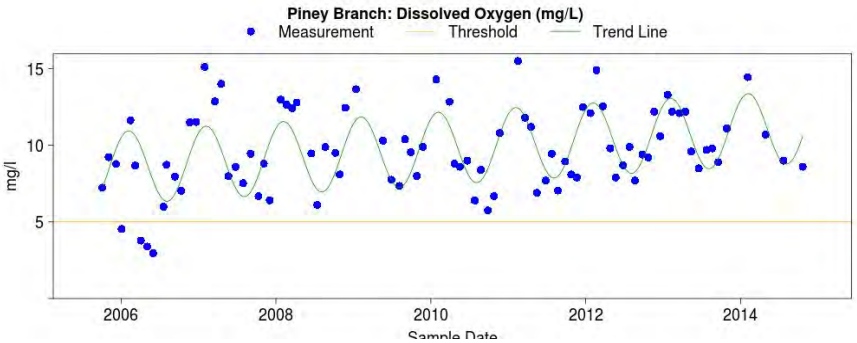
Park Service Creates Online Tool for Visualizing Water Data

The National Park Service (NPS) Inventory & Monitoring Division recently created an online visualization tool for viewing stream-water quality in parks of the Washington, DC, area: science.nature.nps.gov/im/units/ncrn/monitor/water_quality/visualizer.cfm. The "Water Quality Visualizer" graphically displays water-quality data (2005-present) from Maryland, DC, and Virginia national parks, including Rock Creek Park, Antietam National Battlefield, Prince William Forest Park, and Harpers Ferry National Historical Park.

This tool is intended to provide park managers with up-to-date water data as it becomes available, as well providing reference thresholds and calculations of discernable patterns and trends. Water-quality parameters for the 36 streams on the site include pH, temperature, acid neutralizing capacity, dissolved oxygen, specific conductance, total nitrate, and total phosphorus.

A fact sheet on the National Capital Region Network's water monitoring program is available at: science.nature.nps.gov/im/units/ncrn/assets/docs/RBs/NCRN_water_monitoring_2014.pdf

To learn more about the NPS National Capital Region Network, Inventory & Monitoring program, contact Megan Nortrup, at 202-339-8314 or megan_nortrup@nps.gov.



The interface of the Water Quality Visualizer, set to show dissolved oxygen data for Piney Branch in Rock Creek Park. An orange line shows the threshold for acceptable levels, whereas the green line indicates both a seasonal and an overall increasing trend from 2006-2014.

dataRetrieval and EGRET: New R-based Tools for Evaluating Contaminant Fluxes and Trends

A major goal of water quality data collection at a river sampling site is to describe the evolving characteristics of water quality at that location. This includes assessing concentration levels and fluxes (loads) both in terms of average levels, seasonal patterns, and trends. The USGS has developed and released two R-packages (open source, platform independent software) designed to help facilitate these kinds of assessments. The first (dataRetrieval) is designed to provide a simple approach to obtaining a wide range of water data types from web services and bring them into the R computing environment for summary and analysis purposes. The second, called EGRET (Exploration and Graphics for RivEr Trends), is designed specifically for the analysis of long-term records of water quality sample data (e.g., weekly, monthly, or quarterly) in conjunction with daily streamflow data. These packages, developed as a joint effort by Robert M. Hirsch and Laura A. De Cicco of the USGS, are now fully documented and available to users through CRAN (the Comprehensive R Archive Network, cran.r-project.org).

Further information about these packages is available at: github.com/USGS-R/EGRET/wiki. Here is a high level overview of the purposes and functions of these packages:

dataRetrieval

- Retrieves all types of data stored in the USGS NWISWeb as well as data in the Water Quality Portal (which serves USGS, EPA STORET and USDA STEWARDS data). These retrievals can be done using a single command in the R environment, which organizes the data in a manner that makes them immediately available for summarization, graphics, or analysis.
- For USGS data, it has functions for daily values, unit values (i.e., sensor data collected at regular intervals such as 15-minute or hourly), water quality samples, water levels, peak flows, as well as meta-data about the site and the parameters.
- It also has functions that can make queries of these data bases to identify data that meet user-selected geographical, parameter, period of record, or sample number requirements.

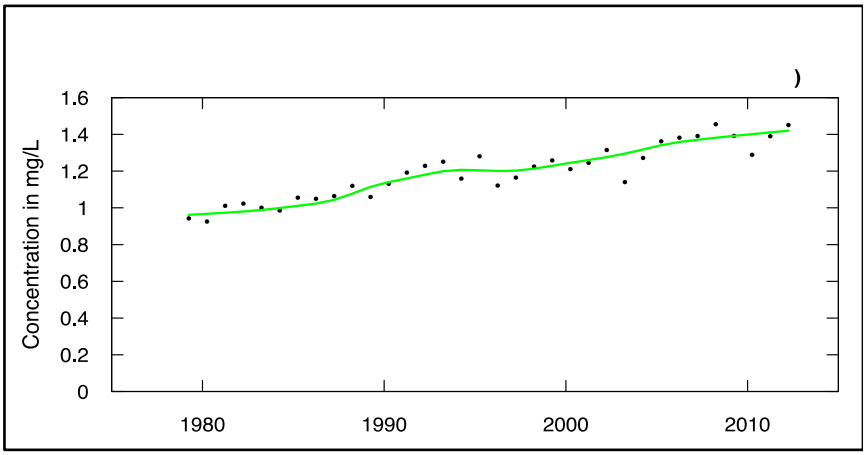
EGRET

- Has similar data retrieval capabilities, but they are particularly tailored for two types of long-term data analysis that are part of EGRET and which operate at a daily time step. These are:
    - Weighted Regressions on Time, Discharge, and Season (WRTDS) a method first published by Hirsch et al. (2010) for the analysis of surface water quality data. (onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2010.00482.x/full).
    - Flow history analysis, which is designed to explore long-term trends and variations in streamflow conditions: high flow, average flow, or low flow at an annual or seasonal time scale.
- Organizes water quality sample data, daily streamflow data, and site and parameter meta-data specifically to meet the needs of EGRET but are also conducive to many other types of data analysis.
- Provides self-labeled graphics and tables of data and statistical model outputs based on the data. The graphics produced are suitable for direct use in presentations and many types of publications.
- Carries out the WRTDS analysis, which is suitable for exploration of water quality trends and the computation of annual and long-term average loads.

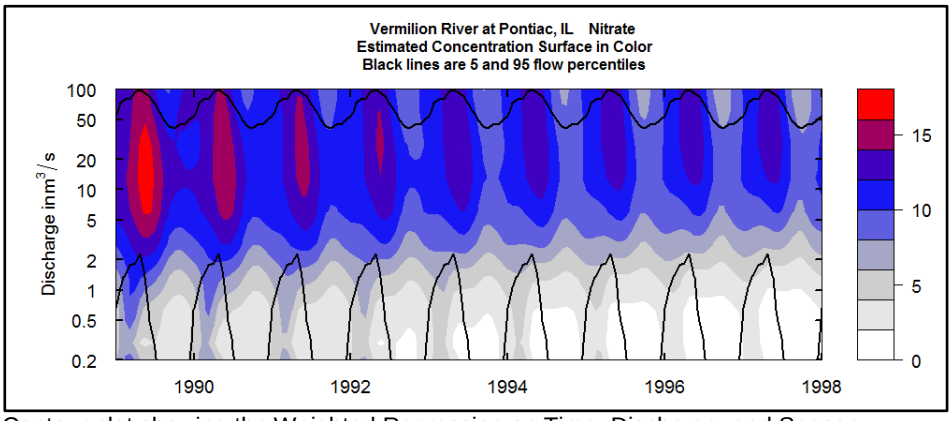
Bob Hirsch Speaks With Sense
Informs Long-Term Perspective
My Water Hero
~ Bob Limbeck, DRBC

Flood, Fire, Wind and Rain
River Rises, Land Erodes
Carried to the Sea
~ Jane Caffrey, University of West Florida

Here are two examples of the types of outputs that can be easily produced by the EGRET software.



Concentration history graphic from the Weighted Regression on Time, Discharge, and Season method based on dissolved nitrate data for the Choptank River near Greensboro, MD, 1979-2012. Dots are the estimated mean concentration by year. Green line is flow normalized concentration (which removes the effect of year-to-year variations in discharge). This graphic is produced by EGRET software.



Contour plot showing the Weighted Regression on Time, Discharge, and Season (WRTDS) estimate of the expected value of nitrate concentration as a function of date and discharge, for the Vermillion River at Pontiac, IL, 1989 - 1998. Black curves indicate the 5th and 95th percentiles of the seasonal flow duration curve. This is a graphic produced by EGRET software.

All of the methods employed in the packages are documented in the USGS Techniques and Methods report that can be found at: pubs.usgs.gov/tm/04/a10/

The tools that are available in these two packages are already in use in several USGS Water Science Centers as well as in the university community. Extensions of the capabilities of these two packages are underway and related new developments will be announced in the future at github.com/USGS-R/EGRET/wiki. If you have questions you can contact the developers at: rhirsch@usgs.gov or ldecicco@usgs.gov.

Clear Choices for Clean Water: The Power of Social Marketing

Clear Choices Clean Water is a social marketing initiative to increase public awareness about the choices we make and the impacts they have on our lakes, streams, and groundwater. The message to every individual is clear: the personal and local actions you take have a direct impact on our water. *Clear Choices* began as a simple campaign, using pledges to encourage changes in behavior, to educate citizens about the impacts of lawn fertilizer on water quality. With its initial success *Clear Choices* quickly expanded to include more pledges on pet waste pickup, native plants and gardens, septic maintenance, and soon a water conservation and volunteer service pledge. In addition to the program's interactive pledge-focused website, the initiative also includes a suite of collateral campaign materials in several media formats and a network of partners working together to promote the program's messages.

Created by two watershed groups in Indiana, this nationally award-winning program provides a turn-key pollution prevention public education and engagement tool for various governmental entities. The program is perfect for municipalities or utilities required to manage storm water in accordance with state and federal permits and is also a great opportunity for a variety of partners to promote a common call-to-action and tangibly measure their outreach success. Individuals are asked to make one or more pledges to change or continue a behavior that benefits water resources. They are able to see themselves on a map, receive personalized positive feedback, see who else in the community is pledging, explore information about the pledge issues, and learn about better alternatives.

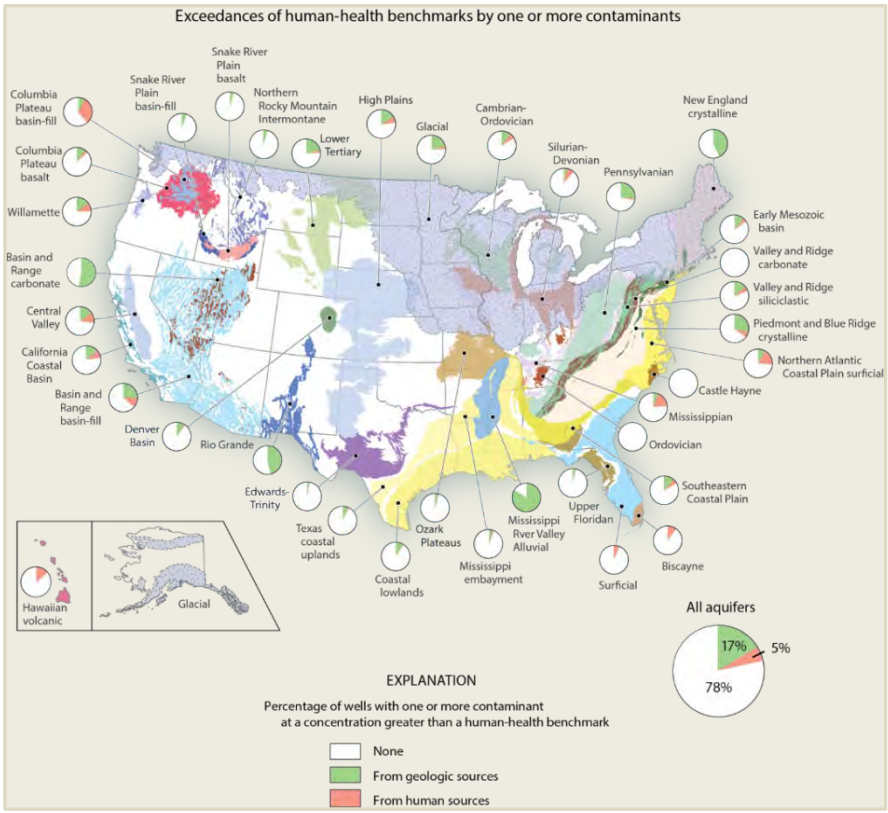
The *Clear Choices* program is now available throughout the United States to be utilized by a variety of community partners across the country, thus allowing for the collective impact of common shared messaging. The goal of the program is to make sure that the messages about how to sustainably, wisely use, and protect our water will resonate with every American. For more information, contact Jill Hoffaman at jill@clearchoicescleanwater.org.

Screen Shot of Clear Choices Homepage

Understanding Where and Why Groundwater is Vulnerable to Contamination

About 115 million people—more than one-third of the Nation's population—rely on groundwater for drinking water, and the need for high-quality drinking-water supplies becomes more urgent as the population grows. The USGS National Water-Quality Assessment (NAWQA) Program assessed water quality in source (untreated) water from 6,600 wells in aquifers that supply most of the groundwater pumped for the Nation's drinking water, irrigation, and other uses.

Comprehensive sampling (1991-2010), along with detailed information on geology, hydrology, geochemistry, and chemical and water use, can be used to explain how and why aquifer vulnerability to contamination varies across the Nation. By knowing where contaminants occur in groundwater, what factors control contaminant concentrations, and what kinds of changes in groundwater quality might be expected in the future, we can ensure the future availability and quality of this vital natural resource. National findings from these studies are summarized in pubs.usgs.gov/circ/1360 and include the following:



Contaminants from geologic sources exceeded human-health benchmarks more frequently than contaminants from human sources in most Principal Aquifers. Human actions such as irrigation and high-volume pumping can change the chemistry of the water within an aquifer, which can cause aquifer rock and sediment to release naturally occurring contaminants, such as arsenic, selenium, and uranium into groundwater.

About 22 percent of groundwater samples contained at least one contaminant at a concentration of potential concern for human health. Contaminants from geologic sources—primarily manganese, arsenic, and radon—accounted for about 80 percent of contaminant concentrations that exceeded a human-health benchmark. Nitrate, which exceeded its benchmark in about 4 percent of wells sampled, was the only constituent from manmade sources that exceeded its human-health benchmark in more than 1 percent of samples.

High-volume pumping and irrigation can cause different types of waters to mix, increasing vulnerability of drinking-water supplies to contamination from nitrate, pesticides, and other manmade chemicals, and causing the release of naturally occurring contaminants such as arsenic, uranium, selenium, or radium into the groundwater.

Concentrations of dissolved solids, chloride, and nitrate (indicators of human influence on groundwater quality) increased in shallow groundwater in many parts of the Nation. Similar changes are likely to occur in deeper parts of some aquifers as the shallow water moves deeper. Groundwater in permeable, unconfined aquifers (Central Valley aquifer system in California and surficial deposits of the Northern Atlantic Coastal Plain aquifer system) is especially vulnerable to contamination.

For additional information, contact Barbara Mahler, bjmahler@usgs.gov, 512-927-3566, or visit water.usgs.gov/nawqa/pubs/prin_aq.

Improvements to Cyanotoxin Monitoring the Goal of New Oregon Guidelines

In February 2015, the Oregon Health Authority (OHA) published an article in a special issue of *Toxins,* titled *Harmful Algal Blooms (HABs) and Public Health: Progress and Current Challenges.* The article, entitled "Health-Based Cyanotoxin Guideline Values Allow for Cyanotoxin-Based Monitoring and Efficient Public Health Response to Cyanobacterial Blooms", reveals that some monitoring programs can overestimate risk and lead to unnecessary health advisories. As a result, OHA developed guideline values for each of the cyanotoxins found in Oregon. Each of the guideline values is for a specific use of cyanobacteria-affected water: drinking water, recreational exposure and dog exposure. These guidelines allow OHA to promote toxin-based monitoring programs, which reduce the number of health advisories and focus advisories on times and places where actual, rather than potential, risks to health exist. For more information, contact Curtis Cude at curtis.g.cude@state.or.us, or read all about it: www.mdpi.com/2072-6651/7/2/457.

Advisory signs are flipped open when a health risk exists as a result of Cyanobacterial blooms present. *(Photo Credit: Oregon Health Authority, HABS Program.)*

Bedded Sediment in New Mexico

The State of New Mexico Environment Department (NMED) associates imbalanced suspended and bedded sediment supply with effects to aquatic life uses through narrative or comparative standards. The degrees to which certain sediment quantities are unnatural and detrimental to associated aquatic life were loosely defined. The NMED's original Clean Water Act sedimentation/siltation assessment protocol was developed in the late 1990s for the purpose of identifying sedimentation (i.e., *stream bottom deposit*) impairments. The protocol was developed to determine whether or not an impairment was occurring due to excessive sedimentation and provide enough information to develop subsequent total maximum daily loads (TMDLs) in rapid fashion. Some issues with the protocol surfaced, and a new approach was taken.

In 2008, NMED, in cooperation with EPA Region 6, US EPA Office of Research and Development Western Ecology Laboratory, and Tetra Tech Corporation, embarked on a stepwise development approach, as described in *Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria*, USEPA 2006, with the goal to propose numeric translators for New Mexico's narrative sedimentation water quality narrative standard in lieu of actual water quality criteria. Multiple sediment and biological datasets were used in the analysis of bedded sediment conditions and effects.

A final report was completed 2010 titled *Sediment in New Mexico Streams: Existing Conditions and Potential Benchmarks* with a complementary assessment protocol document, both of which are available at www.nmenv.state.nm.us/swqb/Sedimentation. A subsequent manuscript was prepared, accepted and published in the Journal of the American Water Resources Association (JAWRA), December 2014, titled *Bedded Sediment Conditions and Macroinvertebrate Responses in New Mexico Streams: A First Step in Establishing Sediment Criteria* available at onlinelibrary.wiley.com/doi/10.1111/jawr.12224/abstract. For more information, contact Forrest John at john.forrest@epamail.epa.gov.

Water, Examine
Its Health, Share Its Story Please
Love, Care, Protect It
~ Julie Vastine, Alliance for Aquatic Resource Monitoring

Labor Expensive
Data need is million times
A job for sensors
~ Jeff Walker, Larry Walker Associates

Upcoming Conferences and Workshops

26th Annual Florida Lake Management Society /

24th Annual North American Lake Management Society

Southeast Lakes & Watersheds Combined Technical Symposium

Theme: Lake, Stream, Spring and Coastal Science,

Technology and Volunteer Programs

June 8-11, 2015

Naples Beach Hotel & Golf Club, Naples, FL

PDHs available for workshops and sessions.

CEUs available for select workshops and sessions.

For more information, visit www.FLMS.net and click on "Annual Symposium"

2015 Tribal Lands and Environment Forum

Minneapolis St. Paul, Minneapolis

August 17 - 20, 2015

Forum will feature special trainings, field trips, and breakout sessions focused on solid/hazardous waste management, brownfields, UST/LUSTs, Superfund sites, and tribal water programs – water quality, drinking water, and habitat restoration (including wetlands, streams and fisheries).

www4.nau.edu/itep/conferences/confr_tlf.asp

To submit an article, announcement, or photo for our Fall 2015 Newsletter, please contact: chopkins@usgs.gov