

# National Water Monitoring News



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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.*



Highlights from the 11<sup>th</sup> National Monitoring Conference in Denver, Colorado.





# National Water Quality Monitoring Council

Working together for clean water



## Words from the Council Co-chairs

Welcome to the 18<sup>th</sup> edition of the National Water Quality Monitoring Newsletter!

Greetings to Friends, Members, and Supporters of the Council!

Here's hoping this message finds everyone that attended the 11th National Monitoring Conference in Denver safe and sound and still energized from all the great talks, posters, workshops, training sessions, exhibitors, and most important, interactions with old friends and colleagues, and new contacts and peers. Susan and I would like to take a moment to acknowledge the work by folks on the Conference Planning Committee (CPC), especially CPC Co-Chairs Lareina Guenzel (EPA), Tim Oden (USGS), and Marie DeLorenzo (NOAA). We'd also like to single out Monty Porter (Oklahoma Water Resources Board) who chaired the conference program committee that organized the many excellent technical sessions offered at the conference, Kristin Parry (TetraTech) who provided critical support on the conference agenda, and Jeff Schloss, Philip Forsberg, and Aylssa Anderson from the North American Lake Management Society (NALMS) who dealt with conference registration, exhibitors, AV support, and facilities. Lastly, we'd call out Candice Hopkins, the NWQMC Executive Secretary who does so much behind the scenes and is the glue that holds the Council together. As many are aware, given the uncertainties and delays following the shutdown of the federal government in January, the Council was very close to postponing the conference until Spring 2020. However, through the hard work of the folks listed above (and many other Council members and friends of the Council) we persevered and were able to hold what we believe was a very successful conference attended by approximately 900 people interested in advancing the Nation's water-quality monitoring capabilities (see report on 11<sup>th</sup> National Monitoring Conference on page 3).

We are pleased to report on the success of the 11<sup>th</sup> National Monitoring Conference, which provided a forum for many of the readers of this newsletter to highlight the outstanding work, they and their organizations are doing to support clean water. We would also like to acknowledge the hard work being done by those of you that could not attend the 11<sup>th</sup> National Monitoring Conference in conducting water-quality monitoring for states and tribes, volunteer and citizen science organizations, federal agencies and academia, some of whose efforts are described in articles appearing in this newsletter. We hope you enjoy reading this edition and as always appreciate your feedback and contributions!

Sincerely,

Gary Rowe, USGS Co-Chair  
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Susan Holdsworth, EPA Co-Chair  
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# National Council Highlights

## 11<sup>th</sup> National Monitoring Conference

The 11<sup>th</sup> National Monitoring Conference (NMC) was a great success, thanks to the hundreds of attendees, sponsors, exhibitors, and volunteers who helped make the meeting truly memorable. The National Monitoring Conference, held March 25-29<sup>th</sup> at the Downton Sheraton in Denver Colorado, hosted over 900 attendees from 7 countries, 49 states, and 31 tribes to discuss water quality monitoring. Participants benefitted from multiple networking opportunities, including the focused topical networking session, and side networking opportunities for volunteer monitors and citizen scientists, new water quality monitoring professionals, and experienced professionals looking to hand off some wisdom. The Fluid5k, our fundraiser for citizen science participants, had over 80 participants running through Downtown Denver during early morning hours. Haikus and Limericks were collected from participants at the 2019 National Monitoring Conference; some are shared in this newsletter.

A variety of field trips were offered, and attendees were able to tour Denver's National Atmospheric Deposition Program (NADP) Air monitoring site, learn about Next Generation Field Methods, tour Denver's New Green Infrastructure Projects, and see sites on the Little Thompson River that utilize Farmer Best Management Practices to improve water quality. Many chose to participate in workshops and trainings that focused on topics such as PFAs and PFSOAs, designing and instrumenting a high-frequency groundwater monitoring station, enhancing water quality monitoring using satellite data products, and analyzing and synthesizing data. Many of these workshops were filled to capacity as people learned new skills from experts in the field.

Speakers for the opening and closing plenary included a diverse lineup of research hydrologists and leaders from the Environmental Protection Agency, Department of Interior, and Internet of Water. Tommy Dewald, Diane Switzer, and Southern California Coastal Water Research Project were all recognized for their outstanding contributions to the field. More information about the awards that were received and a write-up on each award winner is available on our website.

Over 350 oral and poster presentations were given on a multitude of topics. Copies of presentations (if available) will be posted to the Council's website by June. Many thanks to our presenters who truly made this conference worthwhile for all participants and helped push the field of water quality monitoring forward by sharing their knowledge and expertise with their peers and colleagues.



*Water flows downstream  
To sustain life for us all.  
Listen and feel it.*

Sandra Pope,  
City of Lakeland, FL



# Collaboration Through Partnerships

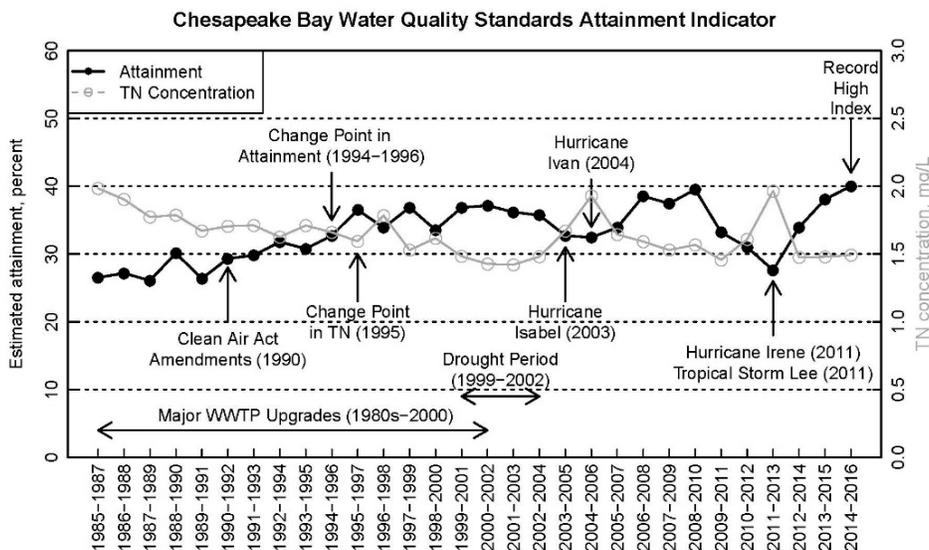
## Federal Partnerships

### Chesapeake Bay Improving: Best Water Quality Conditions Recorded in 30 Years

A multi-metric water quality standards (WQS) attainment indicator was created and applied to three decades of tidal monitoring data to assess status and trends in water quality of the Chesapeake Bay and its tidal tributaries. The indicator uses eutrophication-related metrics of dissolved oxygen concentrations, water clarity assessments, underwater bay grass acreages, and season-specific chlorophyll-*a* distributions to assess habitat health (USEPA, 2017). The metrics are central to tracking progress on meeting these WQS directly related to conditions necessary to achieve restoration goals of the 2010 Chesapeake Bay Total Maximum Daily Load.

During the most recent assessment period (2014-2016), an estimated 40 percent of the Chesapeake Bay and its tidal tributaries met WQS -- the highest estimate of WQS attainment since 1985 (Figure 1). The results show a two percent increase from the previous assessment period due in large part to a rise in dissolved oxygen in the deep channel of the Bay. Over the last three decades, the indicator has followed a nonlinear trajectory, consistent with impacts from extreme weather events (e.g., Hurricane Ivan, Tropical Storm Lee) and subsequent recoveries. A positive long-term trend ( $p < 0.05$ ) was observed, which was statistically linked to nitrogen reductions associated with management actions. While there is still much progress to be made, these results demonstrate that Chesapeake Bay is on a positive trajectory toward recovery.

These results have been published by Zhang et al. (2018). This work highlights Chesapeake Bay as an example where a long-term, collaborative monitoring network has allowed for the development, refinement, and implementation of analyses to assess the ecological status of a complex ecosystem. Additional research is underway to delve into the segment level results, which will provide managers with more detailed information about how estuarine water quality changes in space, time, and across different designated uses. For more information please contact Peter Tango ([pjtango@usgs.gov](mailto:pjtango@usgs.gov)) or Qian Zhang ([qzhang@chesapeakebay.net](mailto:qzhang@chesapeakebay.net)).



Time series of the multimetric indicator score for estimated Chesapeake Bay water quality standards attainment across the thirty 3-year assessment periods. Time series of flow-weighted TN concentration is shown on a separate y-axis. Key weather events, management actions, and change points are labeled with arrows. Source: Zhang et al. (2018).

## Synthesizing Effects of Total Nitrogen and Total Phosphorus on River and Stream Ecosystems: Systematic Review Update

A team at U.S. Environmental Protection Agency's Office of Research and Development has been working to complete three systematic reviews of the scientific literature investigating how stream and river ecosystems respond to total nitrogen (TN) and total phosphorus (TP) concentrations. Response is measured by the impact to aquatic life endpoints including chlorophyll- *a* (chl-*a*), diatoms, and macroinvertebrate abundance. The team has identified more than 300 articles that report relationships between nutrients and aquatic life endpoints. Initial data extraction from these articles has been completed with final stages of the review underway. When the extracted data have been finalized, the team will investigate nutrient stressor-response relationships and thresholds from the dataset – focusing initially on chl-*a*.

Preliminary results illustrate chl-*a* had stronger relationships with nutrients than diatoms or macroinvertebrates. This confirms a common understanding in stream ecology: autotrophic indicators are better predictors of nutrient enrichment. For studies that report relationships for both TN and TP for chl-*a*, when a study shows a strong response to TN, it also shows a strong response to TP.

Extraction of contextual environmental data from relevant studies will enable examination of the effects of environmental variation on the nutrient stressor-response relationship. For instance, the strength of the benthic chl-*a* response declines with increasing stream size. The team is seeking input from practitioners on specific use cases or needs, particularly related to data analysis, operability, and interactivity of a forthcoming interactive database. For more information on this project, please contact Micah Bennett ([bennett.micah@epa.gov](mailto:bennett.micah@epa.gov)).

## Nitrogen Loads Entering Coastal Waters, Despite Widespread Decreases, Remain Elevated

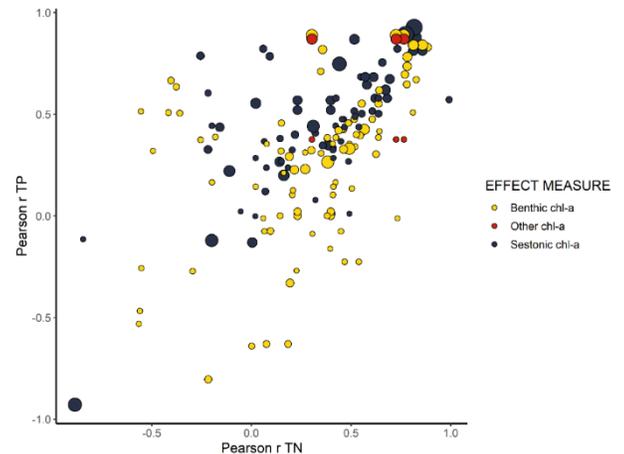
### Attempts to decrease loads more successful for nitrogen than phosphorus

U.S. Geological Survey scientists have been tracking trends in nutrient loads entering the Nation's coastal waters and estuaries, including San Francisco Bay, Chesapeake Bay, and the Great Lakes. Excessive amounts of nutrients (a phenomenon known as eutrophication), mostly nitrogen and phosphorus, are one of the main causes of algal blooms and resulting fish kills. A [newly published study](#) finds that, from 2002 to 2012, decreases in loads of nitrogen compounds, including nitrate, were more common than decreases in loads of phosphorus compounds in the studied water bodies.



Nitrogen loading to Chesapeake Bay decreased during 2002–2012 from most tributaries, but phosphorus loading increased. (Photo by BelindaMariePix, CC BY 2.0)

Most of the decreases in nitrogen loading were in urban watersheds and could reflect regulatory actions to reduce nutrient loading from point sources such as wastewater treatment plants. There was a less consistent pattern of trends in loading from agricultural areas, where nonpoint source loading of nutrients—more difficult to control than point source loading—is more common. Loading of total nitrogen and



Relationship between correlation w/ TN and correlation w/ TP for chl-*a* (overall  $R^2=0.26$ ). Points sized inversely w/ variance.



total phosphorus to coastal waters from streams with little development in their watershed increased from 2002 to 2012, indicating that water quality in these coastal watersheds is degrading despite minimal human activity.

The ratio of total nitrogen to total phosphorus—the N-to-P ratio—was higher than pre-1979 levels. A high N-to-P ratio indicates that the water is phosphorus limited, meaning that the amount of phosphorus present is the determining factor causing algal and plant growth. Even those rivers in which concentrations of both nitrogen and phosphorus decreased remained phosphorus limited, indicating that more progress is needed in reducing both N and P loading to U.S. coastal waters to reduce eutrophication risk.

For additional information [on the study](#), contact Gretchen Oelsner, [goelsner@usgs.gov](mailto:goelsner@usgs.gov).

## Pharmaceuticals and Hormones Few and at Low Concentrations in Groundwater, USGS Scientists Find

### Groundwater in areas with fractured rocks most vulnerable to contamination

The topic of pharmaceuticals and hormones in drinking water gets people's attention, but if that drinking water is pumped from a well, those chemicals are less likely to be present, according to a new study by the U.S. Geological Survey. The [results of the national study](#) are published in the journal *Environmental Science and Technology*. This is the first large-scale, systematic study of the occurrence of hormones and pharmaceuticals in groundwater used as a drinking-water supply for an estimated 80 million people across the United States.

USGS scientists analyzed 103 pharmaceuticals and 21 hormones in samples from nearly 1,100 groundwater wells that tap drinking-water aquifers. The aquifers sampled provide about 60% of the groundwater used for drinking in the nation. Samples were collected prior to the water undergoing any type of treatment. Six percent of samples from public-supply wells and 11 percent of samples from wells used for domestic supply or other uses contained one or more pharmaceuticals or hormones. When detected, the chemicals were at low concentrations and not expected to have adverse human-health effects. Just one sample contained a pharmaceutical—hydrocortisone—at a concentration that exceeded its human-health benchmark.

The hormones and pharmaceuticals most frequently detected were not necessarily those most heavily used, but rather those that move through groundwater easily without adhering to soil, sediment, or rock. Samples from shallow wells, particularly those drilled into fractured crystalline rocks, were more likely to contain pharmaceuticals and hormones than samples from wells in other groundwater settings. Overall, detection frequencies and concentrations for pharmaceuticals and hormones in groundwater were lower than those reported by other studies for pharmaceuticals and hormones in surface water, and similar to or lower than those for other types of organic chemicals, such as pesticides, in groundwater.

For more information, contact Laura Bexfield ([bexfield@usgs.gov](mailto:bexfield@usgs.gov)); learn more about this study and others that are part of the [USGS National Water-Quality Assessment Project](#).

#### Citation:

Bexfield, L.M., Toccalino, P.L., Belitz, K., Foreman, W.T., and Furlong, E.T. 2019. Hormones and pharmaceuticals in groundwater used as a source of drinking water across the United States. *Environmental Science and Technology*, DOI: 10.1021/acs.est.8b05592.



Hormones and pharmaceuticals, widely used for treatment of humans, domestic animals, and livestock, have the potential to enter the environment, including groundwater. In 2009, nearly 70% of Americans took at least one prescription drug, and more than 50% took 2 or more. (Photo: Laura Bexfield, U.S. Geological Survey)



# New Web Tool for Exploring Levels and Sources of Dissolved Solids in U.S. Streams

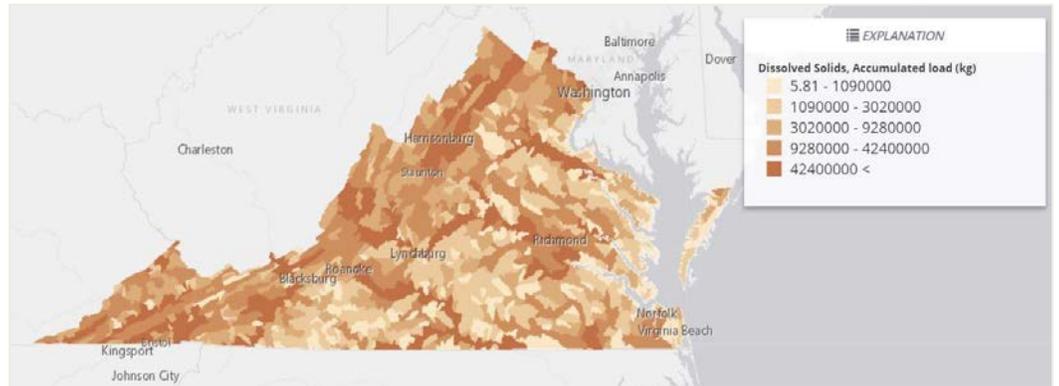
User-friendly interface provides results as maps, graphs, and tables

The U.S. Geological Survey (USGS) National Water Quality Program has introduced an [interactive web tool](#) for exploring dissolved solids in streams and rivers across the United States. The dissolved solids concentration in water is the sum of the concentrations of all the substances dissolved in water and can affect hardness, potential corrosivity, and taste.

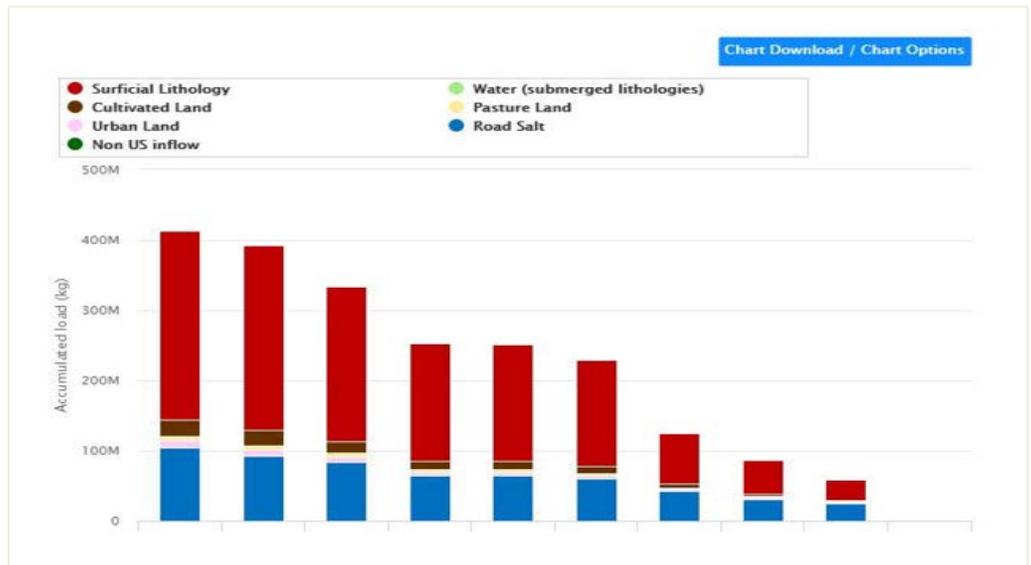
The web tool, a user-friendly interface to the USGS [SPARROW](#) (SPAtially Referenced Regressions On Watershed attributes) model, allows users to obtain and visualize information on concentrations, loads, and yields (load per area) of dissolved solids in all streams of the U.S. The tool also allows users to identify the major sources of dissolved solids in the area draining to any stream. Excessive concentrations of dissolved solids in water can make water taste bad, corrode metal pipes, adversely affect stream health, and render it unusable for irrigation or drinking.

User-generated graphs and tables are dynamically linked to maps to facilitate exploration and understanding of model results. Users also can tailor their search to focus on their own objectives, develop maps that illustrate their results, and download the data derived from the model.

For additional information on the groundwater-quality web tool, or for data and methods used, contact Dave Saad ([dasaad@usgs.gov](mailto:dasaad@usgs.gov)). Try out the tool at [sparrow.wim.usgs.gov/national-dissolved-solids/](http://sparrow.wim.usgs.gov/national-dissolved-solids/). Learn more other USGS web-based mapping tools linked to SPARROW models [here](#).



Results of the SPARROW dissolved-solids mapping tool for the State of Virginia, showing accumulated dissolved solids load by watershed. The user can choose to view a range of dissolved-solids metrics, such as accumulated load and accumulated yield, and can view results by hydrologic units and geographic region.



The web-based mapper also can be used to estimate sources of dissolved solids to catchments in a given watershed. Here, the largest sources of dissolved sources to catchments in Ohio are estimated to be rocks exposed at the land surface (surficial lithology, in red) and road salt (in blue). Each set of bars represents a different watershed contributing to the Sandusky River.



## Scientists Find Many Americans May Be Drinking Groundwater with Elevated Levels of Manganese

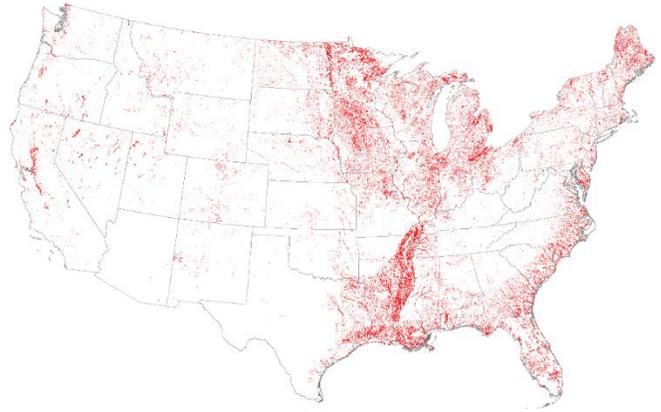
Manganese concentrations highest in shallow groundwater near rivers

A new USGS study reports that about 7 percent of domestic (private) wells in the U.S. have concentrations of manganese at levels that present a potential human health risk. These wells provide drinking water for an estimated 2.6 million people.

Areas with elevated levels of manganese in groundwater were concentrated along the Mississippi valley, the eastern coast up to Maine, and the Great Lakes area. The study found that elevated manganese in groundwater occurs most frequently near rivers, where the water table is shallow, where the overlying soil is rich in organic carbon, or where nitrogen fertilizer has been applied to poorly buffered soil. All these features can be mapped, and such maps could be useful in determining where water wells should be drilled to avoid high concentrations of manganese.

While beneficial in trace quantities, manganese can be harmful to humans at levels above 300 micrograms per liter. At concentrations as low as 50 micrograms per liter, manganese can be noticeable as it gives an unpleasant taste, odor, or color to the water. Levels of manganese can be lowered through treatment. The best way to know the water quality of your domestic well is to have it tested.

For additional information on [the article](#), contact Pete McMahon ([pmcmahon@usgs.gov](mailto:pmcmahon@usgs.gov)).



Areas in the conterminous United States with the highest densities of people potentially consuming groundwater from domestic wells with elevated manganese concentrations.

*Feel the pulse of the  
Continent inhale, exhale  
Our Water Planet*  
Casandra Champion,  
Metropolitan Council Environmental Services, St. Paul, MN

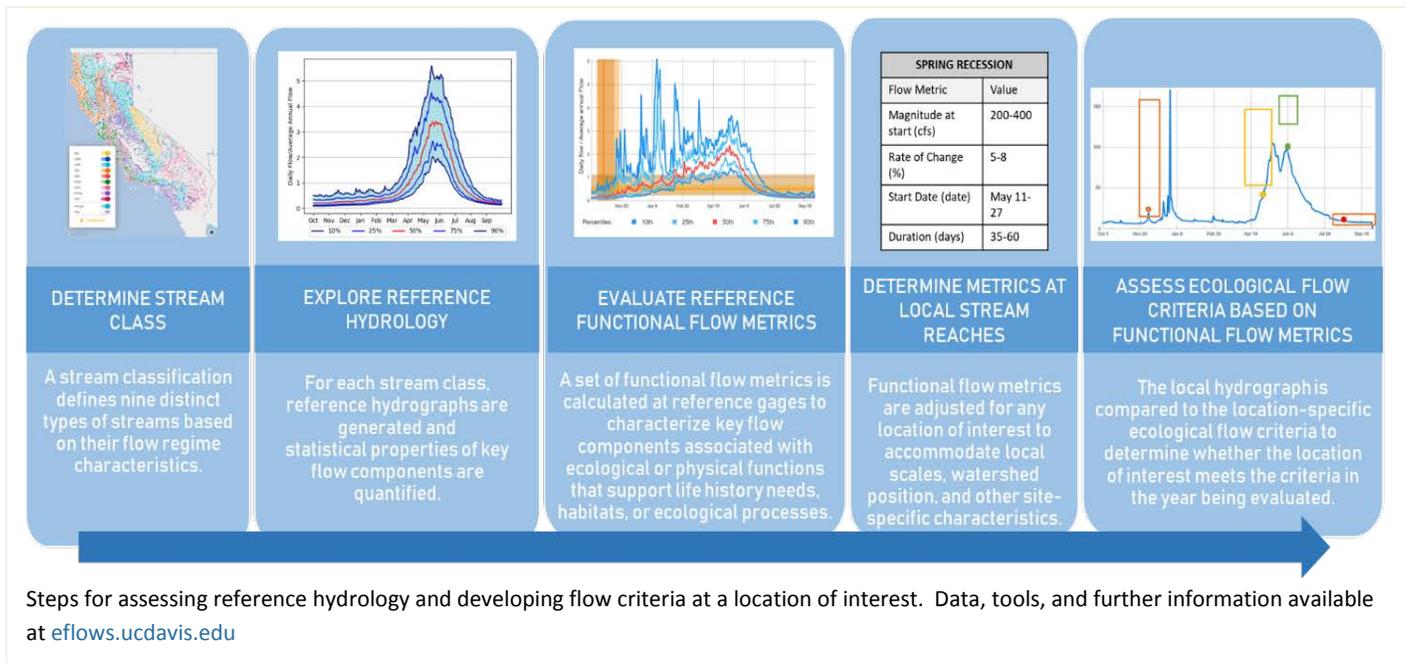
*Stagnant, warm water  
Nitrogen and Phosphorus  
Harmful, Algal Blooms*  
Dan Sobota, Oregon, DEQ

*Water is wet, now  
Water will be dry tomorrow  
What will tomorrow be?*  
Ryan Monahan, EPA Region 8

## Framework and Web Tools for Developing Ecological Flow Criteria in California

Flow alterations are a significant driver of species population declines and biodiversity loss in California and globally. Multiple state and local agencies across California share responsibility for setting flow criteria that protect the health of the state’s water resources, but these approaches have not been well coordinated. Environmental conditions and pressures vary widely, as do the priorities and capacities of agencies responsible for water resource management. To address this challenge, a group of experts developed the California Environmental Flows Framework (CEFF) for determining ecological flow criteria in California that provides a cost-effective statewide method (Tier 1) and guidance on more detailed methods for setting refined environmental flow criteria at locations of interest (Tier 2).

CEFF uses a functional flows approach as the basis for determining environmental flow regimes. A functional flow component is a portion of the natural annual hydrograph that has a disproportionately important role in supporting the physical and ecological processes within a stream system. Targeting preservation of key functional flow components rather than the full natural flow regime can improve freshwater ecosystem health by supporting physical processes and habitat conditions while balancing with other beneficial uses.



Tier 1 of CEFF is a statewide approach for developing general flow criteria protective of river-dependent ecosystems through the use of natural stream classes, reference hydrographs, and the natural ranges of key functional flow metrics. Functional flow metrics are discrete numeric measures of functional flow components calculated from daily streamflow data. Each key functional flow component (e.g. winter peak flows or spring recession flow) can be described by a suite of flow characteristics, such as magnitude, timing, duration, frequency, and rate of change, which are then measured by specific functional flow metrics (e.g. discharge or percent change in flow per day). The **Functional Flows Calculator (FFC)** is a web tool for visualizing, exploring, and downloading California’s *reference hydrology*, including natural stream classes, reference hydrographs, and functional flow metrics (Figure 1). For additional information on the California Environmental Flows Framework see the [CEFF website](#).



## University of Florida/IFAS Florida Keys Water Watch

The Florida Keys are surrounded by the Gulf of Mexico on one side and the Atlantic Ocean on the other, and encompassed by the Florida Keys National Marine Sanctuary, with almost 3,000 square miles of protected coral reefs, seagrass meadows and mangroves. While the Florida Keys are a unique and beautiful ecosystem, they are not without their human impacts. Fill materials dredged from inshore waters were used to create U.S. Route 1 and 170 miles of residential canals with 312 miles of waterfront property. Unfortunately, many of these canals were dug too deep or too long, with not enough flow to keep the water moving, and many do not meet state of Florida surface water standards. Another issue is the seagrass and sargassum that floats into these canals and doesn't leave. Some of these canals have more than 6' of accumulated organic matter. Furthermore, until very recently the Keys were on septic tanks and cesspits— the city of Key West only began advanced wastewater treatment (AWT) in 2001. Currently the Florida Keys have about 67% AWT coverage, with the majority going online in the past 5 years.

In response, the University of Florida Institute of Food and Agricultural Sciences Extension (UF/IFAS Extension) created Florida Keys Water Watch (FKWW) in October 2014, with funding from the U.S. Environmental Protection Agency. FKWW is modeled upon the Georgia Adopt-A-Stream (AAS) program, which will celebrate its 26<sup>th</sup> anniversary in 2019. The true value of volunteer-based water quality monitoring programs is the long-term monitoring by citizens, community groups, teachers and students to collect baseline water quality data over time, which is why FKWW uses AAS as its model. FKWW is designed to raise awareness of the importance of water quality, which has been adversely affected by development in the Florida Keys. Given the compromised state of the water quality in the canals, it is important to provide public education and outreach to reduce nonpoint source pollution. FKWW teaches residents how to test their canals for dissolved oxygen, salinity, temperature, and turbidity. Like AAS, FKWW emphasizes the connections between statewide land uses and the impacts on water quality. For more information, contact Shelly Krueger ([shellydrueger@ufl.edu](mailto:shellydrueger@ufl.edu)).

## New macroinvertebrates.org—An Innovative Online Resource for Identification

Citizen science organizations that train volunteers to identify freshwater macroinvertebrates for water quality monitoring rarely have access to comprehensive specimen reference collections to support teaching and learning. Researchers at Carnegie Mellon University in partnership with the Carnegie Museum of Natural History, Stroud Water Research Center, and Clemson University, are pleased to announce the release of [www.macroinvertebrates.org](http://www.macroinvertebrates.org), an annotated online teaching and learning collection featuring 150 commonly found benthic macroinvertebrates in Eastern North America.



Home page view of macroinvertebrates.org showing groupings of nine insect orders.

The collection is an expansion from the original Ephemeroptera, Plecoptera, and Trichoptera (EPT) site released in 2015 and now features nine orders of aquatic insects and other benthic macroinvertebrates commonly used in citizen science water monitoring. Funded by the National Science Foundation, the project was developed through a participatory design process that included an interdisciplinary team of entomologists, educators, designers, human-computer interaction researchers and volunteer biomonitoring organizations. High-resolution zoomable gigapixel images are annotated with key diagnostic characters to help users learn to see important features needed to make an identification. Explorable specimen images are supplemented with explanatory



text, multimedia visual aids, a comprehensive glossary, and an order level interactive key, as well as set of downloadable training resources being developed with educators from Stroud Water Research Center.

Trainer and volunteer needs for the site were established over three years through surveys, observations, interviews and workshops with multiple volunteer biomonitoring partner groups and through a national survey of macroinvertebrate identification training organizations. Results show that few programs currently incorporate online or digital tools, suggesting potential for the availability of high-quality online resources to positively impact macroinvertebrate training and learning practices. Survey results, publications and associated project resources are available at [www.macroinvertebrates.org/blog](http://www.macroinvertebrates.org/blog). Questions about the project can be addressed to Marti Louw, Director of the Learning Media Design Center at Carnegie Mellon University ([martil@cmu.edu](mailto:martil@cmu.edu)).



Zoomable high-resolution specimen views are annotated with diagnostic characters at order, family, and in some cases genus level.

## Spotlight on States

### Assessment of a Salt Crust Found at the Bottom of Salton Sea, and its Potential Implications for Water Quality, Habitat and Human Health

At the Salton Sea, an extensive subaqueous crust lining much of the sea floor was discovered by staff from the Regional Board in 2015. Operating under a grant from the Coachella Valley Mountains Conservancy, the Regional Board is collaborating with UC Riverside to study the spatial extent and chemical composition of the crust.

Salton Sea is a hypersaline, terminal lake that is sustained primarily by agricultural runoff and treated wastewater, and its sediments harbor more than a century's worth of pesticides and fertilizers. Due to water conservation by farmers, and a significant reduction of inflows, the Salton Sea is rapidly drying up and exposing thousands of acres of playa. Today, the crust is acting as a protective barrier over the fine underlying sediments of the exposed playa. In addition to determining the age, composition and extent of the crust, the study will also investigate the formation processes, the relationships between sediment chemical fluxes and the overlying waters, and how the crust might mitigate against upward reworking and mixing of contaminated sediments and their interstitial fluid into the bottom waters under the erosive effects of a progressively shallowing water column. The study is expected to be completed in late 2020. For additional information on Salton Sea related issues, contact Jeff Geraci ([jgeraci@waterboards.ca.gov](mailto:jgeraci@waterboards.ca.gov)).



As the sea recedes, acres of crust are left exposed on the dry playa. (Photo credit: Jeff Geraci)

## New CA Workgroup Will Help Standardize Molecular Methods Approaches for Bioassessment and Biomonitoring



Molecular, or DNA-based, methods are becoming increasingly popular in the water field of biomonitoring and bioassessment. From environmental DNA to metagenomic sequencing, molecular approaches offer rapid, scalable, and affordable methods for assessing environmental communities. However, standard protocols for generating molecular data for environmental monitoring are not currently available for statewide programs; potentially resulting in data that is not standardized or comparable at the statewide scale. A new workgroup within the California Water Quality Monitoring Council will address this lack of standardization, by bringing together researchers and practitioners to help develop recommended protocols and standards for the collection and analysis of molecular data. The Molecular Methods Workgroup is comprised of academic, non-profit, tribal, federal and state agency members who have either technical expertise in

the use of molecular methods or who are involved in the implementation of these methods. The Workgroup is developing a series of guidance documents and analytical tools, including recommended sampling protocols and a curated DNA reference sequence library. All resources will be available on the workgroup website. Their website will serve as a clearinghouse for training materials to help novice users incorporate molecular methods into their research programs. Additionally, the Workgroup will serve as a platform to improve coordination among research teams and provide new opportunities for collaboration. For more information, please contact Susanna Theroux ([susannat@sccwrp.org](mailto:susannat@sccwrp.org)).

## EcoAtlas: A Web-Based Toolset for Tracking and Visualizing the Effects of Mitigation and Restoration on Landscape Conditions

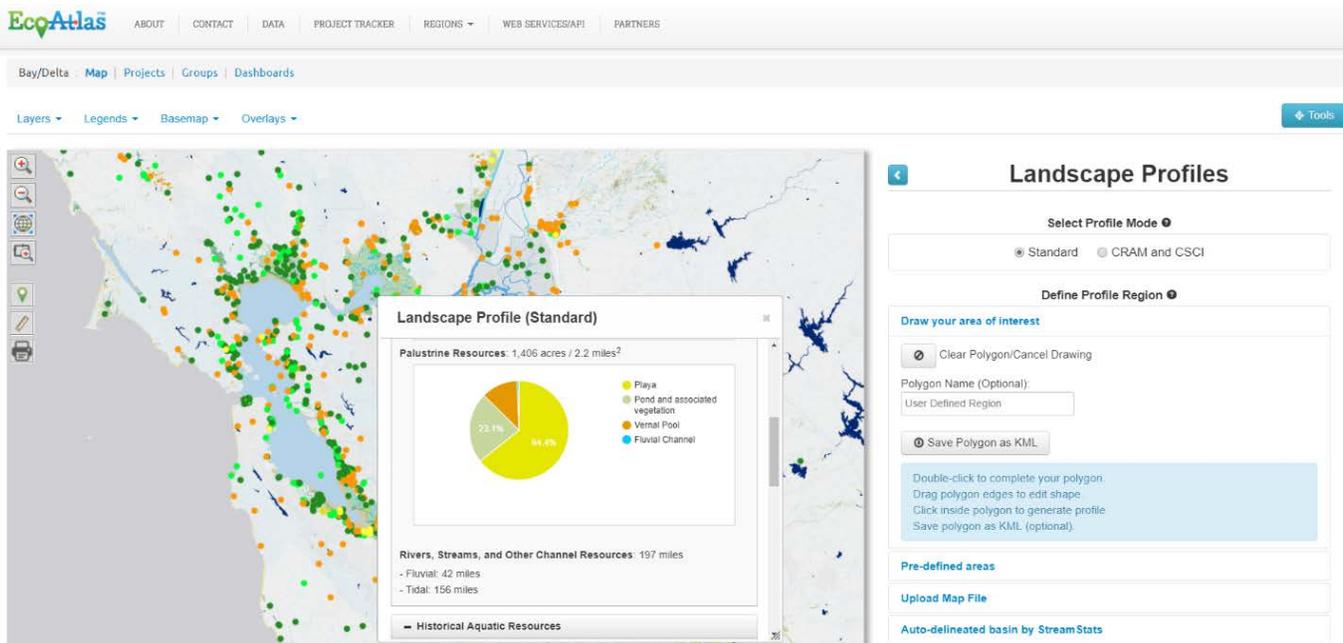
Many programs call for the careful tracking and reporting of restoration or mitigation efforts, yet sharing data related to landscape projects across agencies in a coordinated fashion remains a challenge. Climate change, habitat loss, and human population growth are intensive threats against California's wetlands. However, the ability of government agencies to respond to these threats is hampered by inadequate knowledge of the location of wetlands and how their abundance, diversity, and condition are affected by wetland protection programs, projects, and various stressors.

The [EcoAtlas toolset](#) can help meet various reporting needs by tracking performance and progress, evaluating project settings and alternatives during the planning phase, documenting accomplishments of habitat restoration efforts, and tracking net change in wetlands over time. EcoAtlas was developed by an interagency workgroup to promote consistent project tracking needed to view the cumulative benefits and effects of public policies and programs that manage California's valuable aquatic resources. The toolset provides key mechanisms for consistent project data entry, mapping, and reporting. Customized visualization tools summarize condition at different landscape scales from the site-specific to larger program and regional levels.

EcoAtlas has evolved over the past twenty years to meet users' tracking and reporting needs. Three key lessons learned include: 1) emphasize the importance of a durable underlying scientific framework guided by a multi-agency committee and technical workgroup process; 2) ensure that the fundamental functions to enter, edit, and download data and summary information are included from the start and refined with ongoing user input; and 3) leverage existing data through web services and an open-data



approach, rather than duplicating efforts or data sources. For more information contact Cristina Grosso, California Wetlands Monitoring Workgroup ([cristina@sfei.org](mailto:cristina@sfei.org)).



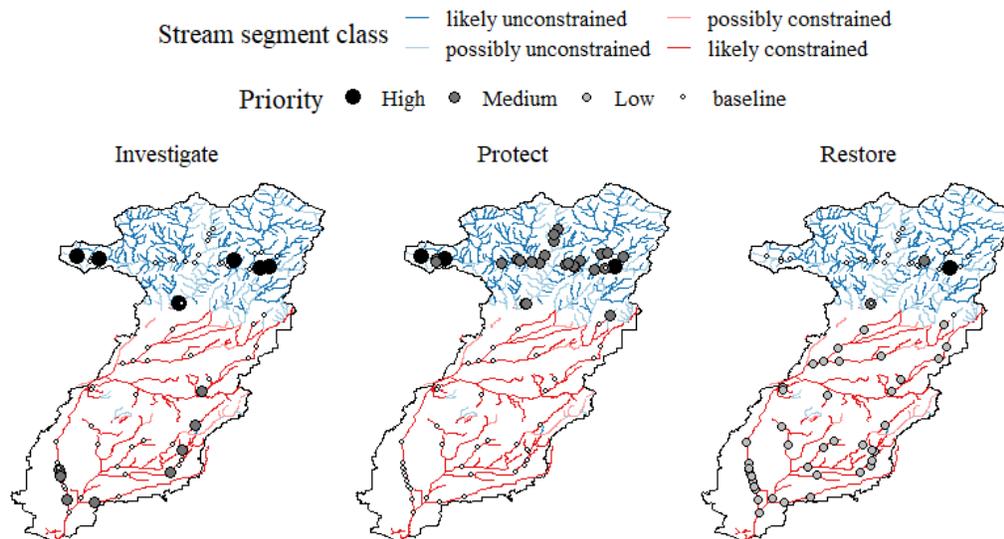
The Landscape Profile Tool summarizes ecological information at various spatial scales for assessment, planning, and reporting.

## SCAPE: A New Interactive Tool for Stream Priorities

The San Gabriel River Regional Monitoring Program (SGRRMP, CA) in partnership with the Southern California Coastal Water Research Project (SCCWRP) has released an interactive application to help prioritize management actions for streams in developed and undeveloped landscapes. The new tool, SCAPE (Stream Classification and Priority Explorer), was released online earlier this year ([shiny.sccwrp.org/scape/](http://shiny.sccwrp.org/scape/))

Modified channels are common in southern California and assessment tools that accurately characterize environmental condition are needed to assist in identifying reasonable expectations for stream health. The SCAPE tool helps identify the range of scores for a California bioassessment condition index that might be expected at a monitoring site given the landscape characteristics of the watershed. These expected ranges for the biological condition are used to classify streams as “constrained” or “unconstrained” based on watershed development. The constraint classes combined with biological index condition scores are then used to identify appropriate management priorities. For example, a monitoring site with an observed biological index score below the 10<sup>th</sup> percentile of reference expectations and below the predicted range for an unconstrained site could be assigned a higher management priority relative to a site that is scoring within the range that is expected based on landscape development.

The SCAPE application is an effective tool for managers to identify streams where management actions and resource expenditures are most warranted and are expected to have intended outcomes within the constraints of landscape pressures. SGRRMP members used SCAPE to prioritize five sites where observed scores were outside the predicted ranges for further investigation; another 45 sites were given a high, medium, or low priority for restoration. Ongoing work between SGRRMP and SCCWRP is leveraging SCAPE to identify follow-up actions at high priority sites, including the development of a framework to guide investigations and approaches for interpretation and analysis of supporting data. For more information, contact Marcus Beck ([marcusmb@sccwrp.org](mailto:marcusmb@sccwrp.org)) or Scott Johnson ([scott@aquaticbioassay.com](mailto:scott@aquaticbioassay.com)).



Management priorities identified for the San Gabriel watershed using the online SCAPE tool (<http://shiny.sccwrp.org/scape/>).

## Volunteer Monitoring News

### Missouri Stream Teams

Mark and David Kuechenmeister, along with Mike Swoboda, are Stream Team #888. They have been monitoring Maline Creek four times a year for twenty-two years. Their site is in Forestwood park in Ferguson, Missouri. The data they collect is sent to the Missouri Department of Natural Resources (MoDNR). It takes the team about two and a half hours to perform their monitoring activities each time they visit the creek. The work they do includes a visual check of the stream banks, riparian cover, and streambed composition. They observe the algae in the creek to see how much and what type it is (filamentous or non-filamentous). Stream Team 888 tests for pH, conductivity, temperature, dissolved oxygen, phosphates, nitrates, ammonia, hardness, alkalinity, turbidity, and chlorides. Then they do three net samples for identification of macroinvertebrates. Lastly, the team measures streamflow.

The MoDNR provides training and equipment needed. Stream Team 888 also pulls trash out of the creek and helps other stream teams pull out trash out of their creeks. Stream Team 888 also helps monitor five other creeks in Missouri. In addition, the team frequently attends learning activities throughout the state, including how to identify the flora and fauna of Missouri streams.

Missouri Stream Teams are monitoring how much road salt enters the streams and the effect on creek life. There are over 50 sites that are tested for road salts every week during the winter. Mark goes out to Maline Creek every week of winter to measure air and water temperature, take a conductivity reading, chloride sample, and test for hardness.

In Missouri there are over 5,871 Stream Teams helping out Missouri streams. In 2017, there were more than 141,000 volunteer hours, and 1,104 monitoring trips, representing a value of over \$3.4 million worth of volunteer labor. Volunteers removed 437 tons of trash, planted 10,466 trees, and worked on 196 habitat improvement projects. Mark and his team say they are just happy to be a part of this wonderful program and look forward to many more years helping our streams. To learn more, go to [mostreamteam.org](http://mostreamteam.org). For more information, contact Mark Kuechenmeister, [markkstreamteam888@juno.com](mailto:markkstreamteam888@juno.com).



## Oysters Make a Comeback

2017 was a record rainfall year for California, and most of the state welcomed the moisture following years of drought. However, the consistent rainfall between January and March 2017 brought so much freshwater into the San Francisco Bay that salinity at The Watershed Project's oyster reef dropped below 10 parts per thousand (ppt) for over two months. Built by volunteers and deployed in 2013, the reef provides substrate for oysters to grow in an area that is mostly mudflat. Native to the Pacific coast, Olympia oysters are best adapted for salinities greater than 25ppt. While they can close during inclement conditions, they were not able to survive such a long period without feeding. By the end of March 2017, 97% of the oysters on the reef had died, and other oyster restoration projects in the bay noted similar die-offs.

This is not the first time that rainfall has caused oyster die-offs in the San Francisco Bay and elsewhere, but it is something that may be happening more frequently in the future. Climate change models predict that we'll see more extremes in California weather, including both very dry and very wet years. [Research](#) indicates that a suitable salinity is one of the most important environmental factors that support an oyster population. The Watershed Project volunteers are finding upwards of 300 small oysters per reef ball, which is approaching where the population stood before the Winter 2017 die-off. This means that enough mature oysters were present in the area to seed the reef during their spawning season this last summer. The Watershed Project will continue to monitor the growth of oysters on the reef and hope that this winter brings a few breaks in the rain to allow the bay salinity to increase again. For more information on our Wild Shorelines Program, please contact Helen Fitanides at [helen@thewatershedproject.org](mailto:helen@thewatershedproject.org).



## Macro-program tests for Microplastics

On a warm day in May, you might find a hundred citizen scientists in the Niagara River Watershed, monitoring water quality and contributing to the restoration of shoreline habitats. In 2018, the Niagara River Watershed suite of citizen science monitoring programs was improved by the addition of a microplastics aquatic surveying program. In partnership with Labatt USA, Buffalo Niagara Waterkeeper engaged volunteers from their staff to learn how to sample for microplastics and how they impact local waterways. These dedicated volunteers sampled eight waterways during May – October testing for the presence or absence of microplastics. This season, they are excited to add to our microplastics monitoring with a newly developed shoreline sampling protocol that will collect data about micro and macroplastics along the shores of seven local waterways.

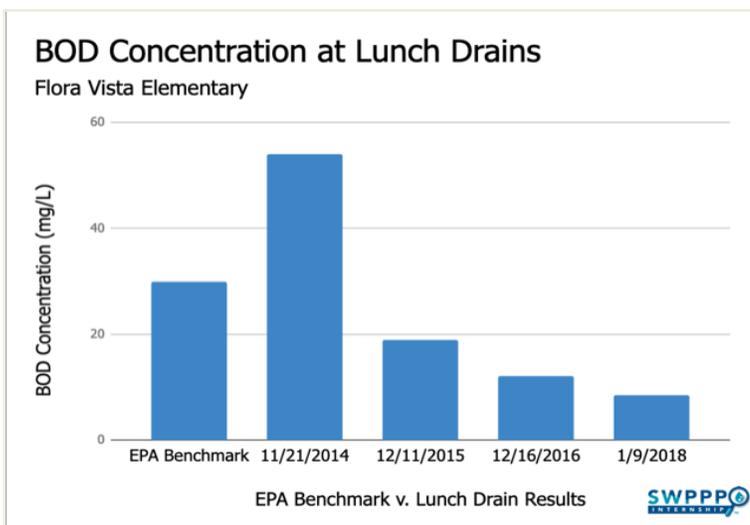


The combination of water quality monitoring programs and the commitment of partner organizations and volunteers help Buffalo Niagara Waterkeeper keep up to date on the state of their waters. The impact that microplastics have on local ecosystems is just beginning to be understood. For more information on this project please contact Claudia Rosen at [crozen@bnwaterkeeper.org](mailto:crozen@bnwaterkeeper.org) or (716) 852-7483 x 14.



Labatt USA volunteers sampling microplastics.

## Students Reduce Stormwater Runoff Pollution from School Site



Fifth and sixth grade SWPPP (Storm Water Pollution Prevention Plan) interns at Flora Vista Elementary School in Encinitas, CA celebrated a measurable reduction in pollutants entering the storm drains on their campus. These young environmentalists are completing a SWPPP for their school site and developing sustainable solutions to reduce pollutants draining from their campus as part of the SWPPP Internship™ Program.

Since 2013, over 1,200 students in San Diego County have collected rain event samples, analyzed lab results to evaluate their designs, newly developed practices, and physical structures. Their goal is to achieve water quality improvements through their internship. Along the way, interns develop essential real-world skills and learn about

careers in the water quality industry, all while addressing state and regional water quality regulations. The overall program goals are to achieve water quality improvements beyond physical structures by educating a larger audience about stormwater pollution and, more importantly, to engage, encourage, and embrace future environmental stewards to affect meaningful change in their communities. For more information, visit [www.swpppinternship.com](http://www.swpppinternship.com), or contact Leanne Vennemeyer ([leanne@bckprograms.com](mailto:leanne@bckprograms.com)).

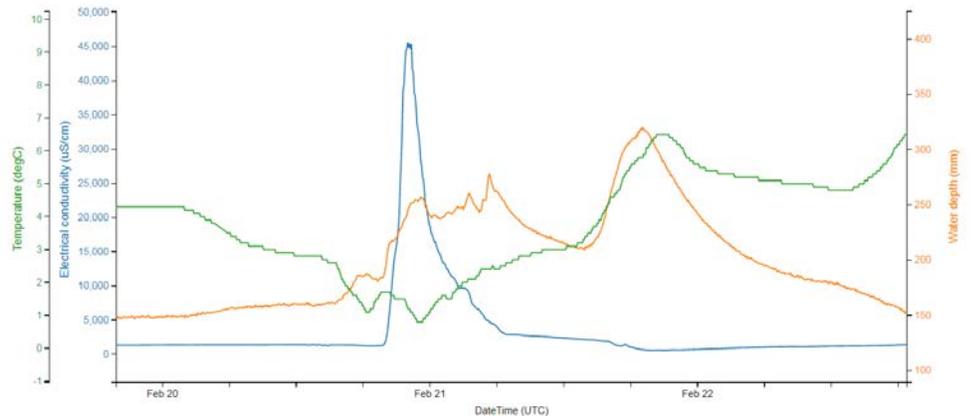
## Foundation Building - A Citizen Science-Based Network of Continuous Sensors in the Delaware River Basin

In close collaboration with watershed groups, land trusts, universities, and schools, and with support from the William Penn Foundation, Stroud Water Research Center has deployed over 70 continuous stream sensor stations across the Delaware River Basin (DRB). All stations are equipped with a CTD (conductivity, temperature, depth) sensor, many with a turbidity sensor, and a few with a dissolved oxygen sensor. Many of the stations are online and transmitting real-time data via 2G cell signal to an online data portal at [MonitorMyWatershed.org](http://MonitorMyWatershed.org). Data from stations that are located in areas without cell coverage can be uploaded to the data portal. All registered sensor stations appear on a map where users can discover metadata about each station. Users can also quickly zoom



to a desired time interval and visualize time-series data, which can be sorted, filtered, and displayed in time-series plots with functionality that allows for multi-parameter and multi-site comparisons.

Workshops, user group gatherings, training materials and manuals, classroom curricula, and communication platforms have been developed by the Stroud Center and collaborators to promote the widespread adoption of this open-source hardware and software system for environmental monitoring within the DRB and beyond. To support the goals of the Delaware River Watershed Initiative ([4states1source.org](http://4states1source.org)) and to build a self-sustaining long-term network, leadership groups have been established with members representing several neighboring organizations, specifically, The Nature Conservancy (Delaware), Musconetcong Watershed Association, East Stroudsburg University, The Watershed Institute, Trout Unlimited (New Jersey), Willistown Conservation Trust, Green Valleys Association, Berks County Conservation District, and Penn State Master Watershed Stewards. Over 30 other nonprofit organizations, schools, and universities are collaborating in the DRB effort by managing sensor stations and building capacity for watershed monitoring and environmental education. Participating organizations are working to analyze and synthesize data, provide education and outreach to local communities, and communicate results at various conferences and meetings. Teams are also organizing to support quality control, rating curve development, and sediment and salt loading estimations.



Volunteers from Stroud Water Research Center, Willistown Conservation Trust, and Drexel University.

This citizen science project is not only designed to gather viable research-quality data; it is also intended to help build science and monitoring capacity across the DRB with long-term volunteer support. Motivations for participating in this network are diverse. Some are interested in quantifying ecological relationships in their watersheds while other groups are focused on broadening cultural science literacy to impact environmental policy and management. Resources that have been developed and shared to support this effort include Monitor My Watershed® ([MonitorMyWatershed.org](http://MonitorMyWatershed.org)) and Model My Watershed® ([ModelMyWatershed.org](http://ModelMyWatershed.org)), EnviroDIY.org™ (a community for do-it-yourself environmental science and monitoring), a private DRB-based online group, online manuals and data sheets, and automated rating curve and load calculation spreadsheets, which are all a part of the broader WikiWatershed.org® toolkit.

For information on this project contact David Bressler ([dbressler@stroudcenter.org](mailto:dbressler@stroudcenter.org)), John Jackson ([jkjackson@stroudcenter.org](mailto:jkjackson@stroudcenter.org)), Matt Ehrhart ([mehrhart@stroudcenter.org](mailto:mehrhart@stroudcenter.org)), or David Arscott ([darscott@stroudcenter.org](mailto:darscott@stroudcenter.org)).



## Recent Publications

### *Cryptosporidium* parasite detected in Minnesota Ggroundwater

When consumed in contaminated water, the microscopic parasite *Cryptosporidium* can cause symptoms of stomach cramps, diarrhea and fever. Now, researchers reporting in the ACS journal *Environmental Science & Technology* have detected evidence of the parasite in about 40 percent of surveyed wells in public water systems in Minnesota — even wells not influenced by surface water. The team emphasizes that they don't know whether the parasite levels are high enough to cause health concerns.

Most *Cryptosporidium* outbreaks associated with drinking water sources have been traced to surface waters such as lakes and rivers that become contaminated by sewage discharge or livestock runoff. For example, *Cryptosporidium* was responsible for the largest waterborne disease outbreak in the US (Milwaukee, 1993). In contrast, water from aquifers deep within the ground was not thought to be as vulnerable because the overlying soil and sediments can filter out *Cryptosporidium* oocysts. The U.S. Environmental Protection Agency requires that public water systems with a surface water source monitor and treat for *Cryptosporidium* contamination, whereas groundwater is exempt from these regulations unless known to be infiltrated by surface waters.

Mark Borchardt and colleagues at the U.S. Department of Agriculture-Agricultural Research Service, U.S. Geological Survey and Minnesota Department of Health wondered if they could detect *Cryptosporidium* parasites in public water system wells with variable surface water influences. Over a two-year period, the researchers collected water samples from 145 wells supplying public water systems across the state of Minnesota. They tested for *Cryptosporidium* DNA with a sensitive technique called quantitative polymerase chain reaction (qPCR). The team found that 40 percent of the wells tested positive for *Cryptosporidium* at least once, while 15 percent were positive more than once. The standard microscopic method also showed *Cryptosporidium* in some of the wells.

The prevalence and levels of contamination were similar regardless of whether groundwater was influenced by surface water. These results suggest that soil may not completely prevent *Cryptosporidium* oocysts from reaching groundwater, and therefore, “monitoring and treatment measures should be considered for groundwater-supplied public water systems,” the researchers say. The new findings also indicate that additional work is needed to better understand how the *Cryptosporidium* got into deep groundwater wells and to characterize potential health threats.

### Recent Workshop and Book Chapter Focus on Real-Time Water-Quality Monitoring

A workshop dedicated to real time water-quality monitoring was held November 7-8, 2018 in St. John's, Newfoundland, Canada. The 2018 Real Time Water Quality Workshop brought together over 100 representatives of Canadian federal, provincial, and local agencies; two US federal agencies, academic institutions, citizen monitoring organizations, equipment and software vendors, and industry. The workshop featured technical exchanges of information, ideas, expertise, and problem solving in real-time water-quality monitoring as well as vendor exhibits. The 2018 workshop was convened by the Province of Newfoundland/Labrador with support from Environment and Climate Change Canada.

The keynote presentation at the St. John's work shop traced innovations in monitoring with water-quality sensors over the past 65 years. Innovation has been a key success factor in the development and use of water-quality sensors worldwide. The presentation was adapted from a book chapter titled “Innovations in Monitoring with Water-Quality Sensors with Case Studies on Floods, Hurricanes, and Harmful Algal Blooms” by Donna Myers, Scientist Emeritus, with the U.S. Geological Survey (USGS). The chapter is planned for release in June 2019 in the Elsevier book *Evaluating Water Quality to Prevent Future Disasters*. An overview presentation of the USGS continuous water-quality network and another on USGS techniques in data collection, processing and dissemination were given by Patrick Rasmussen, USGS. A total of 19 presentations from the 2018 work shop are available on the work shop's [web site](#) along with presentations from similar workshops held in 2007, 2009, and 2011.



## Upcoming Conferences and Workshops

### Canadian Water Resources Association National Conference

Canadian Water Resources Association (CWRA) and Canadian Water Summit are excited to announce [Water Week at Blue](#), a collaboration of two of Canada's premier water events with leading expert keynote speakers, conference sessions, technical workshops, industry awards, and many networking opportunities that will be held May 26-29, 2019 at Blue Mountain Resort in New Collingwood, Ontario. At the beginning of the week, CWRA will host its 72<sup>nd</sup> National

Conference with the theme **"Shared Water, Competing Ethics: Collaboration in Water Management"** followed by the 10<sup>th</sup> annual Canadian Water Summit which will explore **"Progress, Prosperity, and Partnerships: Driving Innovation in the Blue Economy"**.



<b>CWRA</b>	<b>ACRH</b>
Canadian Water Resources Association	Association Canadienne des Ressources Hydriques



### 39<sup>th</sup> International Symposium of the North American Lake Management Society

The [International Symposium](#) of the North American Lake Management Society (NALMS) will be held November 10-14, 2019 in Burlington, Vermont. This year, NALMS is working this year to encompass a broader range of lake management topics, integrating considerable program elements for citizen scientists as well as reflecting new advances on the technical side of lake management.

### 2019 Tribal Lands and Environment Forum

This year is the 10<sup>th</sup> anniversary of the Tribal Lands and Environment Forum (TLEF). TLEF is collaboratively sponsored by ITEP, the Tribal Waste and Response Steering Committee and US EPA Office of Land and Emergency Management. It will be held at the Palm Springs Renaissance Hotel and Convention Center in Palm Springs, California, August 19-22, 2019.

The TLEF will feature special trainings, field trips, and breakout sessions focused on the conference theme: *A National Conversation on Tribal Land and Water Resources*. Topics highlighted at the TLEF include solid/hazardous waste management, brownfields, UST/LUSTs, Superfund sites, and emergency response. Tribal water program topics – water quality, drinking water, and habitat restoration (e.g., wetlands, streams and fisheries) will be included in breakout sessions, training and field trips. The registration fee is \$25 for the 2019 TLEF. To get the latest information, you [may visit www7.nau.edu/itep/main/Conferences/conf\\_r\\_tlef](http://www7.nau.edu/itep/main/Conferences/conf_r_tlef), or you may contact Todd Barnell, Project Director at [Todd.Barnell@nau.edu](mailto:Todd.Barnell@nau.edu), or Julie Jurkowski, Program Coordinator Sr., at [Julie.Jurkowski@nau.edu](mailto:Julie.Jurkowski@nau.edu).

### Summer Opportunities at Iowa Lakeside Laboratory

Three courses related to algae and diatoms are being offered in Summer 2019 at Iowa Lakeside Laboratory. Ecology & Systematics of Diatoms and Ecology & Systematics of Algae classes target advanced undergraduates, grad students, post-docs, teachers, and professionals. College Prep Diatoms is a class for high school students with the opportunity to earn college credit. For more Information/Registration go to: [iowalakesidelab.org/courses](http://iowalakesidelab.org/courses) or contact [lakesidediatoms@gmail.com](mailto:lakesidediatoms@gmail.com). For information on College Prep Diatoms, go to: [iowalakesidelab.org/sites/iowalakesidelab.org/files/wysiwyg\\_uploads/cpd\\_2019\\_flyer\\_updated\\_0.pdf](http://iowalakesidelab.org/sites/iowalakesidelab.org/files/wysiwyg_uploads/cpd_2019_flyer_updated_0.pdf)



## Water Quality Technology Conference 2019

The Water Quality Technology Conference, sponsored by the American Water Works Association, provides a practical forum for a wide range of water technology professionals to exchange the latest research and information. This year's meeting will take place November 3-7, 2019 in Dallas, Texas.



Do you have water-quality monitoring topics or issues you would like to see in the next edition of the newsletter or covered in a webinar? Are there topics you would like the National Water Quality Monitoring Council to address in coming months and years? If so, feel free to reach out and let us know about your ideas.

Please contact us by emailing [NationalMonitoringCouncil@gmail.com](mailto:NationalMonitoringCouncil@gmail.com) with "Suggestion Box" in the subject line or visit our website to submit a suggestion. We will do our best to address concerns and issues that are raised by our audience.

*The winds are changing.  
Currents are slow but run deep.  
Water is love, life.*  
Helen Fitandes, The Watershed Project

*Humble treasures, Earth's  
Water, Accept our Hearts, Minds  
Work as welcome gift.*  
Ed Furlund, USGS Denver



Fluid5K runners sprint down the 16th Street Mall at the 2019 NMC.

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*To submit an article, conference announcement, publication, or photo for our Fall 2019 Newsletter, contact [chopkins@usgs.gov](mailto:chopkins@usgs.gov).*

