Nonpoint Source
News-Notes

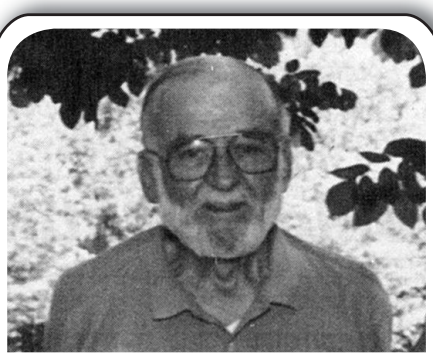
March 2018, #102

The Condition of the Water-Related Environment
The Control of Nonpoint Sources of Water Pollution
The Ecological Management & Restoration of Watersheds

United States Environmental Protection Agency

Farewell to Nonpoint Source News-Notes

It's a bittersweet moment. After 102 issues and 29 years, the U.S. Environmental Protection Agency (EPA) will cease publication of *Nonpoint Source News-Notes*. This is the final issue, although the archived issues will remain available on EPA's *News-Notes website*. We dedicate Issue #102 to Harold (Hal) Wise (1917–1994), who founded *News-Notes* in 1989 near the tail of a storied career where he became known as the father of state planning. For more insights on the impact Hal had on the environment and on his friends and colleagues, read "A Tribute to a Wise Man" in *News-Notes* Issue 36. As Hal noted in the introduction to the very first issue, *News-Notes* was intended to "highlight and report what is happening in those states that are tackling the management of nonpoint sources of pollution and the improvement of water quality," and that it would feature "reports on significant EPA and other federal agency activity, as well as private, corporate and citizen group contributions." The writers and editors of *News-Notes* have faithfully followed his vision ever since. Thank you, Hal.



We are grateful to Hal Wise, father of *NPS News-Notes*. See p. 24 for more details.

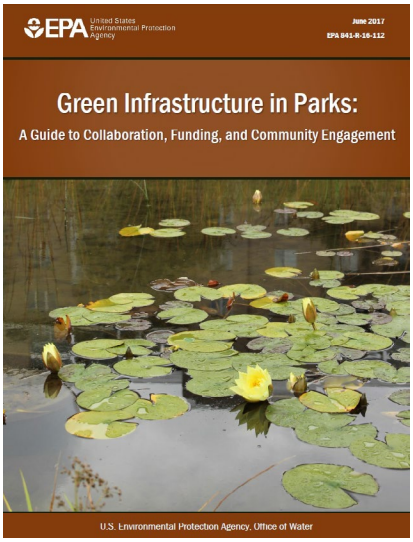
Inside this Issue

All issues of EPA's *Nonpoint Source News-Notes* have been posted online and are available at www.epa.gov/newsnotes.

Notes on the National Scene

Green Infrastructure in Parks: Encouraging Community-Based Partnerships

Public park land and other green spaces serve their surrounding communities in many ways—providing recreational outlets, offering peaceful places for respite and reflection, preserving the environment, and often protecting water quality. To help managers realize their parks' full potential, the U.S. Environmental Protection Agency (EPA) recently released *Green Infrastructure in Parks: A Guide for Collaboration, Funding, and Community Engagement*. The guide is intended to encourage partnerships between park agencies and stormwater agencies to improve park lands, increase access to parks, better manage stormwater, increase community resiliency to changing weather patterns, and provide funding to implement and maintain park enhancements that benefit communities.



The Green Infrastructure in Parks guide helps park managers realize their parks' full potential.

The guide is designed to help stakeholders collaborate to use green infrastructure to improve park lands. The sections walk readers through the multistep process of:

- Identifying and engaging partners, such as elected officials, park superintendents, stormwater utility managers, water regulatory agencies, or staff from departments of conservation or natural resources.
- Building relationships and collaborating to identify common goals.
- Leveraging funding opportunities such as mutually beneficial funding partnerships with water providers, stormwater utilities and watershed groups.
- Identifying green infrastructure opportunities, looking for ways to restore riparian areas and areas with well-draining soil to capture and treat runoff from impervious surfaces and other drainage areas.
- Planning for maintenance, including identifying necessary tasks, funding sources, and agencies' specific roles and responsibilities over the long term.
- Undertaking high-visibility projects to garner support from the community for additional green practices.

Case studies are included to illustrate the approaches presented in the guide. These real-life examples portray how partnerships between municipal stormwater agencies and parks departments have improved recreational resources in the community, enhanced environmental protection, and reduced risks and burdens. For those who wish to go deeper into a topic, the guide includes short descriptions and links to external resources that provide more detail on the material presented within.

Clearinghouse Helps Communities Finance Water Projects

Are you looking to upgrade your community's water resources infrastructure and make other improvements to protect your local waters? The U.S. Environmental Protection Agency's (EPA's) Water Finance Center developed the web-based Water Finance Clearinghouse (Clearinghouse) portal (www.epa.gov/wfc) to connect communities with funding sources and financing resources. The Clearinghouse provides communities with searchable databases featuring more than $10 billion in potential water funding sources and more than 600 water finance resources (e.g., reports, tools, case studies) to support local water infrastructure and watershed protection projects.

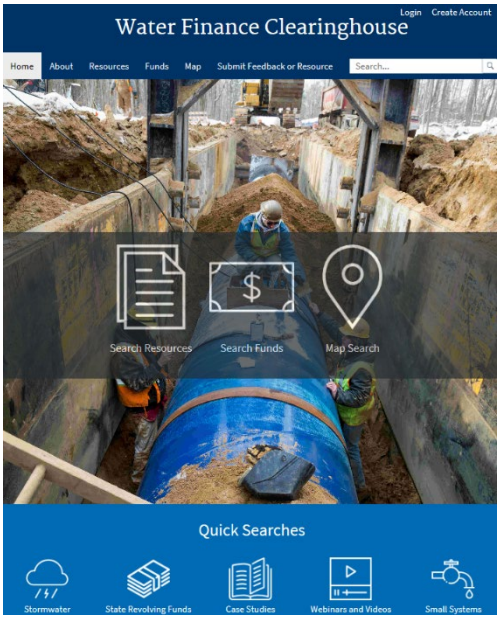
Are You Looking for EPA's Catalog of Federal Funding Sources for Watershed Protection?

No worries. This information has been folded into the Water Finance Clearinghouse database for your convenience.

The Clearinghouse consolidates and expands upon existing EPA-supported databases to create a one-stop-shop that serves all community water finance needs. Several separate resource- and funding-related databases have been rolled into the new Clearinghouse, including EPA's Catalog of Federal Funding Sources for Watershed Protection, EPA's Federal Funding for Water and Wastewater Utilities in National Disasters (Fed FUNDS), and the Environmental Finance Center Network's Funding Sources by State factsheets. The content of the Clearinghouse emphasizes financing, funding, and capacity development, and all linked-to resources are free of charge. The

information provided through the Clearinghouse helps communities make financing decisions for watershed protection and their specific drinking water, wastewater, stormwater and green infrastructure needs.

"Communities need easy and efficient access to water infrastructure finance information," explains Kristyn Abhold, a financial analyst with EPA's Water Finance Center (Center). "Before the Clearinghouse was launched, the Center had to direct communities seeking water finance information and funding sources to multiple websites. It was time-consuming and difficult for communities to locate information. The Center developed the Clearinghouse to meet this need. The Clearinghouse is a one-stop-shop for all things water finance."



The online Water Finance Clearinghouse portal connects communities with funding sources and financing resources.

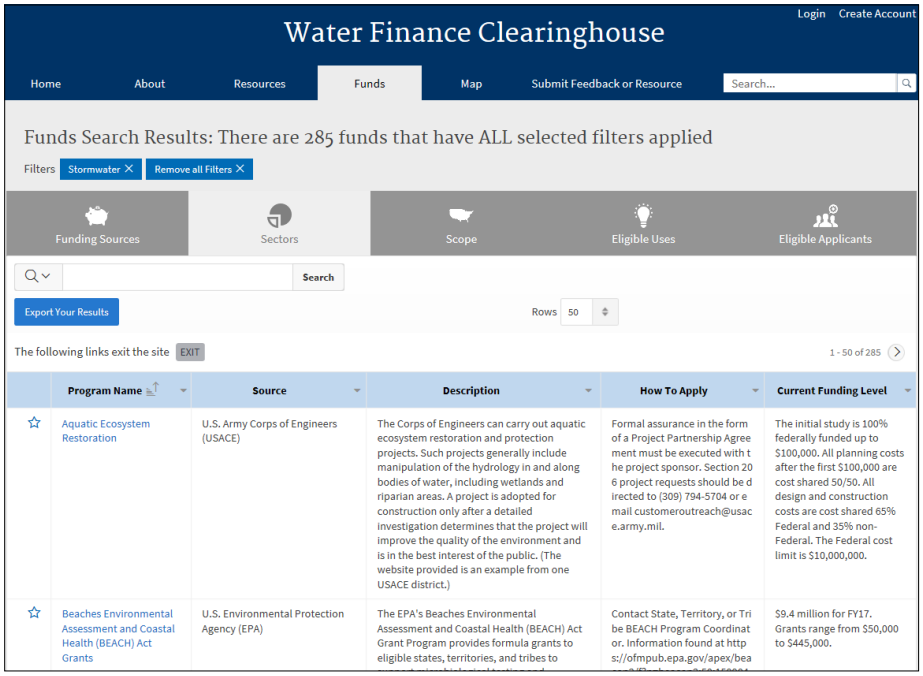
How Does the Clearinghouse Work?

The Clearinghouse features two searchable databases: Resources and Funds. The Resources database contains reports, tools, webinars, case studies and other resources offering information about water financing mechanisms and approaches. The Funds database contains federal, state, local, nongovernmental organization, and some private funding sources that are available to support water infrastructure and watershed protection projects. The Clearinghouse currently contains nearly 600 resources and funding sources specifically focused on stormwater and green infrastructure financing.

You can search for specific financial information by state, region, community population size, keyword, sector (e.g., agriculture, green infrastructure, septic/decentralized), funding source, financing approach, author and resource type. By applying multiple filters, you can narrow down the results and find specific information that meets your needs. Search results can be sorted by column heading, marked as a favorite, saved for later, and can be exported to Excel with the hyperlink to the specific resource(s). Users can create a General User account to view saved searches and subscribe to receive notifications when new resources and funding sources are added to the Clearinghouse.

Accessing Watershed Protection and Restoration-Related Information

The Clearinghouse dataset is large and diverse. The easiest way to access financing and available funding information pertaining to watershed protection, nonpoint source pollution, green infrastructure and similar topics is by typing those terms into the keyword text box. The Clearinghouse will identify resources that include the specified search term in the resources title, author and description.



A search on funding sources using the pre-tagged "Stormwater" sector generates a list of 285 funding sources.

For a more targeted list of resources, you may search by a specific sector (e.g., agriculture, green infrastructure, stormwater, septic/decentralized) or via the "special topics" or "eligible uses" tabs, which allow you to search through information that is pre-tagged (e.g., as watershed protection, source water, conservation, economic development, community engagement and communication). Example watershed-related resources in the Clearinghouse include grant/loan funding source information such as the Clean Water State Revolving Fund (CWSRF), Total Maximum Daily Load (TMDL) Water Quality Restoration

Clearinghouse Helps Communities Finance Water Projects (continued)

Grants, and Clean Water Act Section 319(h) Grants, while resource searches reveal informative guidebooks and reports such as *Staying Green: Strategies to Improve Operations and Maintenance of Green Infrastructure in the Chesapeake Bay Watershed* and *Sustainable Finance for Watersheds*.

How Often Will the Clearinghouse be Updated?

The Clearinghouse is updated in real-time. States, federal agencies, and other water sector stakeholders may suggest edits or the addition of new resources or funding sources at any time by creating a Clearinghouse Contributor account. This is especially valuable for users who are part of funding networks who routinely publish or produce water finance-specific resources and/or those that manage water funding sources. Stakeholders can use this interactive feature to manage how their programs and initiatives are displayed in the Clearinghouse, and they can edit and verify that their content is accurate and complete. In addition to content review by Contributors, EPA plans to review and update content annually.

The Water Finance Center is soliciting feedback on Clearinghouse content and functionality from funding agencies and users. EPA has been conducting outreach to major water associations through postings on numerous listservers, through a series of webinars, and by attending and presenting at numerous conferences. Since the Clearinghouse's launch in July 2016, it has received more than 34,200 hits.

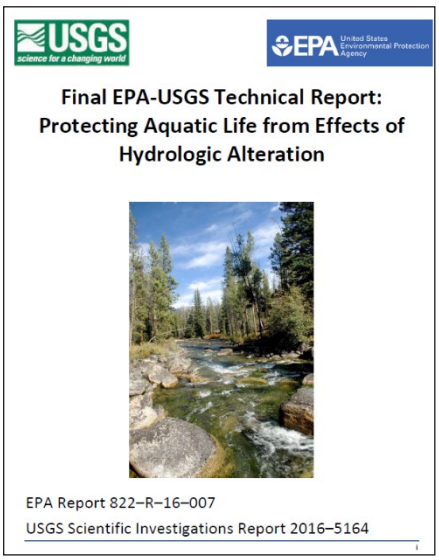
Water Infrastructure and Resiliency Finance Center

The Water Infrastructure and Resiliency Finance Center (Center) is an information and assistance center, helping communities make informed decisions about their drinking water, wastewater and stormwater infrastructure to protect human health and the environment. The Center identifies financial solutions to help communities meet infrastructure needs; provides financial advice, support and technical assistance through Environmental Finance Centers; provides expertise to the national water conversation; and builds relationships through Regional Water Finance Forums.

[For more information, or for a personal demonstration of the Clearinghouse's capabilities, please contact Kristyn Abhold, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, N.W., Mail Code 4201C, Washington, DC 20460; Phone: 202-566-2730; Email: abhold.kristyn@epa.gov]

Report Outlines Tools to Protect Aquatic Life from Hydrologic Alteration

Do you know the extent to which human activities and unpredictable weather events can harm aquatic life? Do you need suggestions on how to protect your streams from extreme weather events? In December 2016 the U.S. Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS) released a joint technical report, *Protecting Aquatic Life from Effects of Hydrologic Alteration*, to help you with these questions. The authors explain how changes in natural flow systems can harm aquatic ecosystems, and then present example narrative water quality assessment criteria and outline strategies that states, tribes and territories can use to asses and protect waterways.



Joint EPA/USGS report provides strategies to protect aquatic communities from flow-related challenges.

Landscape and water management modifications such as dams, urban development, and agricultural practices are causing changes in the magnitude and frequency of flood flows and base flows, peak flow timing, and other flow characteristics in U.S. streams and rivers. Some activities directly add or remove water from streams and cause flows to be unusually high or low for long periods of time. Adding to the challenge, in many places weather is becoming more unpredictable (e.g., more frequent extreme weather events, including droughts and lower-than-normal snow pack thickness).

How Does Hydrologic Alteration Affect Aquatic Life?

A water body's ability to support aquatic life depends on water flow and dependable water temperatures and chemistry. Changing the natural flow conditions can impact river ecosystems in many ways:

- Habitat damage. An increase in the duration and frequency of high flows can damage aquatic habitat (streambed scouring and streambank erosion), and can widen the floodplain.

Report Outlines Tools to Protect Aquatic Life from Hydrologic Alteration (continued)

- Changes in water conditions. Altered flow can lead to changes in water chemistry, sedimentation and temperature.
- Ecosystem disconnection. Stream flow variability can affect the upstream–downstream properties of a natural stream, changing the connections between surface water and groundwater and also between areas of high-quality habitat.
- Life cycle interruption. Streams with altered flows can fail to provide the flow-based cues or signals needed by aquatic species to prompt them to complete their life cycles (e.g., flow-directional cues that indicate which way and when to migrate), thereby disrupting successful reproduction.
- Invasive species introduction. Flow changes can allow invasive and non-native aquatic species to become established within the aquatic system, which can displace native species.

Report Offers Example Water Quality Criteria and Flexible Framework for Water Resource Managers

To help water resource managers plan ahead to protect their local waters from the potential negative effects of hydrologic alteration, the report provides 10 examples of narrative water quality standards that states and tribes have adopted. The narrative language addresses the type of resource to be protected and/or the protection goal. It also provides one or more statements describing the hydrologic condition needed to be maintained to achieve the protection goal.

What is Hydrologic Alteration?

Hydrologic alteration, or flow alteration, is a change to the natural flow regime in a waterway or other aquatic system. It can be further intensified by human activities and unpredictable weather events, and can contribute to the impairment of water bodies that are designated to support aquatic life. Example sources of flow alteration include:

- Dams and impoundments (including for hydropower)
- Diversions (including for hydropower)
- Groundwater withdrawals
- Effluents and other artificial inputs
- Land cover alteration

The report also presents a flexible framework that states and others can use to establish quantitative flow targets. Incorporating EPA's *Guidelines for Ecological Risk Assessment*, the framework consists of eight steps, beginning with how to identify biological goals and assessment endpoints and ending with how to evaluate effects on aquatic life under varying degrees of flow alteration. The framework first focuses on the processes and information needed to evaluate relations between flow and aquatic life. It then leads readers through the development of narrative or numeric flow targets that can be used in a state water quality management program.

For more information see EPA's Final EPA/USGS Technical Report: Protecting Aquatic Life from Effects of Hydrologic Alteration Documents website, which includes a link to the full document, a fact sheet, and public and peer comment response documents.

Special Focus: Nutrient Pollution and Algal Blooms

Summer 2017 Gulf of Mexico Hypoxic Zone Was Largest in Recorded History

Scientists have determined that the summer 2017 Gulf of Mexico's hypoxic zone, sometimes referred to as the "dead zone," was the largest measurement since mapping of the zone began in 1985. This zone, an area of low-oxygen water (less than 2 ppm) that cannot sustain fish and marine life, covered 8,776 square miles (mi^2)—an area roughly equal to the size of New Jersey. Each year, the Mississippi and Atchafalaya rivers carry enormous loads of wastewater from cities in the American heartland and nutrients lost from millions of acres of farm fields to the northern Gulf of Mexico. These nutrients feed large algal blooms that, in turn, cause a hypoxic (low oxygen or "dead") zone to form in bottom waters of the Gulf of Mexico. Much of the nutrient losses to the Gulf occur during heavy rains and floods. In very wet years like last year, the hypoxic zone is far larger than its average size. In July 2017 the zone was about 50 percent larger than the 5,806-square-mile average measured over the past five years, and was more than four times larger than the

Need More Hypoxia Information?

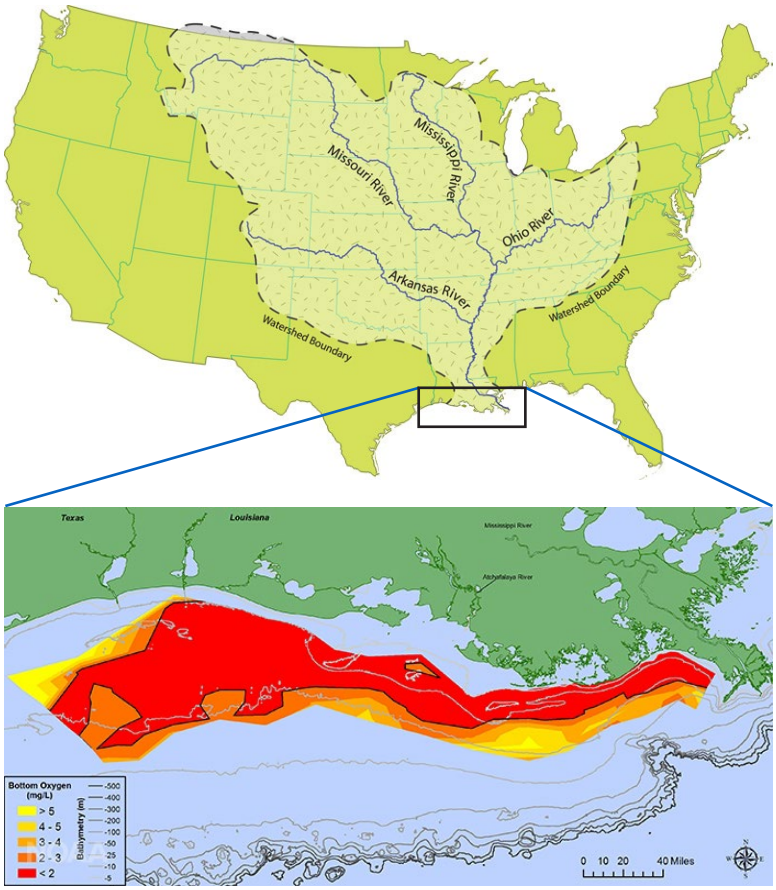
More information about hypoxia is available on the U.S. Environmental Protection Agency's Hypoxia 101 website and on the National Oceanic and Atmospheric Administration's National Ocean Service Hypoxia website. The Louisiana Universities Marine Consortium offers a flash animation that visually explains the processes that lead to hypoxia.

five-year average target size of approximately 1,900 mi^2 established by the Mississippi River/Gulf of Mexico Hypoxia Task Force.

What Causes Gulf Hypoxia?

The Gulf of Mexico hypoxic zone, where dissolved oxygen is too low for many aquatic species to survive, is fueled by nutrients (nitrogen and phosphorus) delivered from the Mississippi–Atchafalaya River Basin and is also affected by stratification (layering) of waters in the Gulf. Nutrient-laden freshwater discharging from the Mississippi–Atchafalaya River is warmer and less dense than the deep ocean water of the Gulf, and tends to collect in an upper, less-saline surface layer. This stratification of the water column restricts mixing of oxygen-rich surface water with oxygen-poor deep water. Additionally, excess nutrients in the Gulf trigger an overgrowth of algae that rapidly consumes oxygen when decomposed. This decomposition, coupled with water column stratification, results in hypoxia. Mobile animals (e.g., adult fish) can typically survive hypoxic events by moving to areas of higher oxygen, but this might push them into less optimal habitats, often along the edge of the hypoxic zone. Less mobile animals (e.g., clams, worms) that typically constitute critical food sources for fish populations cannot move to higher oxygen waters and are often killed during hypoxic events.

Mississippi–Atchafalaya River Basin and the 2017 Hypoxic Zone



The Gulf of Mexico 2017 hypoxic zone *(Hypoxic zone map: N. Rabalais, LSU/LUMCON)*

The Mississippi–Atchafalaya River Basin is the third largest in the world. Parts or all of 31 states plus two Canadian provinces drain into the Mississippi River, totaling 41 percent of the contiguous United States. Before reaching the Gulf of Mexico, the Mississippi River meets up with its distributary, the Atchafalaya River.

Large 2017 Hypoxic Zone Was Forecasted

The wide extent of the summer 2017 hypoxic zone was not unexpected. In June 2017 the National Oceanic and Atmospheric Administration (NOAA) had predicted that the size of the 2017 hypoxic zone would be larger than average because the stream flows in May 2017 were about 34 percent higher than the long-term average and carried higher-than-average nutrient loads. The annual NOAA-sponsored hypoxia forecast assumed typical weather conditions and was modeled based on nutrient runoff and river discharge data collected by the U.S. Geological Survey (USGS) in spring 2017. Through its network of more than 3,000 real-time stream gauges and 60 real-time nitrate sensors, the USGS tracks trends in nutrient loads and concentrations throughout the Mississippi–Atchafalaya River Basin, which drains parts or all of 31 states (41 percent of the lower 48 states). According to the USGS, data indicated that approximately 165,000 metric tons of nitrate (about 2,800 train cars of fertilizer) and 22,600 metric tons of phosphorus flowed down the Mississippi and Atchafalaya rivers into the Gulf of Mexico in May 2017. This nutrient influx was expected to fuel large algae blooms, which in turn would lead to low dissolved oxygen levels in the Gulf of Mexico.

July 2017 monitoring data confirmed the prediction of a large hypoxic zone. During a survey mission in late July, a team of scientists led by partners at the Louisiana Universities Marine Consortium (LUMCON) and Louisiana State University collected water quality data to determine the size of the hypoxic zone. As reported by NOAA in an August 2, 2017, press release, LUMCON found the actual measured hypoxic zone size in the Gulf of Mexico to be 8,776 mi^2—even larger

Nutrient Sources Are Ubiquitous in the Mississippi River Basin and Nationwide

Nutrient pollution is one of America's most widespread, costly, and challenging environmental problems, and is caused by excess nitrogen and phosphorus in the air and water. Addressing nutrients in surface waters can be challenging because nutrients come from many diverse sources, including:

- **Agriculture:** Animal manure, excess fertilizer applied to crops and fields, and soil erosion make agriculture one of the largest sources of nitrogen, phosphorus and sediment pollution.
- **In and around the home:** Fertilizers, yard and pet waste, and certain laundry and dishwashing soaps and detergents contain nitrogen and phosphorus, and can contribute to nutrient pollution. The amount of hard surfaces and type of landscaping on a property can also increase the runoff of nitrogen and phosphorus during wet weather.
- **Stormwater:** When precipitation falls on our cities and towns, it runs across hard surfaces—such as rooftops, sidewalks and roads—and carries pollutants, including nitrogen and phosphorus, into local waterways.
- **Wastewater:** Our sewer and septic systems are responsible for treating large quantities of waste, and some of these systems do not always operate properly or remove enough nitrogen and phosphorus before discharging into surface waters. Even with advanced nutrient removal technology in place at many wastewater treatment plants, not all nutrients can be removed before the effluent is discharged to surface waters.

than the 8,185-mi^2 zone that had been forecasted by NOAA in June 2017. The similarity between predicted and measured hypoxic zone size emphasizes the strong link between the Mississippi River nutrient runoff and the magnitude of Gulf hypoxia. "As algal blooms and hypoxia become more widespread and their effects more pronounced, the USGS's long-term monitoring and real-time sensors, coupled with watershed modeling, will continue to improve our understanding of their causes and the role they play in the Gulf and in lakes and streams across the country," said Don Cline, associate director for the USGS Water Mission Area.

What's Being Done to Combat the Nutrient Pollution that Fuels Hypoxia?

EPA is diligently supporting its partners to combat nutrient pollution in the Mississippi–Atchafalaya River Basin and other U.S. watersheds through a series of activities, including conducting outreach, developing partnerships, providing technical and programmatic support to states, financing nutrient reduction activities, overseeing regulatory programs, conducting targeted research and measuring progress.

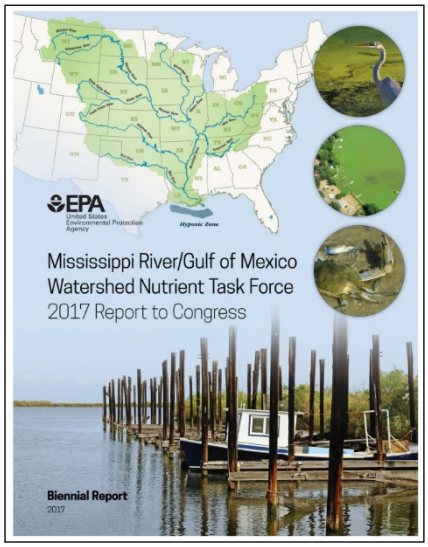
NOAA funds multiyear monitoring and research projects in the Gulf of Mexico through its Northern Gulf of Mexico Ecosystems & Hypoxia Assessment program, known as NGOMEX. Current studies are documenting the dynamics of the hypoxic zone over the Louisiana continental shelf and are better defining the biological, chemical, and physical processes that influence the extent of hypoxic zone development and its impacts on fisheries.

For many years, EPA, its federal partners, and 12 states and tribal partners along the Mississippi and Ohio rivers have worked together through the Hypoxia Task Force (HTF) to reduce the size of the low oxygen zone in the northern Gulf. Each state has a strategy for reducing its nutrient loads. Federal agencies contribute financial, technical resources and scientific expertise, such as the NOAA and USGS support described above. The HTF has quantitative goals for reducing nutrient loads to the Gulf and tracks progress towards its goals. For more information on the HTF and its ongoing work to reduce nutrient pollution, see the next article, Collaborative Nutrient Reduction Efforts Target Gulf of Mexico Hypoxia.

[For more information, see NOAA's August 2, 2017, press release, EPA's Nutrient Pollution webpage, or contact the EPA representative of the Mississippi River/Gulf of Mexico Hypoxia Task Force at: U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds (4501T), 1200 Pennsylvania Avenue, N.W., Washington, DC 20460; Email: ow-hypoxia@epa.gov.]

Collaborative Nutrient Reduction Efforts Target Gulf of Mexico Hypoxia

Higher-than-average spring rainfalls and elevated nutrient loads in early 2017 contributed to a summer 2017 Gulf of Mexico hypoxic zone that encompassed the largest area recorded: 8,776 square miles (mi^2). Despite strong efforts, reducing nutrient loads from a vast landscape, where tens of millions of people live and grow the food that feeds even more, is an extraordinarily large task. The multiagency Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (Hypoxia Task Force, or HTF), established almost two decades ago, collaborates to find and implement solutions to the nutrient enrichment challenges in the Mississippi–Atchafalaya River Basin (MARB) and the Gulf of Mexico.



The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force *2017 Report to Congress* is a biennial progress report required under the Harmful Algal Bloom and Hypoxia Research and Control Amendments Act of 2014.

In February 2015 the HTF announced that it would retain its previous size goal of reducing the five-year average areal extent of the Gulf of Mexico hypoxic zone to 1,900 mi^2 by the year 2035. The HTF agreed on an interim target of a 20 percent nutrient load reduction by the year 2025 as a milestone toward achieving the final goal in 2035. The HTF also agreed to adopt quantitative measures to track progress in reducing point and nonpoint source inputs. As noted in the HTF's *2017 Report to Congress*, myriad partners are collaborating on projects and strategies designed to achieve these goals.

The *2017 Report to Congress* highlights the efforts and achievements of the HTF and its partners as they work together to implement the Gulf Hypoxia 2008 Action Plan. The 2017 report reiterates that HTF members believe the 2008 Action Plan continues to provide a strong framework for reducing nitrogen and phosphorus in the MARB and reducing the size of the Gulf hypoxic zone, mainly by implementing state-level nutrient reduction strategies. The most effective approach to moving forward is for the HTF to accelerate implementation of the activities that were specified in the 2008 Action Plan, while refining specific approaches as better science, new tools, and policy innovations become available.

The 2017 report offers background information about hypoxia and water quality, discusses the history of the HTF and its goals, and describes ongoing efforts such as monitoring and modeling/forecasting (see box) that enable coastal resource managers, the HTF, and the HTF's partners to craft effective strategies and make informed decisions. The report also highlights the HTF's partnerships with land grant universities and others to reduce gaps in research and help conduct outreach, especially to the MARB's agricultural community.

Since the release of the 2008 Action Plan, each HTF state has developed its own nutrient reduction strategy with the help of stakeholders within each state. Each strategy acts as a road map for achieving nutrient reductions in that state, and they collectively serve as the cornerstone for reaching the HTF's overall goals. The 2017 report reviews recent HTF efforts to track the

Hypoxia Project Highlight: Forecasting for Farmers

The HTF's *2017 Report to Congress* describes several efforts to forecast movement of nutrients in the MARB. One of these was expanded into a helpful tool designed to help farmers apply fertilizer at optimum times to limit nutrient runoff to the Gulf of Mexico. First developed in 2008 in Wisconsin, the Runoff Risk Decision Support tool uses National Oceanic and Atmospheric Administration (NOAA) forecast models, including forecasts for precipitation, temperature, snowmelt, and soil conditions up to 10 days into the future. State groups use the results to determine risk levels and develop guidance for farmers based on observations collected at the field scale. State working groups then create maps with this important information, and maintain websites where producers in their states can access these maps when making decisions about applying nutrients to fields. Through funding provided by the Great Lakes Restoration Initiative, NOAA has been expanding and improving the Runoff Risk Decision Support for states across the Great Lakes region (for more information see the Runoff Risk Decision Support fact sheet and explanatory video).

Collaborative Nutrient Reduction Efforts Target Gulf of Mexico Hypoxia (continued)

environmental results of nutrient strategy implementation in 12 states that border the Mississippi and Ohio rivers: Arkansas, Indiana, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, Tennessee and Wisconsin. The report describes efforts by the HTF to develop and report on several common point source and nonpoint source measures that all HTF states will use to measure progress toward the interim target of a 20 percent nutrient load reduction by the year 2025.

[For more information, see EPA's Mississippi River/Gulf of Mexico Watershed Nutrient Task Force webpage, NOAA's Northern Gulf of Mexico Ecosystems & Hypoxia Assessment program (NGOMEX), or the Louisiana Universities Marine Consortium's Gulf Hypoxia website.]

Federal Resources Help Protect People and Wildlife from Harmful Algal Blooms

Did pea-green lakes and rivers appear in your community in 2017? Hot and dry conditions across many areas of the Unites States coincided with elevated nutrient levels in surface waters to create harmful algal blooms (HABs) in waters from California to New Hampshire to Florida. To inform state and local officials and provide them with the tools they need to protect the health of people and wildlife living in their watersheds, the U.S. Environmental Protection Agency (EPA), U.S. Geological Survey, National Oceanic and Atmospheric Administration (NOAA), and other federal agencies offer numerous guidance manuals, news sources, and other resources related to cyanobacteria and HABs. States and communities can access these materials to help protect public health as they prepare for warmer days ahead in 2018. Many states also maintain their own HAB-related web pages.

What are HABs?

HABs are the result of an overgrowth of algal colonies that can have harmful or toxic effects on people or aquatic life (Figure 1). Cyanobacteria, commonly referred to as blue-green algae, are photosynthetic bacteria that occur naturally in surface waters, including those used for primary contact recreation, such as swimming and waterskiing. Under certain conditions, such as high water temperatures and nutrient levels, cyanobacteria can grow rapidly to form dense accumulations known as cyanobacterial blooms. Some harmful cyanobacterial blooms, sometimes called cyanoHABs, produce cyanotoxins (e.g., microcystins, cylindrospermopsin) that have poisonous effects on humans and animals, affect drinking water sources and negatively impact local economies.

Figure 1. Algal blooms, which can occur in nutrient-enriched waters, cause thick, green muck that pollutes the water and can be harmful to people, pets, aquatic life and the economy. *Photo by Eric Vance, USEPA.*

The most common routes of exposure to cyanobacteria and their toxins during recreational activities are:

- By mouth, from accidental or deliberate ingestion of contaminated water.
- Via skin, by direct contact of exposed parts of the body to water containing cyanobacterial cells or by exposure of skin to the water in bathing suits.
- Through inhalation, when HAB toxins are aerosolized (turned into tiny airborne droplets or mist) and are breathed in.

For more information about HABs, including partner resources, graphics/photos, videos, webinars and blogs, see EPA's Harmful Algal Blooms website. [Note: resources on exposure to cyanotoxins through drinking water are addressed on EPA's Cyanotoxins in Drinking Water website.]

Federal Resources Help Protect People and Wildlife from Harmful Algal Blooms (continued)

HAB problems persist across the country, posing risks to humans, livestock, pets and wildlife that contact the water (Figure 2). In June 2017, the *Minot Daily News* reported that several livestock died in northwest North Dakota after drinking pond water experiencing blue-green algae blooms. In July 2017 the *Capital Press* reported that 32 head of livestock in Lake County, Oregon, died after drinking from a reservoir that was experiencing a cyanobacteria bloom. Also in July 2017, the *Sacramento Bee* reported that two dogs died after swimming in a Napa County pond that contained toxic blue-green algae.

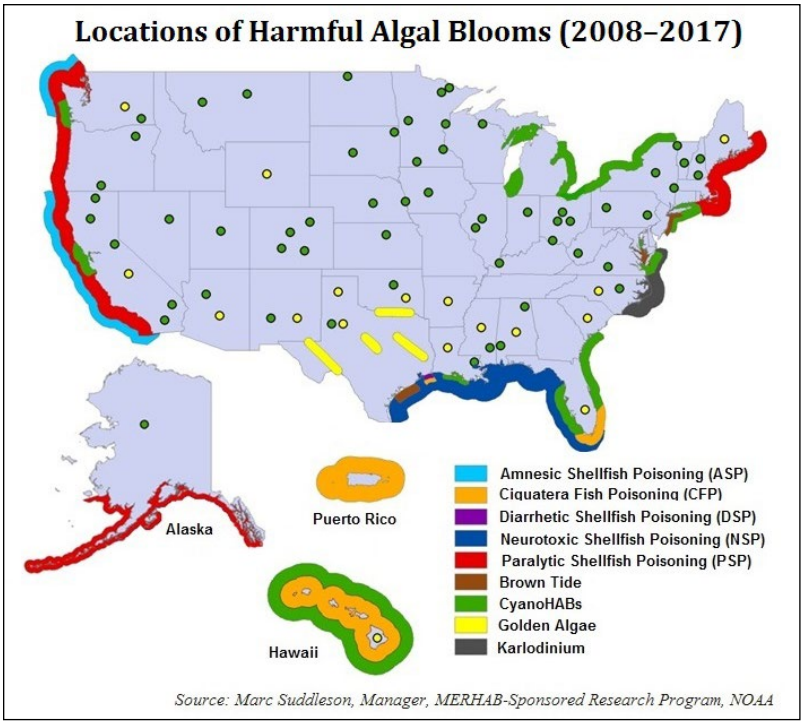


Figure 2. Types of harmful algal bloom events that have occurred across the country since 2008.

EPA tracks postings of HAB-related advisories including blooms, cautions, warnings, public health advisories, and public health warnings due to the presence of algae, toxins, or both. The number of HAB-related events, including advisories issued each year across the United States typically begins increasing in the spring, peaks in late summer, and declines by mid-autumn. For example, in 2016 more than 475 HAB-related events were publicly reported, with a high of 133 cases reported in July 2016. In 2017 that number increased to a total of 822 HAB-related events, with a September 2017 peak of 225. During the hot summer months, the prolonged warming of surface waters favors the growth of HABs, therefore a higher occurrence of blooms will be reported during the warmer months than colder months. This is especially of concern as "the number of HAB events appear to be increasing each year in frequency in the United States, which could be attributed to the combination of excess of nutrients, warmer temperatures and an increase in sampling and monitoring," explains EPA's Lesley D'Anglada.

Communicating the Dangers of HABs to the Public is Key

To support water managers who are facing challenges with HABs in their jurisdictions, EPA offers numerous resources to help with planning, education and implementation. EPA's Cyanobacterial Harmful Algal Blooms in Water website offers detailed background information and resource links describing cyanobacteria and cyanotoxins in marine waters and freshwaters, their effect on health of humans and wildlife, how to detect their presence, and how to control them. It also provides state-based resources and links to numerous guidelines and recommendations for monitoring and communication.

History of the Harmful Algal Bloom and Hypoxia Research and Control Act

In 1998, Congress recognized the severity of threats posed by HABs and hypoxic events and authorized the Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA 1998; embedded in Public Law 105-383). The Harmful Algal Bloom and Hypoxia Research and Control Amendments Act of 2004 (HABHRCA 2004, Public Law 108–456) and 2014 (HABHRCA 2014, Public Law 113–124) reaffirmed and expanded the mandate for NOAA and EPA to advance the scientific understanding and ability to detect, monitor, assess, and predict HAB and hypoxic events in marine and freshwaters. NOAA and EPA co-chair the Interagency Working Group on HABHRCA (IWG), which coordinates with other federal agencies to discuss HAB and hypoxic events in the United States, and to develop action plans. The IWG develop action plans and assessments including the *Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report*, the *Great Lakes HAB and Hypoxia Plan*, and the *Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2015 Report to Congress*.

To help water managers specifically reach users of HAB-impacted recreational waters, EPA recently released a suite of guidance materials on its Monitoring and Responding to Cyanobacteria and Cyanotoxins in Recreational Waters website. Public health officials and outdoor water recreational managers can use EPA's online resources to develop a cyanotoxin monitoring program, communicate potential health risks to the public, and address HAB outbreaks. The website features a guidance document released in June 2017, *Recommendations for Cyanobacteria and Cyanotoxin Monitoring in Recreational Waters,* which provides EPA's recommendations and specific steps that a recreational water manager or public health official might choose to follow, or adapt, to help determine if HABs or cyanotoxins pose a risk to humans, pets, wildlife and livestock in a particular water body.

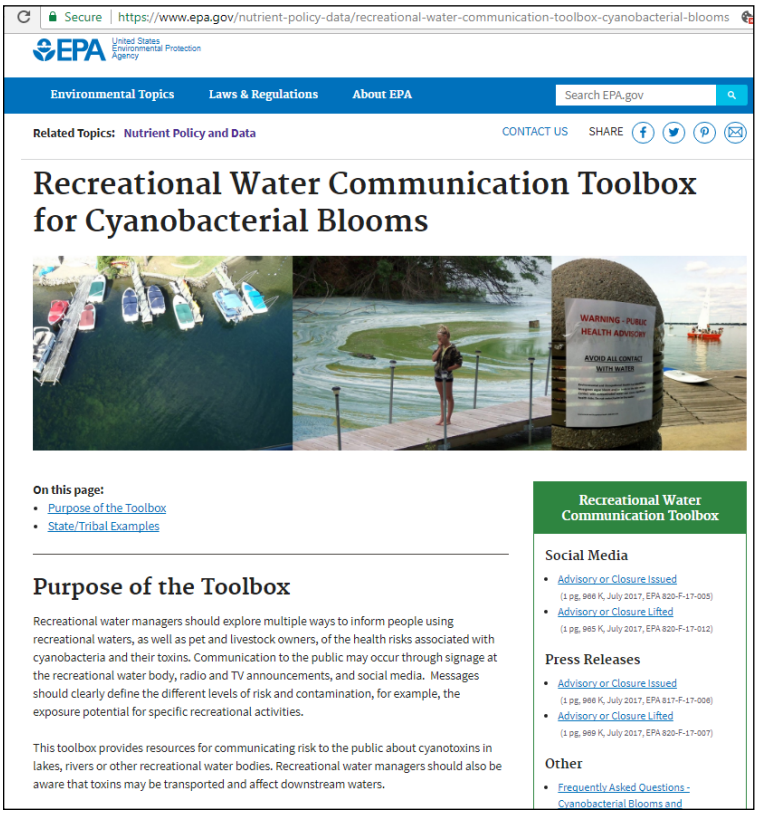


Figure 3. EPA's Recreational Water Communication Toolbox for Cyanobacterial Blooms offers resources to help states, tribes, territories, and local governments develop their own HAB communication materials.

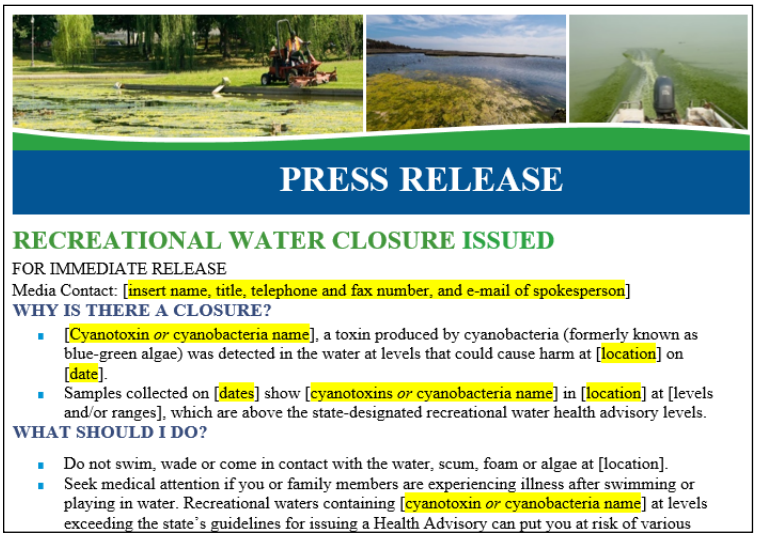


Figure 4. The beginning of this sample press release, available as an editable Microsoft Word document in EPA's Recreational Water Communication Toolbox for Cyanobacterial Blooms, is an example of a readily adaptable communication tool.

EPA also recently released a Recreational Water Communication Toolbox for Cyanobacterial Blooms, which can help water managers inform recreational water users, as well as pet and livestock owners, of the health risks associated with cyanobacteria and their toxins (Figure 3). The toolbox is a ready-to-use "one-stop-shop" to help states, tribes, territories and local governments develop their own HAB communication materials. The toolbox includes editable press release templates, social media posts, and other quick references that can be used or easily adapted (Figure 4).

To increase outreach, EPA issues a monthly HAB newsletter that contains the latest information on HABs including news, useful resources, blooms, beach closures and health advisories across the country, recently published journal articles, and upcoming events, conferences and webinars. It also provides links to HAB-related research conducted by the EPA Office of Research and Development.

NOAA's Center for Operational Oceanographic Products and Services gathers oceanographic data to protect and support government agencies and the public. Using these data, NOAA offers weekly HAB forecast bulletins for both the Gulf of Mexico and Lake Erie, which track HABs of the toxic dinoflagellate *Karenia brevis* (commonly called "red tides"). NOAA's forecast bulletins serve as a decision support tool for local coastal resource managers, public health officials and research scientists. The NOAA forecast website also lists technical publications explaining how the forecasting system operates, offers links to other forecasting resources, and lists the organizations—ranging from federal agencies to university laboratories to county health departments—that contribute data or other forecasting information.

[For more information, contact Lesley D'Anglada, U.S. Environmental Protection Agency, Office of Water (4301T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460; email: Danglada.Lesley@epa.gov; phone: 202-566-1125.]

Notes From the States, Tribes and Localities

Kentucky Stockyard Limits Stormwater Runoff and Promotes Water Reuse

From disaster sometimes comes opportunity. When the 100-year-old Blue Grass Stockyards along the banks of the impaired Town Branch Creek in Lexington, Kentucky, caught fire and burned to the ground in January 2016, it jeopardized the jobs of dozens of people as well as the regional livestock market for thousands of farmers. The massive three-alarm blaze at the seven-acre collection of wooden sheds, barns, and offices spread and also destroyed four neighboring businesses. The fire eventually involved 120 firefighters, prompted air quality warnings, and required the opening of a Red Cross shelter at a nearby school. The stockyard, one of the largest livestock facilities in the eastern United States, was destroyed.

Figure 1. Steve Higgins explains water quality best management practices to attendees at the Scott and Fayette County Farm–City Field day, held in late August 2017 at the new Blue Grass Regional Marketplace stockyard facility.

Figure 2. New stormwater ponds are equipped with drive-in ramps to allow removal of accumulated sediment.

Figure 3. Livestock loading areas are largely under roof to avoid introducing manure and bedding into the stormwater discharge.

Original Stockyard Faced Water Quality Challenges

The original Blue Grass Stockyards was built within the city limits of Lexington near the banks of Town Branch Creek, several reaches of which were listed as impaired for failing to support aquatic habitat and recreational use because of urban stormwater runoff, the loss of riparian habitat, and other causes. Over the years, the stockyard had shown its commitment to water quality protection by implementing a number of grading, berming, vegetative and structural improvements that helped to address concerns regarding runoff from the stockyards. However, the large number of animals moving through the facility, the cramped location, and the proximity to the creek made the site a perennial priority in terms of water quality protection. After the fire, owners of the stockyard knew they had an unprecedented opportunity to do something different. It was time to start anew—bigger, better and cleaner.

"The stockyard owners wanted to build a state-of-the-art facility that showcased the best of the best management practices," said Steve Higgins, Director of Animal and Environmental Compliance at the University of Kentucky College of Agriculture. "We put our collective heads together to design something that everyone could be proud of."

New Stockyard Incorporates Water Quality Best Management Practices

The new Blue Grass Regional Marketplace facility, which opened in September 2017 at a new location about six miles north of the old site, features an 86,600-square-foot roofed stockade and sales pavilion, with an adjacent 40,000-square-foot restaurant and office building. The site includes numerous water quality best management practices that are drawing attention (Figure 1). The new site drains into Cane Run, a tributary of North Elkhorn Creek. To protect water quality, the facility's design includes two stormwater detention ponds with sand filter outlets that collect drainage from access roads and parking lots. Both ponds feature concrete sedimentation forebays constructed as long, rectangular open-topped boxes with drive-in ramps to accommodate front-end loaders and skidders dispatched to remove accumulated solids (Figure 2). These settling basins and their flow controls provide a detention time of 40 minutes for a two-inch storm event. Discharges from the settling basins are then routed to detention ponds that can accommodate 100-year storm events.

The entire operation is under one roof, which allows the facility to minimize polluted stormwater leaving the site. Cattle are moved quickly from farm trucks and trailers to the covered stockade and sales areas, and then to other vehicles for transport (Figure 3). Manure and bedding are stored under the same roofed area, and a third party vendor removes the used bedding and manure and transports it to an offsite composting operation. Rainfall and snowmelt from the facility's roof is collected and routed via underground pipes to a separate "clean water" pond that holds 1.5 million gallons at the normal pool and 3.4 million gallons at the spillway elevation (Figure 4). This pond supplies the water needs of livestock in the stockade area.

Figure 4. Clean runoff water from the facility's large rooftop is routed to a water storage pond and is used to provide water to the livestock at the facility.

"The new stockyard is located in the Cane Run Watershed but not in the recharge area for the aquifer that supplies Royal Springs, which provides part of the drinking water for the city of Georgetown," Higgins said. "Regardless, we wanted to make sure the design and operational plans met the strict requirements of Georgetown's source water protection plan. It took a lot of discussion with state and local water quality officials to get to a place where everyone is comfortable. I think we're there, now."

[For more information on the stormwater and water quality features of the new Blue Grass Stockyards, contact Steve Higgins, PhD, Director of Environmental Compliance, University of Kentucky College of Agriculture at shiggins@uky.edu or 859-218-4326.]

Software Spotlight

National Stormwater Calculator Expands and Goes Mobile

The U.S. Environmental Protection Agency's (EPA's) National Stormwater Calculator (NSWC) software application is now better than ever. It was recently expanded to include a cost module and climate scenarios, and is now available as a mobile web application so you can take it with you into the field. Using national databases and user-entered data, the NSWC can be used to estimate the annual amount of rainwater and the frequency of runoff from a specific site, with and without low impact development (LID)/ green stormwater infrastructure practices in place. It is designed to be used by anyone interested in reducing runoff from a property, including site developers, landscape architects, urban planners and homeowners.

A video highlighting the National Stormwater Calculator is available on EPA's website.

How Does the NSWC Work?

The NSWC can be used to estimate the amount of stormwater runoff that a site generates under different stormwater control scenarios. The calculator accesses several national databases that provide soil, topography, rainfall and evaporation information for the chosen site.

The user supplies land cover information indicating the type of development they wish to analyze, then selects a mix of LID controls that could be used on the site, such as impervious area

National Stormwater Calculator Expands and Goes Mobile (continued)

disconnection, rainwater harvesting, rain gardens, green roofs, street planters, infiltration basins, porous pavement.

Using these data, the NSWC assesses how well different types of LID practices can capture and retain rainfall on-site, and also estimates capital and maintenance costs to help planners evaluate which choices are best for their site. The SWC can answer questions such as:

- What is the largest daily rainfall amount that can be captured by a site in either its predevelopment, current or post-development condition?
- How well can storms of different magnitudes be captured on site?
- What mix of LID controls can be used to meet a given stormwater retention target?
- How well will LID controls perform under future meteorological projections?
- What are the relative cost (capital and maintenance) differences for various mixes of LID controls?

The NSWC uses the EPA Storm Water Management Model (SWMM) as its computational engine. SWMM is a well-established, EPA-developed model that has seen continuous use and periodic updates for 40 years. Its hydrology component uses physically meaningful parameters, making it especially well-suited for application on a nationwide scale. SWMM is set up and runs in the background without requiring any involvement of the user.

The calculator is most appropriate for performing screening-level analyses of small-footprint sites (up to several dozen acres in size) with uniform soil conditions. More information about the NSWC is available in a September 2017 National Stormwater Calculator Fact Sheet and a free, archived webinar held in January 2018.

Reviews and Announcements

Agricultural Nonpoint Source Pollution

Federal Agencies Partner on Animal Agriculture Education Project

The U.S. Environmental Protection Agency (EPA) is partnering with the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service on the Animal Agriculture Education Project, a series of educational modules designed to increase understanding and knowledge among state and federal government agencies and the agricultural industry about water quality protection, manure management, and animal feeding operations. The project will include multimedia features such as videos and virtual tours of farms, and will discuss topics including advances in technologies and production systems, measures to protect water quality, and issues such as on-farm decision making about manure management. An overview module for this project, Animal Agriculture, Manure Management, and Water Quality, was released in early 2017. This module was developed with funding from EPA and with input from animal agriculture stakeholders. It addresses trends in animal agriculture, manure collection and storage, land application of manure nutrients, water quality issues associated with manure, Clean Water Act requirements and planning for stewardship.

Report Features Farm Conservation Water Quality Success Stories

American Farmland Trust and World Resources Institute recently released *Water Quality Targeting Success Stories: How to Achieve Measurably Cleaner Water Through U.S. Farm Conservation Watershed Projects*. This report shows how conservation leaders of six watershed-scale projects collaborated with farmers to implement priority conservation practices and document the resulting water quality improvements. The report also recommends several actions that could be taken by federal government, charitable organizations and corporations to help conservation projects realize their full potential. The top recommendations include: (1) providing watershed project leaders with guidance and training on water quality monitoring and the use of modeling tools to quantify and report on outcomes; (2) offering technical assistance with project development, implementation and future recommendations; (3) delivering additional and sustainable funding;

and (4) offering outreach and education to targeted watershed project leaders. The Farmland Information Center is a clearinghouse for information about farmland protection and stewardship, and is a partnership between the USDA Natural Resources Conservation Service and the American Farmland Trust.

Data Resources

Australian Student's Stormwater Mapping Toolbox Used Worldwide

A stormwater mapping tool created by Alan Pearse, a 19-year-old Australian student, is allowing hydrologists around the world to better map the movement of water and pollutants across different landscape features. His tool, IDW-Plus (Inverse Distance Weighted Percent Land Use for Streams) is used with the Esri open-source mapping platform ArcGIS. The purpose of IDW-Plus is to help Esri ArcGIS users calculate six spatially explicit land use metrics for watersheds: (1) inverse flow length to outlet (iFLO), (2) inverse flow length to stream (iFLS), (3) inverse Euclidean distance to outlet (iEDO), (4) inverse Euclidean distance to stream (iEDS), (5) hydrologically active inverse flow length to outlet (HAiFLO), and (6) hydrologically active inverse flow length to stream (HAiFLS). The toolkit has already gained attention in the United States: U.S. Geological Survey (USGS) hydrologists are using it to study how natural hazards threaten water resources and the USDA is offering IDW-Plus on its Rocky Mountain Research Station's Spatial Modeling website for scientists to download and use. To acknowledge his exceptional work and accomplishment, Esri Australia awarded Mr. Pearse, a third-year student at the Queensland University of Technology, the Australian Esri Young Scholars Award.

Combining Water Assessment Data from Multiple Sources

A recent USGS study, "Challenges with secondary use of multi-source water-quality data in the United States," reports that almost 60 percent of previously collected nutrient water quality records for U.S. rivers and streams have missing or ambiguous reference information. This inconsistency limits the use of these data for assessing water quality across large river basins. The study found that nearly 14.5 million of the 25 million records collected since 1899 by nearly 500 public and private organizations at 321,927 sites across the country had missing or ambiguous metadata, which is the standard descriptive information needed to determine the amount of a chemical present in the sample. By adopting standard metadata practices across all monitoring organizations in the United States, the quality and amount of data that could be used to assess water management actions could be significantly increased. The National Water Quality Monitoring Council—a group of federal, tribal, interstate, state, local and municipal governments; watershed groups; and national associations that include volunteer monitoring groups—is developing sets of water quality data elements that could facilitate the exchange of water quality data among multiple agencies.

Phone App Offers Access to National Low Impact Development (LID) Atlas

The NEMO [Nonpoint Education for Municipal Officials] program at the University of Connecticut has developed a new mobile-friendly version of the National LID Atlas. Available for any mobile device (iOS, Android, Windows Phone, etc.), you can explore the practices near you or start adding your own. The Atlas is a national database of examples of LID/ green stormwater infrastructure developed by the National NEMO Network. The new version offers these features:

- **LID Near You.** When you load the mobile website it will zoom to your location and display any examples of LID from the Atlas within a 10-mile radius.
- **Advanced Filtering.** By clicking the filter icon, you can narrow down the types of sites that appear by choosing a type of practice, state, city, land use type, or keyword. You can also set how big of a radius around your current location you would like to search.
- **Calculating Impact.** When you add a new site to the Atlas, you can enter the size of the practice as well as the size of the drainage area being treated (drainage area). The app uses local annual rainfall amounts to calculate the number of gallons of stormwater removed by the practice per year.

- **Crowdsourcing.** The app has been opened to allow anyone with a Google or Twitter login to navigate to the menu and add a site to the Atlas using their mobile device. This includes taking a photo with your device that will be added to that site's pop-up window in the Atlas.

Story Map Highlights Nutrient Pollution and its Solutions

The Source Water Collaborative recently released Protect the Source, an Esri story map that highlights projects across the country working to reduce nutrient pollution in drinking water sources. This visually engaging presentation weaves together images, graphics, data and interactive maps to tell the "story" of nutrient pollution derived from point and nonpoint sources—and to introduce solutions. Viewers are invited to submit their nutrient reduction projects to the Project Inventory map, which displays projects from across the U.S. The Source Water Collaborative is a partnership of 27 national organizations that have united to protect sources of drinking water.

Educational Resources

High School Envirothons Offer Unique Educational Opportunities

Teams from Pennsylvania, New York and New Mexico high schools took the top honors at the 2017 National Conservation Foundation's Envirothon, held in Emmitsburg, Maryland in July 2017. Envirothon teams are tested on their knowledge in five topic areas: soils and land use, aquatic ecology, forestry, wildlife and a current environmental issue that changes each year. Through the program, students develop an understanding of effective teamwork, resource management and ecology. At the same time, they gain valuable exposure to a range of disciplines while exploring possible career paths in the environmental field. Now entering its 30th year, the Envirothon program continues to grow, reaching more than 500,000 young people across the United States and beyond. More detailed information is available online, including contacts for local Envirothon teams, downloadable brochures, and videos and photos from past events. The 2018 Envirothon will be hosted at Idaho State University in Pocatello, Idaho.

Tool Facilitates Engaging Forest Landowners and Fostering Stewardship

The Sustaining Family Forests Initiative—a collaborative initiative between the Yale School of Forestry & Environmental Studies, the U.S. Forest Service, and the Center for Nonprofit Strategies—has launched a new tool aimed at gaining and disseminating comprehensive knowledge about family forest owners throughout the United States. Tools for Engaging Landowners Effectively (TELE) helps natural resource professionals from all sectors design more effective outreach programs. Tips and techniques included in TELE demonstrate how to connect and share targeted information with specific woodland owner types: (1) *woodland retreat* owners, who place higher importance on lifestyle and amenity reasons for owning woods; (2) *working the land* owners, who assign high importance to both lifestyle and financial reasons for owning woods; (3) *supplemental income* owners, who are the opposite of woodland retreat owners, assign high importance to financial reasons for owning woodland, but lower ratings on amenity reasons; and (4) *uninvolved* owners, who assign relatively low importance ratings to all the reasons for owning woods. TELE helps promote stewardship practices among landowners, such as building trails, protecting water quality, or anything in between. The approach includes a simple six-step process that helps users leverage resources to successfully reach a larger, more diverse set of landowners.

Green Stormwater Infrastructure

EPA Announces Winners of 2016 Campus RainWorks Challenge

In April 2017 EPA announced four winners and two honorable mentions for the 2016 (5th annual) Campus RainWorks Challenge. More than 60 student teams from 30 states submitted innovative green infrastructure designs. These projects show how managing stormwater at its source can benefit the community and environment by reducing the burden on local water infrastructure, managing local flooding, reducing urban heat islands and lowering energy demands. The 2016 competition included a focus on community engagement, and teams were asked to contemplate how public

involvement with the local community, city, state or other organizations could help support the proposed project. EPA invited student teams to compete in two design categories: the Master Plan category, which examines how green infrastructure can be integrated into a broad area of a school's campus, and the Demonstration Project category, which focuses on how green infrastructure can be integrated into a particular site on the team's campus. Teams of undergraduate and graduate students, working with a faculty advisor and in many cases campus facility managers, developed innovative green infrastructure designs in one or both of the categories to show how managing stormwater at its source can benefit the campus community and the environment. For more information, visit the 2016 Campus RainWorks Challenge website or read the 2016 Campus RainWorks Challenge competition brief. EPA announced the 2017 RainWorks Challenge in July 2017, entries were due in December 2017, and judging is currently underway.

Green Infrastructure Effectiveness Database Compiles Resource Information

The National Oceanic and Atmospheric Administration's (NOAA's) Office of Coastal Management assembled a collection of information from a wide array of literature sources (e.g., peer-reviewed journals, online tools, government reports, issue papers, conference proceedings) that document how well green infrastructure techniques reduce the impacts of coastal hazards. This information is presented in an online Green Infrastructure Effectiveness Database, which allows users to quickly search for basic source information, key findings, identification of characteristics that influence effectiveness, and a link to the original source, if available. The database is not an all-inclusive source of NOAA's literature related to green infrastructure, but rather is a collection of literature sources reporting techniques for improving resilience to coastal hazards. Currently, the database contains information on 32 different coastal green infrastructure practices and techniques that cover a full range of approaches to coastal management. The database also illuminates gaps in information and areas that should be studied further. NOAA intends to continue adding to the database over time.

Green Infrastructure Training Tools Offered

NOAA has developed multiple training products to guide communities through the green infrastructure planning process. The products are offered through NOAA's Digital Coast, a website that serves as a central repository for data, tools, training and information pertinent for communities engaged in coastal resource management. One of the instructor-led courses, Introducing Green Infrastructure for Coastal Resilience, covers fundamental concepts and practices that can be integrated into local planning processes. NOAA's Office for Coastal Management will bring this training to your doorstep while providing the instructors and all the materials at the request of your agency or organization. The cost is minimal for participants and the host. Through its Digital Coast Training website, NOAA also offers other online instructor-led courses and information on how to protect and manage coastal resources.

Report Explores Private Financing for Green Infrastructure

A recently released report, *Public Private Partnerships and Finance of Large-Scale Green Infrastructure in the Great Lakes Basin*, presents the initial findings of an initiative to expand the use of green infrastructure in the Great Lakes Basin through the use of private financing and/or contracted services. The Great Lakes Basin includes parts of the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin. The report assesses the market size for large-scale adoption (i.e., investment of at least $50 million) of integrated green infrastructure practices, with an emphasis on communities that could best benefit from using green infrastructure to address their stormwater management challenges. Supported by the Great Lakes Protection Fund, the report covers a number of tools that can be used to aid communities considering establishing a public-private partnership (P3). The tools include a newly developed decision tree for use as a preliminary filter to assess the viability of a P3 in a specific community. The decision tree is applicable for communities that have either municipal separate storm sewer systems or combined sewer overflows.

Report Highlights Economic Markets and Green Stormwater Infrastructure

The Willamette Partnership recently released a report summarizing how stormwater managers can work with market forces to address critical stormwater issues. The report, *Working with the Market: Economic Instruments to Support Investment in Green Stormwater Infrastructure*, illustrates how communities can use economic instruments (e.g., rebates, subsides, trading, mitigation) to create action or drive investment that helps communities meet their environmental goals. This report was authored by Willamette Partnership and Storm and Stream Solutions, and supported by the National Network on Water Quality Trading.

Report Recommends Actions to Integrate Green Infrastructure in NYC

In response to a request by the New York Department of Environmental Protection (DEP), the Natural Resources Defense Council partnered with the New York University Stern School of Business' Center for Sustainable Business to examine how New York City could successfully develop and launch a large-scale grant program that would spur green infrastructure construction on private property. The partners published their findings in an August 2017 report, *Catalyzing Green Infrastructure on Private Property: Recommendations for a Green, Equitable, and Sustainable New York City*. After reviewing initiatives occurring around the country, the authors concluded that DEP should commit to and communicate with the public to help make green infrastructure on private property a core component of New York City's sustainability efforts. The report also contained the recommendation that the DEP partner with community-based organizations to help the new program successfully achieve plan OneNYC goals. The authors noted that DEP should create a new grant program that provides a direct financial benefit, such as compensation for long-term green infrastructure maintenance and on-bill loan financing, to private property owners who invest in green infrastructure. Finally, the authors recommended that DEP institute new rules for new development and redevelopment projects to manage stormwater on site, thereby reducing the volume of runoff, and that DEP adopt a new fee structure on water and sewer bills to more equitably apportion stormwater management costs across the city.

Harmful Algal Blooms

Automated Bibliography Features Agriculture-Linked Algal Bloom Research

The National Agricultural Library has created Great Lakes Harmful Algal Blooms and Hypoxia: Agricultural Aspects, an online, automatically updated bibliography listing current research on the links between agricultural operations and harmful algal blooms and hypoxia affecting the Great Lakes. The bibliography is generated using an automated search of the Scopus database, the largest abstract and citation database of peer-reviewed literature including scientific journals, books and conference proceedings.

Online Training Introduces Remote Sensing of Harmful Algal Blooms

The National Aeronautics and Space Administration's (NASA's) Applied Remote Sensing Training program offered an online training in September 2017, Introduction to Remote Sensing of Harmful Algal Blooms. The training, now available for free as a self-directed online course, was designed to: (1) help people identify NASA's Earth Science remote sensing data products that can be used to identify and monitor HABs, (2) understand how coupled remote sensing and modeling approaches are used in decision support tools, and (3) use a selection of NASA Earth Science data tools to monitor HABs. These skills can help decision makers know where to collect water samples, determine what toxins are in the water, whether they need to change or move drinking water intakes, and whether a fishery needs to be closed. Accessing remote sensing data enables individuals and organizations to create more flexible plans for water sampling, and leads to a more efficient and appropriate allocation of resources for protecting human health.

Paper Describes Use of Algal Indicators to Diagnose Nutrient Pollution

In June 2017 EPA published a summary paper, Algal Indicators in Streams: A Review of their Application in Water Quality Management of Nutrient Pollution, which describes the use of algal indicators to develop water quality diagnostics for nutrient pollution in the United States and reviews scientific developments in the application of algal indicators across the world. The information will help water quality managers better understand when and how to use algae as indicators of nutrient pollution in stream ecosystems.

Researchers Use Genes as Early Warning System for Harmful Algae Blooms

In one of the most comprehensive studies to date, researchers at the University of North Carolina at Chapel Hill have sequenced the genes of a harmful algal bloom, unveiling never-before-seen interactions between algae and bacteria that are thought to propagate their growth. The work also opens up the possibility of forecasting the appearance of a bloom and taking measures to prevent it.

Team Creates Warning System for Toxic Algae in Lakes

Scientists at EPA are part of a team of specialists using remote sensing data to improve cyanobacteria detection methods. EPA is working with partners on the Cyanobacteria Assessment Network (CyAN) to use historic and current satellite data to monitor algal blooms and develop an early warning system for toxic and nuisance blooms that could harm public health. Since the project began in October 2015, CyAN imagery has been used to successfully detect algal blooms before traditional monitoring efforts alerted watershed managers in Ohio, Florida, California, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island. The goal of this project is to provide access, through an Android mobile application and other interactive resources, to satellite images and data that show the concentration and extent of chlorophyll-*a* and cyanobacteria in the continental United States. In November 2017 EPA hosted a Monitoring Cyanobacteria with Satellites webinar that highlighted ongoing work.

Hydromodification

Map Marks U.S. Dams Removed During the Past Century

Researchers have found that the benefits of dam removals far outweigh the alternative of leaving dams in place. Many dams that once supported local economies have aged, no longer serve their intended purposes, or have become unsafe. Dams have been found to disrupt several characteristics of rivers including their natural flow, water temperatures, water quality, sediment transport and biological function. The removal of dams has become an effective river restoration tool that aids in the reversing of damage and restoring a river's integrity. American Rivers has developed an online map showing the location of all U.S. dams removed from 1916 through 2016. Each marked location includes information about the dam that was removed, including its physical characteristics, name, age and location. River restoration practitioners, including federal and state agencies, engineering design firms, other consultants and nonprofit organizations, have played a major role in restoring the ecological integrity of rivers through the removal of dams.

Watershed Management

Municipalities to "Pay-For-Success" to Meet Clean Water Requirements

In June 2017 the Chesapeake Bay Foundation (CBF) announced it will receive an innovative federal grant designed to put conservation practices on Pennsylvania farms that will allow municipalities to satisfy stormwater pollution reduction requirements and return profits to capital investors. The Conservation Innovation Grant of $415,000 from the USDA Natural Resources Conservation Service is to be matched by CBF and multiple partners for the three-year project. With the grant, CBF and partners will apply an innovative pay-for-success (PFS) approach. Under the PFS approach, select municipalities contract to pay a financial intermediary. With capital from private investors, the intermediary contracts with service providers to install pollution reduction

measures on farms. If the desired pollution reductions are achieved, the municipality can apply the results to satisfy its urban/suburban stormwater compliance requirements. The municipality will then pay the intermediary, which in turn repays investors, with interest.

Report Shows Trading Programs Not Widely Used

The General Accounting Office (GAO) was tasked with examining nutrient credit trading programs. In October 2017 the GAO released its results in a report, *Some States Have Trading Programs to Help Address Nutrient Pollution, But Use Has Been Limited*, that describes: (1) the extent to which nutrient credit trading programs have been used and what the outcomes of the programs have been, (2) how states and EPA oversee nutrient credit trading programs, and (3) what key factors stakeholders view as affecting participation in nutrient credit trading. GAO selected a sample of three state programs with the most trades in 2014; reviewed program documents; and interviewed EPA, state, and program officials and other stakeholders about the programs. According to stakeholders, two key factors have affected participation in nutrient credit trading: the presence of discharge limits for nutrients and the challenges of measuring the results of nutrient reduction activities from nonpoint source projects. Officials from the three state programs and other stakeholders cited the importance of discharge limits for nutrients as a driver to create demand for trading. Without such a driver, point sources have little incentive to purchase nutrient credits. The challenges of measuring nutrient reductions from nonpoint sources create uncertainties about the value of credits generated by nonpoint sources. In part, because of these uncertainties, the states GAO reviewed either did not allow nonpoint sources to trade or created special rules for nonpoint sources. State officials and stakeholders also told GAO that even if a program allows nonpoint sources to trade, point sources often prefer to trade with other point sources because they have similar permit and monitoring requirements.

Watershed Approach Mitigates Stormwater Impacts from Roadways

The Transportation Research Board's (TRB's) National Cooperative Highway Research Program *Research Report 840: A Watershed Approach to Mitigating Stormwater Impacts* provides a practical decision-making framework that will enable state and local departments of transportation to identify and implement off-site cost-effective and environmentally beneficial water quality solutions for stormwater impacts when on-site treatment or mitigation is not possible within the right-of-way. The multiyear research effort includes the development of the Watershed Based Stormwater Mitigation Toolbox (WBSMT), a Microsoft Excel-based program that helps characterize the project watershed and identify mitigation options at the planning level. The WBSMT uses readily available national datasets and can be used to evaluate common stormwater pollutants of concern. It can easily be adapted for evaluating targeted regional and local datasets and complex and emerging watershed protection issues, such as ecosystem services. The research report and the WBSMT can be found at TRB's website: A Watershed Approach to Mitigating Stormwater Impacts.

Winter Maintenance Assessment Tool Reduces Salt in Minnesota

Minnesota state agencies, local municipalities and experts within the Twin Cities Metropolitan Area created a partnership to develop a chloride management plan to effectively minimize and manage salt (primarily sodium chloride) use for deicing purposes in order to protect water resources. As part of this plan, the Winter Maintenance Assessment tool (WMAt) was developed as an all-encompassing resource listing approximately 180 salt-reducing best management practices. The web-based tool was developed to help public and private winter maintenance professionals and organizations assess their current practices, determine which practices can be modified to reduce the use of salt, track their progress over time, and display the results of their efforts. Users of the tool will be asked questions about their winter maintenance activities on roads, parking lots and sidewalks or other areas where road salt is used as a deicer. The tool then generates a report that summarizes their current practices and identifies areas of improvement. It highlights specific best management practices unique to each operation, as well as the timeframe that would be required to incorporate those changes.

Data Show Pesticides Prevalent in Midwestern Streams

More than 180 pesticides and their byproducts were detected in small streams throughout 11 Midwestern states, some at concentrations likely to harm aquatic insects, according to a 2017 USGS study, Complex mixtures of dissolved pesticides show potential aquatic toxicity in a synoptic study of Midwestern U.S. streams. On average, 52 pesticide compounds were detected in each stream. At least one pesticide in at least half of the 100 streams sampled exceeded a threshold predicted to cause harm to aquatic insects and other stream organisms. Pesticides were not measured at levels predicted to be toxic to fish in most streams. Although numerous pesticides were detected at low levels, only a few—atrazine, acetochlor, metolachlor, imidacloprid, fipronil and organophosphate insecticides—were predicted to be major contributors to toxicity. The first three are widely used agricultural herbicides, and the latter three are insecticides used in both residential and agricultural settings. This is one of the most extensive assessments of pesticides in streams to date: 1,200 samples were collected at 100 Midwest streams over a 12-week period during the 2013 growing season and analyzed for 228 pesticide compounds. This study is one component in the first in a series of five USGS regional stream quality assessments.

National Water Quality Monitoring Council Newsletter Released

The National Water Quality Monitoring Council released its 15th edition of the online newsletter *National Water Monitoring News* in fall 2017. This newsletter provides a forum of communication among water practitioners across the United States and highlights many events, activities and new products related to water quality monitoring. This issue includes an article on the Interagency Working Group on the Harmful Algal Bloom and Hypoxia Research and Control Act's latest report, "Harmful Algal Blooms and Hypoxia in the Great Lakes Research Plan and Action Strategy: An Interagency Report"; an article about the Interoperable Watersheds Network, a national data-sharing platform that seamlessly links continuously monitored sensor data from multiple sources into one accessible and searchable location; a discussion of water quality-related apps available from the USGS; and other items of interest from federal, state and local sources.

Stream Selfie Campaign Underway

The Izaak Walton League's (IWL's) new Stream Selfie campaign encourages people to snap a photo of a stream that's important to them, answer a few key questions, and share their picture on the Stream Selfie website. With each photo, IWL is creating a first-of-its-kind national map for volunteers and community organizations involved with stream monitoring. By putting this information in one place, IWL is highlighting streams that are being monitored today and will develop a national inventory of streams that need to be monitored in the future.

Water Quality Monitoring Fact Sheet Series Available

The National Water Quality Monitoring Council's Water Information Strategies workgroup has developed Water Quality Monitoring: A Guide for Informed Decision Making, a series of fact sheets intended to help explain and clarify differences in water quality monitoring designs. Each fact sheet is organized to answer the "how," "what," and "when" questions of monitoring design. "How" is the program implemented? "What" types of questions does this design answer?" "When" is this particular design appropriate? Examples from existing programs are provided to help guide the reader; quick links provide more in-depth information for each topic. Individual fact sheets include: (1) Overview: A Guide for Informed Decision Making, (2) Targeted Water Quality Monitoring, (3) Fixed Site Monitoring, (4) Statistical Surveys, (5) Remote Sensing, and (6) Rotating Basin Monitoring Designs.

Other

EPA Releases Route to Resilience Tool

Maintaining and repairing aging drinking water infrastructure remains a significant challenge for the water sector. Utilities must be able to increase their readiness and resilience to potential all-hazard incidents and adapt to future hazards that could impact their ability to provide safe and clean drinking water. EPA is releasing the Route to Resilience (RtoR) tool that will help small- and medium-sized drinking water and wastewater utilities learn more about becoming resilient to hazards such as floods, tornadoes, hurricanes and contamination incidents. The interactive desktop application guides utilities through five stops along the Route to Resilience: (1) Assess, (2) Plan, (3) Train, (4) Respond, and (5) Recover. RtoR also provides utilities with a custom report that highlights products and tools that will help guide utilities in their efforts to become more resilient.

Tools Provide Compliance Assistance for Construction Stormwater Program

As part of EPA's compliance assistance for the National Pollutant Discharge Elimination System (NPDES) construction stormwater program, EPA created a "Do I Need A Permit?" flow chart to help construction operators determine if and from whom they need to get NPDES permit coverage for their construction activities. EPA also updated the Stormwater Pollution Prevention Plan (SWPPP) template and Inspection and Corrective Action Report templates for the new 2017 Construction General Permit (CGP). These fillable templates help construction site operators develop a SWPPP and prepare inspection and corrective action reports that meet the requirements of EPA's 2017 CGP. The templates are available on the Construction General Permit: Resources, Tools, and Templates website.

Recent and Relevant Periodical Articles

Eutrophication Will Increase During the 21st Century as a Result of Precipitation Changes

This article, published in the *Science* July 28, 2017, issue (Vol. 357, Issue 6349, pp. 405–408), highlights evidence from a recent study that discusses how changing precipitation patterns will substantially increase riverine total nitrogen loading within the continental United States by the end of the century. These impacts are driven by projected increases in both total and extreme precipitation, and will be especially strong for the Northeast and the corn belt of the Midwest. Offsetting the anticipated increases would require a significant reduction in nitrogen inputs from runoff, direct discharges and air deposition.

Harmful Algal Bloom–Associated Illnesses in Humans and Dogs Identified Through a Pilot Surveillance System — New York, 2015

This article, featured in the Centers for Disease Control and Prevention's *Morbidity and Mortality Weekly Report* on November 3, 2017, features results from a pilot harmful algal bloom (HAB) surveillance system conducted by the New York State Department of Health (NYSDOH). The system was implemented in 16 New York counties in order to assess the extent to which nutrient-fueled HABs in state waters affects humans and dogs. Activities included collecting data from environmental HAB reports, illness reports and poison control centers, and conducting outreach to the public, health care providers and veterinarians. Before 2015, HAB-associated illness reports made to NYSDOH never exceeded 10 statewide in any given year, whereas 51 illness reports were made through the pilot surveillance system across the 16 participating counties during June–September 2015. Of the 51 reports identified through the pilot surveillance system, 35 were considered cases of HAB-associated illness meeting the Centers for Disease Control and Prevention's case definition, suggesting that the occurrence of such illnesses might typically be underreported.

Rare Fish Sheds Light on Improved Water Quality

This article, featured in the online *High Plains/Midwest Ag Journal* on May, 26, 2017, describes a study by the University of Missouri Extension and the Missouri Department of Conservation. Researchers discovered that the population of the grotto sculpin—a rare, cave-dwelling fish—is increasing in local cavern systems. The study attributed the population increase to efforts by farmers to protect water quality by using no-till cropping systems, cover crops and nutrient management in this sinkhole-prone area.

Websites Worth A Bookmark

Coastal and Waterfront Smart Growth

This NOAA-created website describes different elements essential for communities that are interested in implementing coastal and waterfront smart growth. By clicking on the 10 individual chapters featured on the left side bar, readers can see a description of each coastal and waterfront smart growth element, how it relates to coastal and waterfront issues, case studies, and numerous tools and techniques your communities can use to implement smart growth practices.

Nonpoint Source Success Stories

This EPA site provides updated information about successful nonpoint source pollution-related restoration and water quality improvement efforts across the nation. Each story explains how watershed stakeholders have collaborated to restore clean and healthy watersheds.

Polluted Runoff: Nonpoint Source Pollution

This EPA website offers updated information about the control of nonpoint sources of water pollution and the ecological management and restoration of watersheds. The site highlights new and existing publications, tools, and resources designed to help you manage polluted runoff and restore aquatic ecosystems.

State Progress Toward Developing Numeric Nutrient Water Quality Criteria for Nitrogen and Phosphorus

This EPA website tracks states' efforts nationwide to develop numeric nutrient criteria related to nitrogen and phosphorus pollution. Featured within the Water Quality Criteria section of EPA's website, this page provides interactive maps and tables describing the criteria they've developed as well as specific details about Clean Water Act-adopted criteria, including values and parameters.

Water Quality Changes in the Nation's Streams and Rivers

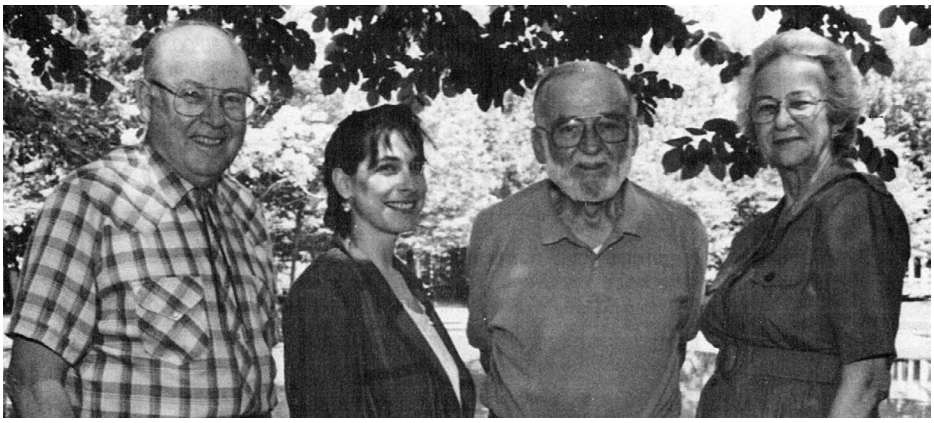
A new USGS interactive map provides a comprehensive look at changes in the quality of U.S. rivers and streams over the last four decades. Monitoring data collected by 74 organizations at approximately 1,400 sites across the nation have been combined to provide a look at river and stream quality between the 1972 passage of the Clean Water Act and 2012. The interactive map, developed by the USGS National Water Quality Assessment Project, can be used to see changes in 51 water quality constituents, such as nutrients and pesticides, and 38 aquatic life metrics, such as the types and numbers of fish, macroinvertebrates, and algae.

Need More Nonpoint Source Pollution-Related News?

To continue to stay in touch with others who are concerned about nonpoint source pollution issues, be sure to subscribe to EPA's free NPSINFO discussion list. NPSINFO is a public forum for discussing both unregulated nonpoint source pollution runoff issues and regulated stormwater issues. NPSINFO welcomes participants from across public and private sectors, including government agencies, nonprofit and other organizations, researchers, educators, local water managers, industry, the agricultural community and concerned individuals across the country and beyond.

Hal Wise's Legacy Lives On

By Elaine Bloom, NYS Department of Environmental Conservation



Original *NPS News-Notes* team, 1993. Left to right: Harold Owens (EPA), Elaine Bloom (Associate Editor, Tetra Tech), Hal Wise (Editor, EPA), and Carol Forshee (EPA).

Much has changed since Hal founded *Nonpoint Source News-Notes* and in the decades since we lost him. But, as his colleague and friend, I know he'd be gratified that *News-Notes* continued to connect, inspire and inform the community that formed around it. He was adored by these front-line folks, and it was mutual. They were his energy source, his fountain of youth, his inspiration. He delighted in sharing their stories of innovation and success in his favorite section of the newsletter, News from the States, Tribes, and Localities, to which Hal always added "Where the Action Is" (you could hear the caps when he said it).

News-Notes drew together a nucleus of regional, state and local water managers; nonprofit staff; researchers; extension staff and educators, joined by students; farmers; sharp, passionate laypeople and outside-the-box thinkers of all persuasions. Their efforts now are often the driving force behind real change in watersheds.

It's definitely Where the Action Is.

And Hal would love it.

[Elaine Bloom was News-Notes' assistant editor from 1991 to 1994. After Hal's passing, she continued as editor until 1999. She can be contacted at elaine.bloom@dec.ny.gov.]

Thank You to Our Entire *News-Notes* Team!

NPS News-Notes owes its longevity to a dedicated team of people who've continued to bring Hal's vision to life over the years. We've striven to bring you a balance of informative national-level news, interesting and innovative local stories, and helpful tidbits about valuable tools and resources. *News-Notes* has always been about you, our readers. Your dedicated and creative water quality protection efforts across our country have constantly amazed and inspired us. Thank you for allowing us to be a part of it.

In addition to the original *News-Notes* team members highlighted in the above photograph (Harold Owens [EPA], Elaine Bloom [Tetra Tech], Hal Wise [EPA], and Carol Forshee [EPA]), we'd like to extend our special thanks to the many other people who have led and supported the *NPS News-Notes* development process through the years: Stu Tuller (EPA), Jim Meek (EPA), Tim Icke (EPA), Dov Weitman (EPA), Stacie Craddock (EPA, 1994–2003), Judy Taggart (Terrene Institute, 1989–2002), Laura Kasley (Tetra Tech), Melissa Bowen DeSantis (Tetra Tech, 1999–2004), Krista Carlson (Tetra Tech, 2003–2018), and countless contributors and reviewers from across the country, including our dedicated regional and state nonpoint source coordinators. Don Waye (EPA) and Kary Phillips (Tetra Tech) have served as co-editors for News-Notes from 2004 through this final issue. We couldn't have done it without each and every one of you.