Nonpoint Source
News-Notes
February 2010, #89
The Condition of the Water-Related Environment
The Control of Nonpoint Sources of Water Pollution
The Ecological Management & Restoration of Watersheds

Notes on the National Scene

First National Lakes Assessment Released

The U.S. Environmental Protection Agency (EPA) just released its most comprehensive study of the nation's lakes to date. The draft study, which rated the condition of 56 percent of the lakes in the United States as good and the remainder as fair or poor, marked the first time EPA and its state and tribal partners used a nationally consistent approach to survey the ecological and water quality of lakes.

The National Lakes Assessment (NLA) is the latest in a series of surveys of the nation's aquatic resources being conducted by EPA and its partners. The NLA provides unbiased estimates of the condition of natural and man-made freshwater lakes, ponds and reservoirs greater than 10 acres and at least one meter deep. Using a statistical survey design, study partners selected lakes at random to represent the condition of the larger population of lakes across the 48 contiguous states.

An innovative program combines monitoring, education and restoration. See article on page 9.

Inside this Issue

Notes on the National Scene 1
First National Lakes Assessment Released 1
Water Quality Scorecard and Incentive Guide Added to Municipal Handbook . 3
Road Salt Affects Nation's Northern Waters 5
Targeting Watershed Nutrient Sources to Reduce Gulf Hypoxia 5

Notes from the States, Tribes, and Localities 6
Web Site Highlights States' TMDL Successes 6
Making Way for Salmon 7

Notes on Education 9
Project Watershed—Collecting and Sharing Information 9
World's First Floating Wetland Classroom Opens in Virginia 12
Free Online Training Available to Help Tackle Nonpoint Source Pollution 14
Watershed Investigations Book Links Hydrology and Human Impact 15

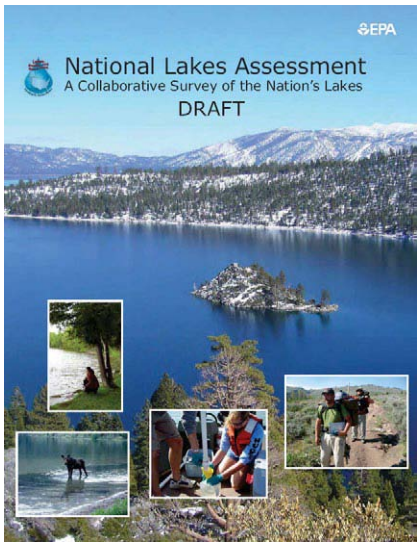
Reviews and Announcements 16
Agencies Release Seven Draft Reports on the Chesapeake Bay 16
Climate Change Coastal Adaptation Planning Guidebook Available 16
Climate Change Education Toolkit Updated 16
DIRT! The Movie Now Available 16
Environmental Education Resource Targets Diverse Cultures 17
EPA Issues Rule to Reduce Water Pollution from Construction Sites 17
EPA Offers Facebook Page about Water 17
EPA Releases National Water Program Research Strategy 17
Fact Sheet Explores LID and Emergency Services Concerns 17
Green Stormwater Infrastructure Training Resources Available 18
Group Develops Stormwater Tutorial 18
Guide Explores Green Street Development 18
National Wildlife Federation Launches Campaign 18
New Fact Sheets Highlight Coastal Ocean Science 18
Newsletter Features Homemade Monitoring Equipment Ideas 19
North Carolina Releases LID Guidebook 19
Report Highlights Sustainable Water Management 19
Report Validates Importance of Coastal Economies 19
Save Our Streams Guide Now on DVD 19
Series Discusses Challenges of Stream Restoration 19
Study Addresses State of Public Recreation Resources 20
Video Features Stormwater Management in the Pacific Northwest 20
Washington County's Phosphate Law Working 20

Recent and Relevant Periodical Articles 20
Glacial Melting May Release Pollutants into the Environment 20
Pathogenic *E. Coli* Pervasive in Stream-Water Samples with Low Concentrations of Fecal Indicator Bacteria 21
Paving an Environmentally Friendly Path: Pr. George's Town Sees Facelift, Economic Boost in Road Project 21
Popular Herbicide Affects Sexual Development in Frogs, Research Finds 21
Using Technology to Save Water in the Western United States 21
Water Measured From the Sky: Satellites Track Land's Consumption 21

Web Sites Worth a Bookmark 22
Calendar 22

First National Lakes Assessment Released (continued)

EPA, states and tribes sampled a total of 1,028 lakes for the NLA during summer 2007, representing the condition of about 50,000 lakes nationwide, not including the Great Lakes and Great Salt Lake. Field crews collected samples using the same methods at all lakes to ensure that results can be compared across the country. Researchers processed and analyzed 680,000 measurements, including indicators of water quality such as nutrients, dissolved oxygen and algal density; biological indicators such as phytoplankton and zooplankton (algae and microscopic animals); recreational indicators such as algal toxins and pathogens; and physical habitat indicators such as lakeshore and shallow water habitat cover.



The National Lakes Assessment report, available at www.epa.gov/lakessurvey, summarizes the condition of our nation's lakes.

What Does the Study Show?

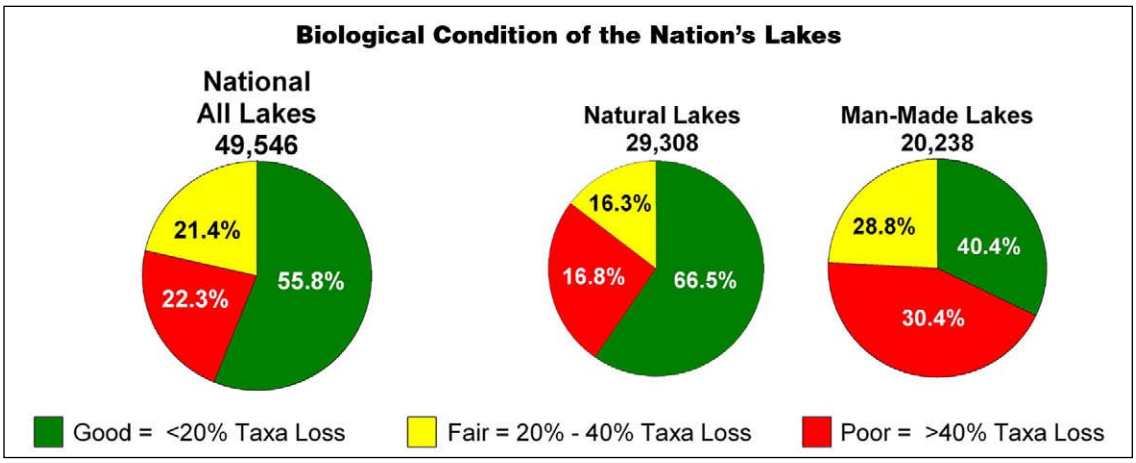
The NLA finds that 56 percent of the nation's lakes support healthy biological communities when compared to least disturbed sites. Another 21 percent of lakes are in fair biological condition, and 22 percent are in poor condition (see chart). Natural lakes are generally healthier than man-made lakes. The study shows that poor habitat condition along the lakeshore (found in 36 percent of lakes) is the most significant stressor in lakes. Removing trees and shrubs and constructing docks, marinas, homes and other structures along shorelines all contribute to degraded lakeshore habitat. Poor biological health is three times more likely in lakes with poor lakeshore habitat than in lakes with good habitat.

High levels of the nutrients nitrogen and phosphorus have been found in 20 percent of lakes, which makes this the next leading stressor. Excess nutrients entering the lakes from a variety of point and nonpoint sources contribute to algae blooms, weed growth, reduced water clarity and other lake problems. Poor biological health is 2.5 times more likely in lakes with high nutrient levels.

The NLA shows that ongoing efforts to protect lakes are helping. When EPA compared NLA data to a subset of wastewater-impacted lakes sampled 35 years ago, the data suggest that the nation's investments in wastewater treatment and other point and nonpoint source pollution control activities are working despite increased population pressures across the United States. The study finds that phosphorus levels in nearly 75 percent of the 800 lakes sampled in the 1970s have either dropped or remain unchanged. Trophic status, a measure of the biological productivity of lakes which changes very slowly under natural conditions, also improved or remained the same in about 75 percent of those lakes.

National Aquatic Resource Surveys

The NLA is the latest in a series of EPA surveys that use standardized field and lab methods to estimate the condition of the nation's water resources. EPA has already completed surveys on wadeable streams (Wadeable Streams Assessment) and estuaries and coastal waters (National Coastal Condition Reports). National studies of rivers and wetlands are underway. To learn more about the National Aquatic Resource Surveys, see www.epa.gov/aquaticsurveys.



First National Lakes Assessment Released (continued)

The NLA included the first-ever national study of algal toxins in lakes. Researchers found microcystin—a toxin that can harm humans, pets and wildlife—in about one third of lakes, and at levels of concern in one percent of lakes. NLA also collected samples for *Enterococci* bacteria, which serve as an indicator for the presence of more dangerous pathogens. The results of these analyses are not yet available.

Want More Information?

Download the archived version of "National Lakes Assessment: A Collaborative Survey of the Nation's Lakes," a two-hour Watershed Academy Webcast presented on January 5, 2010. For details see www.epa.gov/watershedwebcasts.

Implications

The NLA results allow EPA and its state and tribal partners to begin answering important national questions about the condition of the country's lakes. The survey's results establish a national baseline status for future monitoring efforts which can be used to track scientifically credible trends in lake conditions. Successive surveys (planned for every five years) will help determine if our lakes are improving over time.

In the meantime, in the face of incredible development pressures around lakes, the NLA findings suggest that our lakes remain vulnerable to excess human disturbances, especially along the lakeshore. Therefore, local, state and national initiatives should center on protecting shoreline habitats, particularly maintaining vegetative cover and controlling development. Furthermore, since the NLA identified nutrient pollution as the second-leading lake stressor, watershed stakeholders should continue to look for innovative ways to control point and nonpoint sources of nutrient pollution throughout lake watersheds.

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Water Quality Scorecard and Incentive Guide Added to Municipal Handbook

The U.S. Environmental Protection Agency (EPA) has added to its series of documents designed to help local officials implement green stormwater infrastructure in their communities. Collectively known as the "Municipal Handbook," topics cover issues such as green infrastructure financing, operation and maintenance, incentives, designs, codes and ordinances, and a variety of other subjects. The handbook documents are intended to serve as "how to" manuals on these topics, written primarily from the standpoint of municipal implementation. The handbook is being produced in sections, or chapters, with each new element being released as it is completed. EPA recently added two new chapters of the handbook. One offers a Water Quality Scorecard to help identify local policy barriers to—and opportunities for—water quality protection. The other describes local incentives mechanisms that can be used to encourage the use of green infrastructure practices on private property.

Handbook Offers Water Quality Scorecard

In August 2009 EPA released the *Water Quality Scorecard* (scorecard) to help local governments identify opportunities to remove barriers, and revise and create codes, ordinances and incentives for better water quality protection. The scorecard, available at www.epa.gov/npdes/pubs/gi_municipal_scorecard.pdf, is designed for use by municipalities of various sizes in rural, suburban and urban settings, including those that have combined sewers, municipal separate storm sewers and those with limited or no existing stormwater infrastructure. It can help municipal staff and others identify where a municipality's land development regulations and other ordinances present barriers and opportunities to implement comprehensive water quality protection. The two main goals of this tool are to (1) help communities protect water quality by identifying ways to reduce the amount of stormwater flows in a community and (2) educate stakeholders on the wide range of policies and regulations that have water quality implications.

Water Quality Scorecard and Incentive Guide Added to Municipal Handbook (continued)

EPA worked with numerous water quality experts, local government staff, developers, urban designers and others working on land use and water quality issues to develop the scorecard. The structure of the document leads municipal staff through a review of relevant local codes and ordinances, across multiple municipal departments and at three scales within the jurisdiction of a local government (municipality, neighborhood and site), to ensure that these codes work together to protect water quality goals. Officials from Lenexa, Kansas, field-tested the scorecard. EPA used Lenexa's experiences to make final adjustments before releasing the scorecard for wider use.

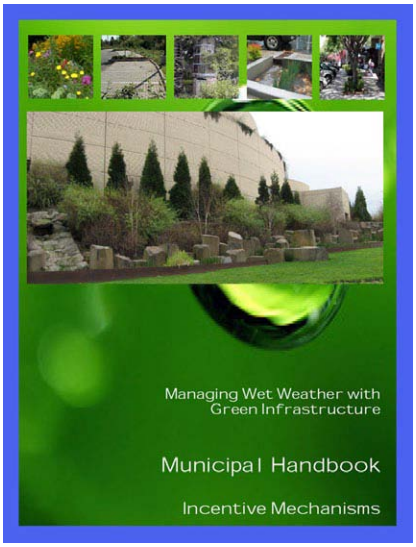
The scorecard is a locally controlled self-assessment and guide to better incorporate green stormwater infrastructure practices at the municipal, neighborhood and site scales. While one department or agency could complete the tool, the tool will be most effective if the municipality establishes an interagency process to review all local codes and policies that might affect water quality. To complete the scorecard, a municipality will need to review a variety of its documents, plans, codes and guidance manuals. The legal structure for stormwater management and land development regulation varies among municipalities; however, the most common and relevant documents needed to complete the scorecard include zoning ordinances, subdivision codes, street standards or road design guidelines, parking requirements, setback requirements, height limitations, open space or natural resource plans, and comprehensive plans.

The scorecard includes a point system to make it easier to evaluate and improve local programs. The municipality can decide whether to use the point system at all. By using the point system, a municipality can establish where it is currently and set locally appropriate thresholds and goals for the future.

The scorecard was produced by EPA's Smart Growth Office, in conjunction with EPA's Office of Water. In October 2009 the Smart Growth Office released a stand-alone version of the scorecard (*Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scale*), available for download through its Web site (www.epa.gov/dced/water_scorecard.htm). For hard copies, email nscep@bps-lmit.com or call 800-490-9198 and request document number EPA 231-B-09-001. EPA's Smart Growth Office plans to update its Web page with case studies of how municipalities have used the scorecard, example scores from test communities and more. Please send case study suggestions, scores and any other feedback to the EPA project manager, Abby Hall, at hall.abby@epa.gov or 202-566-2086.

Handbook Now Includes Incentive Mechanisms Guide

In June 2009 EPA added the *Incentives Mechanisms* chapter to the Municipal Handbook (see www.epa.gov/npdes/pubs/gi_munichandbook_incentives.pdf). Incentives are a creative tool that local governments can use to encourage the use of green stormwater infrastructure practices on private property. Incentive mechanisms allow municipalities to act beyond the confines of their regulatory authorities to improve wet weather management on properties that may not fall under updated stormwater requirements or other state and municipal policies, codes and ordinances.



The chapter discusses how municipalities can apply incentives to both new developments and existing developments. For new development projects, municipalities can incorporate incentives to creatively encourage green stormwater infrastructure through building permits and stormwater permits or other development codes and requirements. In already developed areas, municipalities can design incentives to encourage private property owners to retrofit their properties to include green stormwater infrastructure practices where they do not already exist. Examples of local incentive mechanisms can include stormwater fee discounts, expedited permitting, grants, tax credits, rebate and installation financing, and awards and recognition. The chapter provides brief examples of municipalities that use a variety of incentives across the country.

For more information on EPA's Municipal Handbook, and to download the other available chapters in the series, see cfpub.epa.gov/npdes/greeninfrastructure/munichandbook.cfm.

Road Salt Affects Nation's Northern Waters

A recent U.S. Geological Survey (USGS) study indicates that levels of chloride, a component of salt, are elevated in many urban streams and in some groundwater across the northern United States. Researchers analyzed data from 1,329 wells and 100 streams in 19 states in the northern United States in forested, agricultural and urban areas. The data had been collected as part of the National Water-Quality Assessment Program between 1991 and 2004.

Maine's Road Salt Risk Assessment Project Underway

The University of Maine is examining the risks and benefits associated with the use of road salts in Maine. The overall goal of the project is to help stakeholders understand the public policy issues and the relationships between funding, current research, levels of service and risks associated with the use of road salts. The project team is identifying and gathering background research on common de-icing chemicals and their properties, best practices used for winter maintenance, the environmental consequences of road salt use and other related topics. The final report is expected in early 2010. In the meantime, numerous background documents are available for download at http://mcspolicycenter.umaine.edu/?q=RoadSalt.

Overall, 15 percent of all streams had chloride levels exceeding the recommended federal criteria set to protect aquatic life. Annual chloride yield was largest in the urban basins (median of 88 tons of chloride per square mile), followed by agricultural basins (median of 15.4 tons per square mile) and forested basins (median of 6.4 tons per square mile).

The data demonstrate higher chloride concentrations in urban areas during winter months when salt and other chemicals are used for deicing. The highest levels of chloride (as great as 4,000 parts per million, which is about 20 times higher than the recommended federal criteria) were measured during the icy winter months.

The study identified elevated chloride levels in some groundwater samples. Fewer than two percent of drinking-water wells sampled in the USGS study had chloride levels greater than federal standards set for human consumption. Approximately 2.5 percent of shallow monitoring wells exceeded standards. Overall, chloride concentrations were largest in samples from shallow monitoring wells in urban areas, followed by the concentrations in samples from agricultural areas and forested areas.

Chloride Sources

Chloride in ground and surface waters can originate from runoff from the use and storage of salt for deicing roads, as well as many other sources including leaky septic systems, wastewater treatment facility discharge, use of water softeners, runoff of animal waste and fertilizers, discharge from landfills, natural sources of salt and brine in geologic deposits, and from natural and human sources in precipitation. The USGS report links the increasing chloride levels seen in the study to the expansion of road networks and parking lots that require deicing, increases in the number of septic systems, increases in wastewater discharge, and increases in saline groundwater from landfills. To read the entire report, see http://pubs.usgs.gov/sir/2009/5086.

Targeting Watershed Nutrient Sources to Reduce Gulf Hypoxia

Every summer a large area of water off the Gulf of Mexico's northern shore exhibits low oxygen, or hypoxic, conditions. First documented in the early 1970s, the hypoxic zone has grown over time, and now averages about 15,000 square kilometers annually. Although many sources of nutrients contribute to the formation of hypoxic conditions, scientists have identified agricultural nonpoint source pollution from the large Mississippi River Basin as one of the primary causes. Now, a new U.S. Department of Agriculture (USDA) targeted initiative will work to further reduce the nutrients reaching the Gulf.

In September 2009 the USDA's Natural Resources Conservation Service announced its new Mississippi River Basin Healthy Watersheds Initiative (MRBI). Through this initiative, NRCS and its partners will help agricultural producers in 41 selected watersheds within the Mississippi River Basin to voluntarily implement conservation practices that avoid, control, and trap nutrient runoff; improve wildlife habitat; and maintain agricultural productivity. The MRBI covers selected watersheds within 12 states: Arkansas, Kentucky, Illinois, Indiana, Iowa, Louisiana, Minnesota, Mississippi, Missouri, Ohio, Tennessee and Wisconsin.

Targeting Watershed Nutrient Sources to Reduce Gulf Hypoxia (continued)

NRCS will offer the MRBI in fiscal years 2010 through 2013, awarding at least $80 million annually through programs such as the Cooperative Conservation Partnership Initiative ($50 million), Conservation Innovation Grants ($5 million) and the Wetlands Reserve Enhancement Program ($25 million). These funds are in addition to the agency's regular program funding in the 12 MRBI states.

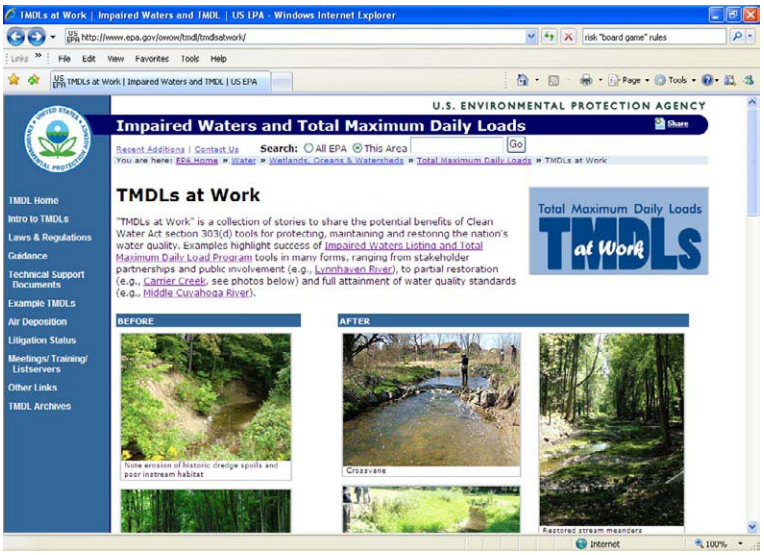
"USDA is going to partner with farmers to implement a range of land stewardship practices, including conservation tillage, nutrient management, and other innovative practices," said NRCS' Dave White. "We all live downstream of other water users and this initiative will help make the Mississippi River Basin and the Mississippi River and its tributaries healthier for everyone." For more information, and to view the 41 priority watersheds, see www.nrcs.usda.gov/programs/mrbi/mrbi.html.

The Mississippi River Basin drains 41 percent of the contiguous United States and 15 percent of North America. Water from 31 states—a drainage area of 1,245,000 square miles—flows into the Mississippi River. Raindrops that fall on the Mississippi River's headwaters in northern Minnesota will travel 2,350 miles and empty into the northern Gulf of Mexico in approximately 90 days. Nutrients carried by the river system fuel the formation of a hypoxic zone every summer.

Notes from the States, Tribes, and Localities

Web Site Highlights States' TMDL Successes

The U.S. Environmental Protection Agency (EPA) recently launched a new Web site that highlights a collection of stories demonstrating how total maximum daily loads (TMDLs) have helped to restore and protect water quality across the nation. Also referred to as a "pollution budget," a TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards (see box on following page). The new Web site, "TMDLs at Work" (www.epa.gov/owow/tmdl/tmdlsatwork), features ten stories about diverse stakeholders that are helping to develop and implement TMDLs using innovative approaches to reduce pollution from a variety of sources.



EPA's new "TMDLs at Work" Web page (www.epa.gov/owow/tmdl/tmdlsatwork) highlights states' TMDL successes.

"TMDLs at Work" currently features stories about TMDLs developed for 10 different waterbodies, including a lake in Oregon, a river in Virginia, a creek in Utah and an estuary in New York, among others. Each story shows how stakeholders can help identify and clean up polluted waters that do not meet their state's water quality standards. The stories also provide real-life examples of benefits citizens can enjoy from restored waters, such as enhancements to recreation and better quality drinking water supplies. While some stories show how stakeholders' involvement in TMDL

Web Site Highlights States' TMDL Successes (continued)

efforts have led to waters being partially or fully restored, other stories highlight successful new stakeholder partnerships and public outreach programs that would not have formed without a TMDL in place.

EPA hopes that the collection of stories will "inform and educate stakeholders about the benefits of TMDLs and related Clean Water Act section 303(d) tools," explains Sarah Furtak with EPA's Watershed Branch. She believes that state and local governments, agricultural groups, watershed organizations and other stakeholders will find the stories useful in a variety of situations—as handouts at conferences and meetings, as case studies within Clean Water Act and TMDL presentations, and as handy Web references when sharing TMDL information. To make the stories widely applicable, "we include examples highlighting successes on different aspects of the TMDL process," Furtak adds.

Navigating the Site

Visitors to the "TMDLs at Work" Web site can search for stories by state, cause of impairment (bacteria, nutrients, etc.), type of partners involved (counties, local businesses, etc.), and name of waterbody. Each story's Web page offers an overview of the TMDL effort, the current status of the TMDL and a discussion of how stakeholders benefitted. Each story page includes links to two types of printable PDF versions of the story—a short version of about two pages designed for the general public, and an in-depth "technical" version of about four pages designed for TMDL practitioners. EPA is considering updating or expanding the collection of "TMDLs at Work" annually.

What is a TMDL?

Under section 303(d) of the Clean Water Act, states, territories and authorized tribes are required to develop lists of impaired waters. These are waters for which technology-based regulations and other required controls are not stringent enough to meet the water quality standards set by states. The law requires that states establish priority rankings for waters on the lists and develop TMDLs for these waters.

A TMDL calculates the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and allocates that load among various point and nonpoint sources of that pollutant. Point sources include all sources subject to regulation under the National Pollutant Discharge Elimination System such as wastewater treatment facilities, some stormwater discharges and concentrated animal feeding operations. Nonpoint sources include all remaining sources of the pollutant, as well as anthropogenic and natural background sources. TMDLs must also account for seasonal variations in water quality, and include a margin of safety to account for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards. For more information, see www.epa.gov/owow/tmdl.

[For more information, please contact Jamie Fowler, USEPA, 1200 Pennsylvania Avenue, N.W., Mail Code 4503T, Phone: 202-566-1390; E-mail: fowler.jamie@epa.gov.]

Making Way for Salmon

In 2001, a small miracle occurred in a stream south of the California city of Arcata: the salmon came back. Lots of them. The stream, called Morrison Gulch, flows into Jacoby Creek, which empties into Humboldt Bay. Biologists knew it had once been spawning ground for salmon, because for several years they had counted hundreds trying to make their way upstream to mate—600 in one winter alone. But an old culvert under Quarry Road blocked the way; not one fish could make the jump into it from the pool below. Faced with such a barrier, some fish will try to find other places to spawn, while others will die of exhaustion from their futile attempt to reach historic spawning grounds.

Then, in August 2001, the county replaced the Quarry Road culvert with a wider one and re-graded the stream above and below to raise the channel, allowing the fish to move freely through the new culvert. With the barrier gone, the salmon moved right back into the stream. That winter, biologists counted 70 coho returning to spawn, and the following winter they observed 238 adults and 116 redds (nests of salmon eggs).

Making Way for Salmon (continued)

What happened in the Jacoby Creek watershed is happening, or beginning to happen, in many watersheds along the California coast from Del Norte County to Monterey. In the past ten years, through collaborative efforts by counties, state and federal agencies, private landowners, and nonprofit organizations, almost 300 miles of streams have been reopened to salmon and restored to conditions favorable to the fishes' survival. At a time when so many other things seem to be going wrong for West Coast salmon, this achievement is true bright spot.

Locked Out

Culverts and other small stream barriers may seem trivial compared to the large and intractable difficulties salmon face—drought, water diversions, hydropower dams, changes in ocean productivity—but there are so many of them that they have effectively locked fish out of huge areas of spawning habitat. A 2004 report by the California Coastal Conservancy (a state agency), identified more than 19,000 barriers in California's coastal watersheds, at least 1,400 of them severe or impassable.

Even obstacles that are not completely impassable to adult salmon can exhaust the fish before they reach spawning grounds, or keep juveniles, which can't jump as high as adults, from reaching tributaries that serve as safe havens during floods. "It's a huge problem," said Tom Weseloh, North Coast manager for California Trout, an advocacy group. "If you've got a barrier at the mouth of a watershed, the whole watershed is impaired."

Until recently, the needs of fish have rarely been considered when roads and other structures were built. In California's early days, many coastal roads were cut right next to creeks for the logging industry, and streams were constricted and blocked by pipes and culverts. Those roads, usually built quickly and cheaply, have eroded over the years, spilling sediment into the creeks and causing creekbanks to fail. During heavy rains, the old culverts block water and sediment flow, causing floods. But quick fixes cost less up front than bringing back a more natural streamflow, and because there are so many barriers, removing any one of them seemed a waste of time and money—until 1996 and 1997, when coho salmon on the North and Central Coasts were listed as threatened or endangered under the Endangered Species Act (ESA).

Counties Collaborate

North Coast counties moved first, perhaps because they remembered the economic and social turmoil that followed the spotted owl listing in 1990 and due to their nervousness about their vulnerability to lawsuits. Shortly after the North Coast ESA listing in 1997, the counties of Del Norte, Humboldt, Trinity, Siskiyou and Mendocino agreed to work together on watershed-wide strategies to help save the fish. That same year, they created the Five Counties Salmonid Conservation Program (5C) to focus on county land-use policies, general plans and road projects that would provide immediate benefits to salmon. In the past 12 years these counties have removed or modified 53 barriers—about 45 percent of their high-priority sites—opening up 130 miles of stream. Morrison Gulch was one of the first four projects completed.

Before this culvert in Santa Cruz County was retrofitted with concrete baffles, water shot through its smooth barrel at high speed, making it very difficult for fish to swim upstream. *(Photo by Eileen Ecklund)*

In 1998, Bay Area and Central Coast county supervisors established the Fishery Network of the Central California Coastal Counties (FishNet 4C) in response to federal listings of their own coho and steelhead runs. Bringing together Sonoma, Marin, San Mateo, Santa Cruz and Monterey counties, and part of southern Mendocino County, FishNet 4C has helped remove 58 barriers, opening 162 miles of stream.

In 2002, federal, state and local watershed restoration partners in Santa Cruz County, including the Coastal Conservancy, established the Integrated Watershed Restoration Program (IWRP) to help prioritize restoration projects and provide funding and technical advice for project designs. In addition, the group helps coordinate permits and approvals, and negotiates with public and private landholders. Since then projects have moved more swiftly, allowing 67 fish barriers to be removed in Santa Cruz County, with 14 more projects ready for construction. IWRP is helping to coordinate projects in San Mateo and Monterey counties, as well.

Making Way for Salmon (continued)

All along the North and Central Coasts, the counties and IWRP have been doing more than remove fish barriers. They have worked to reduce runoff from roads into streams and wetlands, to restore marsh habitat, and to train county road crews in fish-friendly construction and maintenance practices. The Coastal Conservancy has been a key source of assistance in all these coastal areas, funding not only construction but also project design and permitting, which other agencies and organizations typically have been reluctant to do. The Conservancy also compiled the first comprehensive inventory of passage barriers along the coast, a key step in helping counties determine which should be fixed first.

Willow cuttings are soaked in Santa Cruz County's Valencia Creek to prepare them for planting along the streambanks. *(Photo by Eileen Ecklund)*

"The counties love these programs now," said Weseloh, "because they have so many benefits." When stream flow is restored for salmon, counties also save money on road maintenance and flood control. The projects also bring some jobs and new business opportunities to rural areas. "There are tremendous benefits, a lot of them things you don't see," said Mark Lancaster, program director of 5C. "And at an average [cost] of $110,000 per mile of habitat restored, it's some of the cheapest habitat restoration out there."

Private landowners have been increasingly interested in participating. "The demand far exceeds the resources we have," said Karen Christensen, executive director of Santa Cruz's Resource Conservation District and a founder of IWRP. "People see fish in the streams on their land and get excited," said Weseloh. "They want to know if they can get help fixing their driveway culvert." Part of what gets people so excited is that "It's instant gratification. Whenever you remove a barrier, you generally see fish upstream in the first season."

[This article was excerpted and reprinted with permission from "Making Way for Salmon: Fish passage barriers removed from streams," by Eileen Ecklund; it appeared in the Coast & Ocean magazine, Volume 25, number 2 (2009), published by the Coastal Conservancy Association. To view the article in full, see www.coastandocean.org/coast_v25_no2_2009/articles/Fish_Passage_01.htm]

Notes on Education

Project Watershed—Collecting and Sharing Information

In tight economic times, efficiency is important, especially for watershed organizations. One upstate New York-based Izaak Walton League of America (IWLA) program has developed protocols that serve multiple purposes and audiences at a relatively low cost. The group has combined education, monitoring and restoration programs into one package that appeals to teachers, benefits students and provides a platform for high quality data collection.

Called Project Watershed (http://projectwatershed.org), the effort is an outgrowth of the IWLA's Save Our Stream program, a national watershed education and outreach program. (For more information, see www.iwla.org/sos, or read "Forty Years Later—and Still Saving Our Streams" in *Nonpoint Source News-Notes* issue 87, available at www.epa.gov/NewsNotes/pdf/87issue.pdf.) "Project Watershed was started in the early 1990s by educators looking for ways to get their students outdoors," explained Mat Webber, Project Watershed Coordinator. Today, Project Watershed brings together adult volunteers with central New York middle school, high school and college students to monitor water quality and protect local streams. The program engages students in classroom instruction, stream data collection, data analysis, and in some cases, stream restoration projects.

How does it Work?

Teachers use Project Watershed curricula in the classroom to introduce the students to water quality, nonpoint source pollution, and stream hydrology, biology and chemistry. All curricula meet New York state learning standards for science, math and technology.

Project Watershed—Collecting and Sharing Information (continued)

Once the students are exposed to the curricula in class, Project Watershed staff members or volunteers meet the teacher and students at a local stream. Most of the participating schools have streams either on-site or within reasonable walking distance. On the field day, Project Watershed leaders arrive at the site about an hour earlier than the students are expected. During this time, leaders set up for the students' arrival and collect data using sophisticated probes and other equipment that record dissolved oxygen, biochemical oxygen demand, pH, nitrate and phosphate levels, chloride, turbidity, total dissolved solids, temperature and other parameters. These data meet quality assurance requirements and therefore are considered valid by local and state agencies.

Once the students arrive, the leaders teach them how to properly collect the various types of stream data. Students carry out U.S. Environmental Protection Agency-certified Save Our Streams biological survey protocols (see box) using kick seine nets to collect, sort and characterize benthic macroinvertebrate populations. They also conduct physical measurements of the stream and engage in simple water chemistry tests such as using pH strips. The students do not use the more complicated probes, as this "would take too much valuable time for the students to master…and that technical mastery would be of little educational value," adds Webber.

Save Our Streams Biological Monitoring

A key element of Project Watershed is the Save Our Streams water quality monitoring method—an inexpensive, low-tech, hands-on technique that works well for schools and other groups with limited budgets. The Save Our Streams biological monitoring method relies on the presence of benthic macroinvertebrates to indicate water quality. Macroinvertebrates are large enough to see with the naked eye (macro) and have no backbone (invertebrate). Benthic macroinvertebrates live in the benthos, or stream bottom, and include insect larvae, adult insects and crustaceans. A group can use the Save Our Stream method to assess water quality with just a few inexpensive supplies including a kick seine net, macroinvertebrate identification chart and a notebook. For more information, see www.iwla.org/sos.

The leaders help the students understand what their data indicate about stream health. The students also compare their chemistry data with the quality-assured data collected by Project Watershed leaders prior to the students' arrival. "When the student's test results are different from those we got using the more sophisticated equipment, we use it as a teaching moment," explains Webber. "We ask the students what might have caused the discrepancy—such as human error, changed conditions between samplings, the area in the stream that samples were obtained, or equipment limitations, etc." Because the students' hands-on tests are conducted by several individuals or small groups, the students usually have several data points to consider. When averaged, the final number is usually very close to the quality assured result collected by the Project Watershed leaders. "If not, then we promise to redo the test after they leave, using our equipment—just to be sure of our initial readings," explains Webber. "And we promise that any error, if there is one, will be corrected."

After returning to the office, Project Watershed leaders upload the quality-assured data to Project Watershed's online database—the largest publicly accessible volunteer stream monitoring database in New York. Back in the classroom, teachers access the Project Watershed database to continue the students' stream education. Students hone their science and math skills as they compare their monitoring data with the results from previous years at that same site, as well as with data from other area streams. Project Watershed provides the teachers with additional follow-up activities to reinforce the learning experience.

Success Stories

Many schools have participated in the program for numerous consecutive years conducting stream surveys every spring and fall. This provides a long-term data set that students, IWLA, and other groups can review and analyze. Sometimes the data will show the unexpected. One group of students in a school along Syracuse's Beartrap Creek noticed that the chemistry scores had dropped significantly compared to previous years. Project Watershed leaders alerted county and state authorities to a potential problem. The authorities collected samples to confirm the problem, investigated and discovered that de-icing chemicals from nearby Syracuse International Airport were reaching the creek. The airport has since installed a water filtration system that has dramatically improved water quality.

This event set into motion numerous additional water quality protection efforts along Beartrap Creek. An annual creek clean-up is held by students, neighbors, county officials and members

of the Central New York IWLA. Additionally, a Project Watershed school installed in-stream structures to enhance aquatic habitat. Over the past 18 months of monitoring since the restoration effort, Project Watershed leaders and students have seen a significant improvement in the numbers and variety of insects, crustaceans and fish found in that section of the stream. "In fact, the stream improved to the point where we thought it could sustain trout again," notes Webber. "A local school raised trout as part of its aquaculture program and brought them to Beartrap Creek for release, after getting permission from the proper authorities."

At Corcoran High School, students' multi-year data showed consistently good water quality in Furnace Brook, a stream that flows wholly within the city of Syracuse's borders. In the 1990s, students learned of a proposed upstream development that would have filled in a wetland that feeds the stream. The students took their concerns to the local government and newspapers. They used their monitoring data to help convince local zoning officials not to permit new development that could degrade water quality. Project Watershed has continued to work with students along the stream. Now, almost twenty years later, "the stream is still in good shape," adds Webber.

Program Expands Reach

Project Watershed provides many students with their first opportunity to learn about and experience their local waterways. Thanks to positive feedback from teachers and school administrators, Project Watershed is currently expanding its target area. In just the past year, the program has doubled the number of students it reaches to more than 2,700 students from 42 schools, including 36 middle schools. To accommodate the expansion, IWLA is training a series of undergraduates and graduate school interns from local colleges, along with new volunteers, to take the program to additional schools.

Students disturb the stream bottom to knock benthic macroinvertebrates into the water column, where they are carried downstream and captured in a kick seine net. Students first use their hands to rub rocks on the stream bottom (as seen above). Next, they will "kick around" in the stream bottom to dislodge additional macroinvertebrates hiding in the substrate.

IWLA has compiled a detailed list of equipment and materials needed to assemble a kit to successfully run a Project Watershed program. Each completed kit costs approximately $1500, and includes 20 pairs of slip-on waterproof boots, multiple kick seine nets, water quality measuring equipment and other items. "We currently have four sets of equipment that serve around 50 schools and 10 adult survey teams," explains Webber. Once assembled, the kits are relatively inexpensive to maintain, he adds. "Replacing worn boots would be the major annual resupplying expense. The boots and replacement chemicals, plus incidentals, would be in the $300 range. This would support an entire year of multi-school activities."

IWLA hopes to expand Project Watershed further—first across New York, then throughout the Northeast, and, eventually, nationwide. In the meantime, "other groups could adapt our program design to their needs fairly easily. We've worked hard at making this program an easy sell—even to teachers or group leaders who have very little knowledge of watersheds or stream life," notes Webber.

Program Expands Focus

In addition to its regular school outreach and monitoring program, Project Watershed staff and teachers worked together to develop a self-contained, two- to three-week-long, full-time summer school program revolving around science and environmental studies. The program, first held in 2009, included both intensive classroom learning and in-stream monitoring. Teachers easily incorporated required science and math elements into the curriculum. Teachers met the English requirements by asking the students to write about their experiences in the stream. For social studies, teachers asked the students to consider who had used the watershed in the past and for what purpose, and what human activities might be affecting the stream today. Students met art

Project Watershed—Collecting and Sharing Information (continued)

requirements by sketching macroinvertebrates and other stream-related subjects. "The students had a great time—and learned a lot," notes Webber. He anticipates repeating and expanding the summer school program to meet future needs in this and other schools.

IWLA has also expanded the focus of Project Watershed to include restoration activities. "Incorporating restoration elements was a natural progression of our stream monitoring program," explains Webber. The group has begun to offer its services to help people identify and manage potential stream restoration activities. Restoration activities might include stabilizing streambanks, removing invasive species, helping landowners restore riparian areas, and other efforts. Webber hopes that restoration will become an integral part of their education and monitoring program. "We have submitted several grant requests," he says, "one of which would involve awarding mini-grants to qualified projects run by students."

Program Design Benefits Many

Project Watershed offers immeasurable benefits to youth and local schools through education and outdoor water quality monitoring experiences. By using consistent protocols in the Project Watershed program, the IWLA also offers the unique benefit of an ever-growing, quality-assured, wide-scale monitoring dataset. This dataset, in turn, can help IWLA, watershed organizations and government agencies pinpoint trouble spots and target potential on-the-ground restoration projects. Unlike some restoration projects where the scale and duration of associated monitoring efforts is limited by a funding window, Project Watershed offers a wide-scale, long term dataset that often already contains years of baseline data for many streams.

Project Watershed participants help care for newly planted trees in a creek's riparian zone.

Once a restoration project is implemented, Project Watershed leaders and students plan to collect years of follow-up data as an integral part of the education experience. "Far too often, restoration projects, though well intended, fail because there is no follow-up monitoring to catch and correct things that may not be working as expected," says Webber. "Continued monitoring and tweaking of the original restoration plan helps a project succeed, which gives everyone involved a great feeling of accomplishment—and lessons that last a lifetime."

[For more information, contact Mat Webber, Izaak Walton League of America, Inc., Project Watershed Coordinator, 3826 Lane Road, Cazenovia, NY 13035. Phone: 315-655-3375; E-mail: mwebber@iwla.org]

World's First Floating Wetland Classroom Opens in Virginia

Students in southeastern Virginia are the first in the world to enjoy a truly unique learning experience—a floating wetland classroom. In September 2009, staff from the nonprofit Elizabeth River Project, faculty and students from the University of Virginia (UVA), and many other sponsors and supporters gathered to christen the new "Learning Barge," a self-sustaining, mobile education center that holds up to 149 passengers. Moored on Virginia's heavily polluted Elizabeth River, a tributary to the Chesapeake Bay, the barge serves as an interactive classroom designed to help students of all ages learn how to take care of the Elizabeth River and its resources—with the ultimate goal of helping to make the river swimmable and fishable by 2020.

Building the Barge Benefitted Many

The Learning Barge is the result of years of collaboration between the Elizabeth River Project and the UVA School of Architecture and Engineering. With funding from Lowe's, Dominion Virginia Power, EPA and many others, UVA students and faculty designed and built the $1.3 million barge beginning in 2007. The collaboration connected university students with communities that would not have otherwise had access to design services, and provided opportunities for the students to

learn and practice green strategies at the architectural and urban scales. Plus, it helped students see how their efforts could make a difference in a local community's effort to improve the environment.

The partners designed the Learning Barge to be self-sustaining—it harnesses energy from sun and wind, filters rainwater and gray water in a contained bed wetland, and utilizes recycled materials and green technologies such as composting toilets. The barge is a Coast Guard-certified vessel and offers full accessibility to all visitors. Project partners estimate that more than 19,000 students and adults (including visitors from civic groups, garden clubs, and other organizations) will visit the barge annually from throughout southeastern Virginia and beyond.

The Elizabeth River Project's Learning Barge is the world's first floating wetland classroom.

Whereas many environmental education centers are often located in pristine or protected natural areas, the Learning Barge traverses an important, but polluted, urban river that links key Virginia cities, including Norfolk, Portsmouth, Chesapeake and Virginia Beach, with the Chesapeake Bay and Atlantic Ocean. The barge provides a new way for students and adults to access the Elizabeth River; often, people in these communities can't reach the river because much of its shoreline is controlled by industrial and military interests. The students get to see the river and better understand that it serves as a transportation corridor. "The students love seeing all the different kinds of maritime vessels continually going by," explains Robin Dunbar, Education Coordinator for the Elizabeth River Project and lead educator of the Learning Barge. "They enjoy seeing the ferry, tug boats, military and police boats, and yachts – but they especially love when a barge goes by."

The mobility of the Learning Barge adds to its appeal. Although not capable of moving under its own power, the barge can be easily moved by tug boat. Every few months, the barge is taken to a different site along the river, such as a school, public dock, river festival or river restoration site. By traveling to different places along the river, the barge can offer site-specific, hands-on environmental education. Plus, the barge becomes more easily accessible to a different group of schools in a time of limited transportation budgets.

Learning on the Barge

The barge serves as a demonstration tool to teach visitors about power generation, water collection and filtration utilizing native plants, and other environmentally friendly technologies. Plus, educators teach participants about the Elizabeth River's tidal estuary ecosystem, its ongoing wetland and oyster restoration and sediment remediation projects, and the economic significance of the Elizabeth River as a transportation corridor.

The Learning Barge provides interactive educational activities for pre-Kindergarten children through adults. Activities focus on wetlands, ecology, water quality, sustainable practices, art, literature, history and geography. "Princess Elizabeth" of the Elizabeth River, portrayed in historical costume by Dunbar, serves as the host and primary educator. She is assisted by five seasonal interns who work as "educational deckhands" for each learning station.

"Princess Elizabeth" serves as the Learning Barge's host and primary educator.

During the program, visitors experience a living wetland nursery, where they test river water and find out if it is cleaner once wetlands filter it. Visitors explore the "green alley," which demonstrates the barge's ability to reuse water and operate solely with sun and wind. An enclosed classroom lab invites visitors to examine river conditions where the barge is docked and compare those data to that collected by a nearby National Oceanic and Atmospheric Administration buoy. A "river reflections" station, funded by the National Endowment for the Arts, engages visitors in their own expression of river art while

World's First Floating Wetland Classroom Opens in Virginia (continued)

they learn how other cultures honor their rivers. Other unique features of the barge include a large observation pool, oyster garden and composting toilets. For detailed descriptions of the stations, see www.elizabethriver.org/PDFs/LearningBarge/Fieldtrip%20packet.pdf.

Children love their time on the barge—as do the teachers, notes Dunbar. "Teachers fill out an evaluation before they leave. One of the questions asks them to rate the field trip on a scale of 1 to 10, with 10 being excellent. We've gotten responses like '10+++++' and '15.' It was an immediate confirmation that the program is a success."

The curriculum used on the Learning Barge was developed cooperatively by doctoral students from UVA's Curry School of Education; public outreach staff from the Elizabeth River Project; science coordinators and teachers from the Portsmouth, Chesapeake and Virginia Beach school districts; and staff from the cities of Norfolk, Portsmouth, Chesapeake and Virginia Beach. The curriculum is largely based on the Virginia Standards of Learning (SOL) with a particular concentration on grades 3 through 8. Sample lesson plans are available online at www.arch.virginia.edu/learningbarge/educate_curriculum.html. The education partners also offer a series of activities to engage students both before and after their visit.

The Learning Barge has been nationally recognized for its combination of science education and sustainable design. It has received numerous major awards including the 2009 National Endowment for the Arts' Access to Artistic Excellence Grant, 2008 Excellence on the Waterfront Student Award from the Waterfront Center, and the 2007 EPA People, Prosperity and the Planet (P3) Sustainability Award, among others. For a complete list, see www.arch.virginia.edu/learningbarge/awards.html.

[For more information, contact Robin Dunbar, Elizabeth River Project, Admirals Landing, 475 Water Street, Suite 103A, Portsmouth, VA 23704. Phone: 757-399-7487; rdunbar@elizabethriver.org]

Free Online Training Available to Help Tackle Nonpoint Source Pollution

Need help training new employees about the basics of nonpoint source pollution? Need a refresher course on stormwater permitting requirements? The U.S. Environmental Protection Agency (EPA) offers numerous free, Web-based watershed training options for a variety of audiences.

Watershed Management Training

Watershed Academy Web offers more than 50 free, self-paced training modules that represent a basic and broad introduction to the watershed management field (see www.epa.gov/watertrain). The modules are appropriate for a wide array of audiences—from government employees to interested citizens. EPA continually updates and adds modules as needed. For example, EPA recently added a new module called "The Effect of Climate Change on Water Resources and Programs." To help you find what you need, EPA has organized the online modules into six themes:

- *Introductory/Overview Modules*, which introduce the principles of the watershed approach and the value of working at a watershed level.
- *Watershed Ecology Modules*, which show that watersheds are natural systems that can provide substantial benefits to people and the environment.
- *Watershed Change Modules*, which describe both natural and human-induced changes in watersheds, and compare normal changes with changes of concern.
- *Analysis and Planning Modules,* which show how watershed planning, monitoring and assessment are important first steps for solving problems.
- *Management Practices Modules*, which show how watershed management challenges such as urban runoff, cropland management, forestry and other issues are addressed by techniques that reduce environmental impacts.
- *Community/Social/Water Law Modules*, which cover social issues, communications, relevant laws and regulations.

Free Online Training Available to Help Tackle Nonpoint Source Pollution (continued)

The Watershed Academy also offers ongoing Webcast seminars, which can be accessed live or may be downloaded later (see www.epa.gov/watershedwebcasts). EPA's two most recent Webcasts include:

- "National Lakes Assessment: Reporting on the Condition of the Nation's Lakes." Held in early January 2010, this Webcast discusses EPA's newly released draft report, *National Lakes Assessment: A Collaborative Survey of the Nation's Lakes*, which presents data on the extent of lakes that support healthy biological communities, offers information about selected stressors impacting lake quality, and describes recreational indicators of lake condition. (See the lead article in this issue for more on the National Lakes Assessment study.)
- "An Urgent Call to Action: Nutrient Innovations Task Group Report." Held in early December 2009, this Webcast presents findings from a new report that characterizes the scope and major sources of nutrients that enter our waterbodies, and offers recommendations for ways to address the problem.

The site offers archived versions of 44 other Webcasts, as well, addressing subjects ranging from implementing total maximum daily loads to launching a water quality monitoring program.

Stormwater Training for Municipalities

Because municipal stormwater runoff is discharged into surface waterbodies through pipes and man-made ditches, it is technically considered a point source pollutant when the collection system serves a significant urban population (as defined in EPA's municipal stormwater rule), and is regulated by EPA's National Pollutant Discharge Elimination System (NPDES) stormwater permit program. However, pollutant sources in the municipal stormwater stream are primarily nonpoint source in origin—sediment from disturbed land areas, fertilizers and pesticides from lawns, and petroleum products from roads, parking lots and other impervious surfaces.

To help people better understand the regulatory framework and technical issues associated with the NPDES stormwater permit program, EPA holds training sessions, workshops and Webcasts. EPA's NPDES training Web site www.epa.gov/npdes/training) currently includes 26 Webcasts covering various aspects of stormwater, including how to: communicate your stormwater message to the public; identify illicit discharges to your stormwater system; manage stormwater before and after construction; and use green infrastructure to manage stormwater. EPA also offers a free, self-paced, Web-based NPDES permit writers training.

Watershed Investigations Book Links Hydrology and Human Impact

A new education resource is available from the National Science Teachers Association to help high school students better understand how human behavior impacts watersheds. *Watershed Investigations: 12 Labs for High School Science* provides high school educators with a series of broad-based, hands-on experiments designed to help students understand the relationships between human impact and local hydrology. Covering a range of disciplines—including geology, chemistry, earth science, botany, and biology—this volume gives educators lesson plans that will interest the student and meet a wide array of state and national curricular standards.

The book includes 12 customizable labs, each with extensive background and reference information designed to allow students to share the excitement of discovery along with the methods of scientific research and relevant examples of textbook subject material.

Labs include:

- Modeling Glacier Features with Sand
- Glacial Features of a Watershed
- Plant Identifications
- Wetland Delineation
- Measuring Plant Allelopathy
- Stream Channel Morphology
- Calculating Stream Discharge

Want to find additional watershed education resources for grades K-12 from the National Science Teachers Association? Go to www.nsta.org/store and type "watershed" in the search box.

Watershed Investigations Book Links Hydrology and Human Impact (continued)

- Flood Frequency Analysis for a River
- Comparison of Phosphorus Levels in Stream Sediments
- Macroinvertebrate Identification
- Factors that Affect Eutrophication
- Groundwater Contamination

The flexible formats of these labs can be customized to fit any teaching style, and can be adapted to fit either inquiry-based or traditional methods based on the given class and situation. Additionally, the book contains helpful reference materials and appendices that include a history of the watershed, resources for additional information, and rubrics for writing classroom laboratory reports. The book is available in either hard copy or electronic format from the National Science Teachers Association for between $18 and $28. See www.nsta.org/store and type "Watershed Investigations" in the search box. The book's description page offers more information, including a link to a sample chapter, information about the authors and a complete index for the resource.

Reviews and Announcements

Agencies Release Seven Draft Reports on the Chesapeake Bay

Federal agencies have released seven draft reports on how to protect and restore the Chesapeake Bay and its watershed (see http://executiveorder.chesapeakebay.net). The draft reports recommend ways to: (a) define the next generation of tools and actions to restore water quality; (b) target resources to better protect the Chesapeake Bay and its tributary waters; (c) strengthen stormwater management practices at federal facilities and on federal lands; (d) assess the impacts of a changing climate; (e) expand public access to waters and open spaces; (f) strengthen scientific support for decision-making; and (g) develop focused and coordinated habitat and research activities.

Climate Change Coastal Adaptation Planning Guidebook Available

The U.S. Agency for International Development recently released *Adapting to Coastal Climate Change: A Guidebook for Development Planners*, available at www.crc.uri.edu/download/CoastalAdaptationGuide.pdf. This 148-page guide proposes ways to assess climate change vulnerability and incorporate adaptation options into development plans at local and national levels.

Climate Change Education Toolkit Updated

The U.S. Environmental Protection Agency (EPA) and numerous partners recently updated and expanded the *Climate Change, Wildlife and Wildlands Toolkit for Formal and Informal Educators*. This award-winning toolkit was originally released in 2001. In 2007 EPA decided to revise the kit to reflect the most recently available reports on climate change and its impacts to wildlife and their habitats in specific eco-regions of the United States. The updated kit is designed for classroom teachers and informal educators in parks, refuges, forest lands, nature centers, zoos, aquariums, science centers, etc., and is targeted at middle school students. To access the kits and view a short promotional trailer, visit EPA's Web site at www.epa.gov/climatechange/wycd/CCWKit.html.

DIRT! The Movie Now Available

DIRT! The Movie (www.dirtthemovie.org) provides an insider's look at the wonders of the soil. It tells the story of Earth's most valuable and underappreciated source of fertility—from its miraculous beginning to its crippling degradation. The film explores the environmental, economic, social and political impact of soil. Check the Web site to identify screening events scheduled near you, to view the trailer or to buy the DVD (prices start at $19.95).

Environmental Education Resource Targets Diverse Cultures

The EPA-funded Environmental Education (EE) and Training Partnership recently released a new environmental education resource. *Still Developing the Toolbox: Making EE Relevant for Culturally Diverse Groups*, by Joanne M. Lozar Glenn, profiles five organizations working to connect their EE programming to the communities they serve. From creating learning groups to reaching urban, immigrant and native audiences, these organizations address what it means to work with diverse audiences, and how connecting with these communities changes what they're doing and how that work gets done. The article includes 10 learning points that have emerged from environmental educators who are working to make EE more inclusive. The article also provides a list of resources (books, articles, Web sites, programs, and organizations and individuals) designed to inspire readers who want to learn more. See http://cms.eetap.org/repository/moderncms_documents/Still_Developing_Toolbox.1.1.1.pdf to download a free copy.

EPA Issues Rule to Reduce Water Pollution from Construction Sites

On November 23, 2009, EPA issued a final rule to help reduce water pollution from construction sites. The agency believes this rule, which takes effect in February 2010 and will be phased in over four years, will significantly improve the quality of water nationwide. The final rule requires construction site owners and operators that disturb one or more acres to use best management practices to ensure that soil disturbed during construction activity does not pollute nearby water bodies. In addition, owners and operators of sites that impact 10 or more acres of land at one time will be required to monitor discharges to verify that they comply with specific discharge limits. This is the first time that EPA has imposed national monitoring requirements and enforceable numeric limitations on construction site stormwater discharges. For more information, see www.epa.gov/waterscience/guide/construction.

EPA Offers Facebook Page about Water

EPA's Office of Water launched "Water Is Worth It," a new Facebook Page that provides a public forum to share information, encourage discussion, and raise awareness about the value of water and water-related resources. EPA will be regularly posting information and discussion topics, which Facebook users can have delivered to their virtual door by becoming a "fan" of the page. See www.facebook.com/pages/Washington-DC/EPA-Water-Is-Worth-It/175423483336?ref=mf for more information.

EPA Releases National Water Program Research Strategy

EPA released its National Water Research Strategy to engage a broad range of researchers in meeting the challenges of protecting and improving our nation's water resources. The strategy identifies and promotes the research needs of EPA's national water program to potential partners. The strategy outlines the water program's four research priorities: healthy watersheds and coastal waters, safe drinking water, sustainable water infrastructure and water security. Each priority also focuses on five technical areas: aquatic life health effects, human health effects, method development, occurrence and exposure, and treatment technologies and effectiveness. The strategy's objective is to diversify the science that the water program uses to develop its regulatory and non-regulatory water management tools and decisions. For more information, see www.epa.gov/waterscience/strategy.

Fact Sheet Explores LID and Emergency Services Concerns

Drs. Timothy Lawrence and Monique Myers of the California Sea Grant Program recently released *Emergency Services and Storm Water Management*, a stormwater factsheet that discusses how best to manage stormwater runoff while also maintaining public health and safety services. The authors discuss the concerns of emergency services personnel when considering low impact development (LID) techniques such as narrow streets and the use of porous concrete. The fact sheet may be downloaded at www.csgc.ucsd.edu/BOOKSTORE/Resources/LID_FACTSHEET.pdf.

Green Stormwater Infrastructure Training Resources Available

Using green stormwater infrastructure as part of wet weather management programs across the country is creating opportunities for new areas of employment. The potential is notable, not just for designing and installing practices such as bioretention and permeable pavements, but also for long-term operation and maintenance services. In early 2009 EPA released its *Green Jobs Training Catalog* (www.epa.gov/npdes/pubs/gi_greenjobs_feb09.pdf) to help connect people with available green stormwater infrastructure technologies training resources. This catalog is intended to provide a central link to a wide variety of training opportunities, including those of colleges and universities, nonprofit and trade organizations, state certification programs, training grants and more. For an online calendar of ongoing green stormwater infrastructure-related workshops and conferences, see http://cfpub.epa.gov/npdes/greeninfrastructure/gitrainings.cfm.

Group Develops Stormwater Tutorial

The nonprofit group American Rivers recently released a *Stormwater Communications Tutorial* (www.americanrivers.org/our-work/clean-water/sewage-and-stormwater/stormwater-messaging.html). The tutorial helps you to develop a message about stormwater to prompt your local leaders to take action for smarter stormwater solutions. American Rivers interviewed and tested message concepts with a variety of local leaders around the Chesapeake Bay region. The lessons learned are broadly applicable to water-related communications.

Guide Explores Green Street Development

EPA recently released a seven-page *Green Streets* guide (www.epa.gov/npdes/pubs/gi_arra_green_streets.pdf), which offers a quick look at ways to incorporate green infrastructure into residential streets, commercial streets, arterial streets and alleys. A green street uses a natural systems approach to reduce stormwater flow, improve water quality, reduce urban heating, enhance pedestrian safety, reduce carbon footprints and beautify neighborhoods. Examples of green street features include vegetated curb extensions, sidewalk planters, landscaped medians, vegetated swales, permeable paving and street trees. The guide provides an overview of different strategies that can be used in transportation rights-of-way at the local or neighborhood scale.

National Wildlife Federation Launches Campaign

The National Wildlife Federation recently launched "Be Out There™," a national campaign to get families and kids to spend daily time outdoors to connect with the natural world. Developed in concert with the 2009 film "Where the Wild Things Are," the campaign shares ideas for wild outdoor fun, including how to find amazing wild creatures and build a fort. The campaign's Web site (www.nwf.org/beoutthere) offers a series of supplemental materials and activity guides for free download.

New Fact Sheets Highlight Coastal Ocean Science

The U.S. Geological Survey (USGS) recently released three new fact sheets in a series highlighting coastal and ocean science in USGS' Western Region (Washington, Oregon, Idaho, California, Nevada, Utah, Arizona, Alaska and Hawaii). The fact sheets illustrate the spectrum of USGS research that provides information for resource managers and policy makers who must balance conservation mandates with increasing demands for resources. The three new fact sheets include an overview of the entire region, a more detailed look at a specific area (Alaska), and a narrower focus on one topic (seabirds). For more information, see the article in the October 2009 issue of USGS' newsletter, *Soundwaves* (http://soundwaves.usgs.gov/2009/10/pubs.html).

Newsletter Features Homemade Monitoring Equipment Ideas

The Fall 2009 issue of EPA's *Volunteer Monitor* (www.epa.gov/owow/monitoring/volunteer/newsletter/volmon20no2.pdf) features ideas for building your own benthic macroinvertebrate sampling equipment, including kick seine nets, net spoons, bug racks and sieve buckets. Another article in the same issue features ideas for make-it-yourself water sampling devices, including sampling rods, bucket samplers and discrete-depth samplers.

North Carolina Releases LID Guidebook

In 2009 North Carolina released *Low Impact Development—A Guidebook for North Carolina*, a manual designed to help North Carolina communities use low impact development (LID) to manage stormwater runoff in a ecologically sensitive manner. This guidebook is also intended to raise communities' awareness of how their existing development codes and ordinances assist or prohibit the use of LID. The manual provides guidance on federal and state stormwater regulations/performance criteria; code and ordinance review procedures (with model LID/stormwater ordinances); and offers a spreadsheet model that can be downloaded and used for prescreening site designs. To download the guidebook and spreadsheet, see www.ncsu.edu/lid.

Report Highlights Sustainable Water Management

A new report released by the nonprofit organization American Rivers highlights eight communities' sustainable water management approaches that will make them more resilient to a changing climate. The report, *Natural Security: How Sustainable Water Strategies Are Preparing Communities for Climate Change*, shows how 21st century green infrastructure approaches will ensure clean water, public health and economic benefits for communities into the future. The report, along with a video and other supplementary information, are available at www.americanrivers.org/our-work/global-warming-and-rivers/infrastructure/natural-security.html.

Report Validates Importance of Coastal Economies

Coastal states are tremendously important to the U.S. economy—in 2007 alone, the 30 coastal and Great Lakes states contributed $11.4 trillion to the national gross domestic product. A new report by the National Ocean Economics Program, *State of the U.S. Ocean and Coastal Economies: 2009*, presents time-series data compiled over the past 10 years that track economic activities, demographics, natural resource production, nonmarket values, and federal expenditures in the U.S. coastal zone on land and water. The report may be downloaded at www.oceaneconomics.org/NationalReport.

Save Our Streams Guide Now on DVD

SOS for America's Streams: A Guide to Water Quality Monitoring provides step-by-step instructions on using biological monitoring to measure water quality. Just released on DVD, this excellent training tool describes pollution sources, explains the importance of tracking stream health, and shows how to determine water quality based on aquatic insects and crustaceans found in streams. The DVD costs $19.95 + shipping and handling and may be ordered online (www.mwpubco.com/titles/iwlasoswqmvideo.htm) or by calling 800-233-8787.

Series Discusses Challenges of Stream Restoration

Stormwater magazine recently completed a three-part series about restoring streams. All three articles in the "Challenges of Stream Restoration as a Stormwater Management Tool" series are available online. "Part 1: A designer's perspective" (www.stormh2o.com/may-2009/stream-restoration-management.aspx), discusses the key challenges that frequently pose the greatest risks to the success of a stream restoration project. "Part 2: Planning for construction" (www.stormh2o.com/september-2009/challenges-stream-restoration.aspx), identifies key issues that a project manager should

consider during the construction phase. Finally, "Part 3: Lessons learned" (www.stormh2o.com/november-december-2009/challenges-of-stream.aspx), offers insights from landowners, designers and contractors who have worked on stream restoration projects.

Study Addresses State of Public Recreation Resources

The nation's parks, public lands, waterways and other outdoor recreational assets provide the American public a multitude of benefits, but a new study by Resources for the Future concludes that they face major challenges in funding and maintaining the condition of these lands and associated amenities. Population growth is leading to development of lands on the edge of parks, wildlife refuges and other protected public lands. This creates a number of problems—point source and nonpoint source pollution, lack of habitat connectivity for wildlife, and sometimes reduced access to the public lands. Invasive species present another problem that can cause deterioration in the quality of outdoor resources. The study report, *The State of the Great Outdoors: America's Parks, Public Lands, and Recreation Resources* (September 2009), delves into the status of America's outdoor resources, the demand for recreation, and the financing of conservation, parks and open space. The report may be downloaded at www.rff.org/RFF/Documents/RFF-RPT-ORRG-State-of-Outdoors.pdf.

Video Features Stormwater Management in the Pacific Northwest

The Pacific Northwest Water Program held a free video conference, "Stormwater Management: One Backyard at a Time," in September 2009. Now available online at http://eces.wsu.edu/video/stream.html, the 2.5-hour video offers a glimpse of what private citizens, city/county governments, and agencies are doing to control polluted stormwater runoff. The video team traveled to two high desert communities: Ketchum, Idaho and Bend, Oregon; as well as to Whidbey Island to film strategies used in those diverse climates to manage rain and snowmelt runoff. Interviews held with local government officials, city engineers, developers and homeowners tell the story of stewardship and social responsibility.

Washington County's Phosphate Law Working

A year after Spokane County, Washington, adopted the nation's first near-total prohibition (no more than 0.5 percent phosphorus by weight) on sales of water-softening phosphates in dishwasher detergent, data indicate that the ban has reduced phosphorus levels. Water entering Spokane's wastewater treatment plant during the first months following the ban had 10.7 percent less phosphorus than the annual average from the last three years. The Washington Department of Ecology estimates that, before the ban, dishwashing detergent accounted for an estimated 10 to 12 percent of the phosphorus entering municipal wastewater plants. Treatment plants can remove much of the phosphorus in wastewater, but they cannot treat and remove all phosphorus. The phosphorus that treatment plants cannot remove is released into Washington's waters in treated wastewater. Therefore, any reduction in phosphorus will help improve overall water quality. The state of Washington will begin enforcing a similar, statewide ban beginning in July 2010. For more information, see www.ecy.wa.gov/programs/wq/nonpoint/phosphorus/PhosphorusBan.html.

Recent and Relevant Periodical Articles

Glacial Melting May Release Pollutants into the Environment

By Science Daily (www.sciencedaily.com/releases/2009/10/091021100742.htm)

This article, featured in the October 21, 2009 online issue of *Science Daily*, discusses a recent study indicating that melting glaciers might be the source of a mysterious increase in persistent organic pollutants in sediment in certain lakes since the 1990s. Although many of these compounds are no longer used in industrial processes, chemicals that were deposited in glaciers decades ago are now being released through meltwater.

Pathogenic E. Coli *Pervasive in Stream-Water Samples with Low Concentrations of Fecal Indicator Bacteria*

By Science Daily (www.sciencedaily.com/releases/2009/09/090922160106.htm)

This article, featured in the October 29, 2009 online issue of *Science Daily*, discusses a recent study showing that the *E. Coli* bacteria were common in water samples with low levels of fecal coliform bacteria. The study questions whether fecal coliform bacteria should be used as an indicator for the presence of pathogenic organisms in water.

Paving an Environmentally Friendly Path: Pr. George's Town Sees Facelift, Economic Boost in Road Project

By Lisa Rein (www.washingtonpost.com/wp-dyn/content/article/2009/07/22/AR2009072203470.html?hpid=artslot)

Printed in the July 23, 2009 edition of the *Washington Post*, this article describes an industrial Maryland town's large-scale infrastructure renovation project designed to better control stormwater—naturally. Funded through $1.3 million in federal stimulus money, the town of Edmonston will implement new green stormwater infrastructure elements including rain gardens, porous pavement and numerous trees.

Popular Herbicide Affects Sexual Development in Frogs, Research Finds

By Science Daily (www.sciencedaily.com/releases/2009/12/091203225038.htm)

Featured in the December 5, 2009 issue of *Science Daily,* this article discussed the finding of a recent study in Canada. Researchers from the University of Ottawa's Department of Biology found that atrazine, a heavily-used herbicide, alters the sexual development in frogs. The researchers added atrazine to outdoor tanks so the concentration was comparable to levels typically measured in the Canadian environment. They kept tadpoles of leopard frogs for an entire spring and summer in mesocosms (semi-natural conditions). At the end of the summer, researchers found that the tanks with herbicide had fewer tadpoles reaching the froglet stage. Moreover, the atrazine appears to have had a feminizing effect on the animal, resulting in development of more females than males.

Using Technology to Save Water in the Western United States

By Don Comis (www.ars.usda.gov/is/AR/archive/sep09/water0909.htm)

This article was published in the September 2009 issue of *Agricultural Research*, the USDA's Agricultural Research Service's (ARS) online newsletter. It discusses a system being developed by ARS scientists that saves water by using aerial imagery and ground-based sensors to determine the irrigation needs of small sections of cultivated fields. ARS' goal is to combine one remote sensing aerial image of a field with a system of wireless sensors tied to computer software that will accurately determine the irrigation needs of small areas on a daily basis throughout the season. Ideally, farmers could identify areas with high or low water needs with data transmitted to their computers and, using either a drip or a sprinkler system, adjust irrigation levels based on the data.

Water Measured From the Sky: Satellites Track Land's Consumption

By Kari Lydersen (www.washingtonpost.com/wp-dyn/content/article/2009/09/13/AR2009091302368.html)

Featured in the September 14, 2009 edition of the *Washington Post*, this article discusses a new water management tool—Mapping EvapoTranspiration with High Resolution and Internalized Calibration (METRIC). Developed by the Idaho Department of Water Resources and the University of Idaho, the tool employs a system of computer algorithms that use surface

temperature readings from government satellites and air temperature to measure how much water is "consumed" on a certain piece of land through evapotranspiration.

Web Sites Worth a Bookmark

Backyard Rain Gardens (www.bae.ncsu.edu/topic/raingarden)

This site, developed by the North Carolina Cooperative Extension, provides detailed rain garden information for homeowners. The site describes the benefits of rain gardens for controlling storm-water and explains how to locate, build and maintain a rain garden. Visitors can download plant selection lists and educational handouts and slide presentations. The site also offers a photo gallery and a page of links for more information.

Freebies for Science Teachers (www.nsta.org/publications/freebies.aspx?lid=exp)

The site, developed by the National Science Teachers Association, offers numerous resources that address watersheds, water quality issues and water pollution sources. This tool would be useful for anyone seeking to engage children in science-related activities. A search box at the top of the page makes it easy to find what you need.

LandScope America (www.landscope.org)

The LandScope America Web site is a collaborative project of NatureServe and the National Geographic Society designed as a conservation and educational resource for the land-protection community and the public. LandScope America brings together maps, data and information from many sources and presents them to the public in dynamic and accessible formats. The site incorporates interactive maps that portray conservation priorities with photos, video and stories about people and places.

Livestock Waste Management (www.lwmtech.org)

This Web site from the Conservation Technology Information Center allows livestock producers, advisors and regulators to access online tools, data resources, contacts and success stories to help livestock operations meet their regulatory requirements. Popular links include an array of online manure management planners, cost calculators and publications developed by university specialists in EPA Region 5, which includes Minnesota, Wisconsin, Illinois, Indiana, Michigan and Ohio.

Calendar

For an updated events calendar, see www.epa.gov/newsnotes/calendar.htm.

February 2010

2/21–25	*2010 Land Grant and Sea Grant National Water Conference*, Hilton Head Island, SC. For more information, see www.usawaterquality.org.
2/23–25	*Clean Water, Wetlands and the Law: New Tools and Opportunities*, Shepherdstown, WV. For more information, see www.aswm.org/calendar.

March 2010

3/2	*"It's Your Water" Showcase*, St. Louis, MO. For more information, see www.ars.usda.gov.
3/10–13	*39th Benthic Ecology Meeting*, Wilmington, NC. For more information, see www.benthicecologymeeting2010.org.
3/11–12	*8th Annual Green Building Conference,* Syracuse, NY. For more information, see www.esf.edu/greenbuilding.
3/24–26	*International Drought Symposium: Integrating Science and Policy*, Riverside, CA. For more information, see http://cnas.ucr.edu/drought-symposium.
3/29–31	*2010 American Water Resources Association Spring Specialty Conference: GIS and Water Resources VI*, Orlando, FL. For more information, see www.awra.org/meetings/Florida2010.

April 2010

4/11–14 *2010 International Low Impact Development Conference: Redefining Water in the City*, San Francisco, CA. For more information, see http://content.asce.org/conferences/lid10.

4/11–15 *2010 Ground Water Summit and 2010 Ground Water Protection Council Spring Meeting*, Denver, CO. For more information, see www.ngwa.org/summit2010.

4/25–27 *66th Annual Northeast Fish and Wildlife Conference*, Newton, MA. For more information, see www.neafwa.org/2010.

4/25–29 *7th National Monitoring Conference: Monitoring From the Summit to the Sea*, Denver CO. For more information, see www.nalms.org/nalmsnew/nalms.aspx?subcatid=44&Sid=3.

4/27–30 *National Association of Environmental Professionals 35th Annual Conference—Tracking Changes: 40 Years of Implementing NEPA and Improving the Environment*, Atlanta, GA. For more information, see www.naep.org/mc/page.do?sitePageId=92305&orgId=naep.

4/28–30 *Managing Agricultural Landscapes for Environmental Quality*, Denver, CO. For more information, see www.swcs.org/en/conferences/managing_agricultural_landscapes_ii.

May 2010

5/3–6 *Aquatic Weed Control Short Course*, Coral Springs, FL. For more information, see http://conference.ifas.ufl.edu/aw.

5/3–6 *National Mitigation and Ecosystem Banking Conference*, Austin, TX. For more information, see www.mitigationbankingconference.com.

5/9–12 *Agriculture Without Borders: Creating Knowledge and Partnerships Across Disciplines and Across the World*, West Lafayette, IN. For more information, see http://usain.lib.purdue.edu.

5/16–20 *2010 World Environmental and Water Resources Congress: Challenges of Change*, Providence, RI. For more information, see http://content.asce.org/conferences/ewri2010.

5/16–21 *Building Blocks of Floodplain Management*, Oklahoma City, OK. For more information, see www.floods.org/index.asp?menuid=381&firstlevelmenuid=181&siteid=1.

5/17–19 *New England Interstate Water Pollution Control Commission's Annual Nonpoint Source Pollution Conference*, Plymouth, MA. For more information, see www.neiwpcc.org/NPSconference.

5/21–24 *National River Rally*, Snowbird, UT. For more information, see www.rivernetwork.org/programs/national-river-rally.

5/26–28 *2010 Challenges of Natural Resource Economics and Policy: 3rd National Forum on Socioeconomic Research in Coastal Systems*, New Orleans, LA. For more information, see www.cnrep.lsu.edu.

June 2010

6/8–10 *State of the Coast: Implementing a Sustainable Coast for Louisiana*, Baton Rouge, LA. For more information, see www.stateofthecoast.org.

6/13–16 *9th International Drainage Symposium*, Quebec City, Canada. For more information, see www.asabe.org/meetings/IDS-2010-CFP-DM-Wkshp.pdf.

6/15–17 *Towards Sustainable Groundwater in Agriculture*, San Francisco, CA. For more information, see www.ag-groundwater.org.

6/20–23 *American Society of Agricultural and Biological Engineers Annual International Meeting*, Pittsburgh, PA. For more information, see www.asabemeetings.org.

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Do you have an article or idea to share? Want to ask a question or need more information? Please contact NPS News-Notes, c/o Don Waye, by mail at U.S. EPA, Mail Code 4503-T, 1200 Pennsylvania Ave., NW, Washington, DC 20460, by phone at 202-566-1170, or by e-mail at waye.don@epa.gov.

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