



Nonpoint Source News-Notes

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

News-Notes Goes Electronic!

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Commentary

Smart Growth vs Urban Sprawl

By Jim Meek, Environmental Consultant

Everywhere we turn, we hear about problems created by sprawl, but sprawl still happens. Despite studies, commissions, task force reports, and conferences on trying to manage, control, redirect, or even eliminate sprawl, it has been stubbornly resistant to local and regional efforts to slow its inexorable creep across the American landscape. Research shows that even limited sprawl can have disastrous consequences on our streams, lakes, coastal areas, and wetlands. But watersheds *can* be protected if the way land is *managed* is fundamentally changed and if what we think of as a dream home — a large house on a large lot with a large paved driveway — changes also.

This past spring (May 9-11) I participated in a regional watershed roundtable “Emerging Watershed Issues: Smart Growth and Urban Sprawl” that served as one step along the path to changing how we think about development and how we manage our land. The roundtable was funded under the Clean Water Action Plan (CWAP) and sponsored by the Conservation Technology Information Center and EPA Region 5 in Chicago. Several other regional roundtables, also called for under CWAP, have been held across the nation to discuss various watershed management issues with a broad range of stakeholders who are responsible for the way land is managed. (See related article on page 6.) The Chicago roundtable brought these stakeholders together to discuss critical environmental concerns associated with smart growth and urban sprawl such as land conversion, critical habitat loss, and downstream impacts.



The CWAP logo denotes articles related to action items called for in the President's Clean Water Action Plan. See *News-Notes* #51 and #52 for more information on the plan.

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News-Notes is Going Electronic — Well, Almost!

After 10 years of printing 14,000 copies per issue, *News-Notes* is finally entering the digital age! In order to better serve *News-Notes* subscribers and to save on printing costs, the producers of *News-Notes* are switching to electronic distribution of the newsletter.

Future issues of *News-Notes* will be available on EPA's web site at www.epa.gov/owow/info/NewsNotes in both pdf and html formats (they are currently available in only html format). An added feature will be the ability to search through back issues using an online searchable database. Users will be also able to search by keyword, date and issue, or by typing in their own search criteria.

We have set up a *News-Notes* listserver that will be used to announce the posting of each new issue on the web. It will also provide a table of contents of what articles are available as well as a short description of each article. **To sign up for this listserver, please send an e-mail directly to:**

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-

Once subscribed, you will receive a welcome message explaining how the listserver works. Unlike the widely popular NPSINFO listserver, subscribers will not be able to post messages to the *News-Notes* listserver. It will only be used to distribute information pertaining to *News-Notes*.

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Many of the speakers at the roundtable provided examples of the benefits gained from efforts to limit the amount of new pavement, rooftops, and other impervious cover created by new developments — the overriding principle of smart growth. EPA's 1996 assessment of water quality impairment shows that point sources now contribute only 25 percent of the pollution going into the nation's waters, whereas polluted runoff from urban areas, suburban landscapes, and agriculture account for 75 percent. Timothy Henry of EPA Region 5 explained how development patterns, including heavy auto emissions, contribute heavily to the 40 percent of assessed surface waters deemed not fishable or swimmable.

Henry explained how several new federal initiatives are helping to define the roles and responsibilities of federal, state, and local watershed practitioners in combating urban sprawl, including new storm water phase II regulations and TMDLs. In 1998, states and tribes selected 300 watersheds to develop Watershed Restoration Action Strategies (WRASs) called for in CWAP. These strategies will use collaborative partnerships to minimize the environmental impacts of sprawl. Solutions are also coming from transit-oriented development, conservation development, urban BMPs, and brownfields restoration. Will this work?

The answer depends on how much we can reduce the number of vehicle miles traveled, reduce chemical lawn maintenance, improve biodiversity, develop walkable neighborhoods (5 minutes to a convenience store), and much more. For the public to have more meaningful input in these decisions, we each need to know the boundaries of the watershed we live in, our relation to these boundaries, and our own specific impact on water quality and overall watershed health.

The Center for Watershed Protection's Jennifer Zielinski thinks the answer lies in how we address the impacts from land development along four fronts — hydrology, geomorphology, water quality, and habitat. Urbanization has disrupted the natural water balance, increased flood peaks and storm water runoff, caused more frequent flooding, and resulted in more bankfull flows and lower dry weather flows. Our watershed hydrology must be restored using detention ponds for large impervious areas, incorporating swales in our backyard landscapes to handle roof and yard runoff, and restoring stream and flood plain characteristics.

Zielinski particularly stressed the importance of reducing the impacts of rapid urbanization on our streams. Urbanization has widened streams and increased erosion, reduced fish passage, degraded habitat structure, decreased channel stability, destroyed pool riffle structure, fragmented riparian tree canopy, caused embeddedness, and decreased substrate quality. Together these problems have drastically changed the geomorphology of our waterways. The Center is working to reduce these impacts by studying channel enlargement as a function of impervious cover to show how the stream channel cross section increases as we get ever larger "blow out" flows from normal storms. (See the Center's *Watershed Protection Techniques* Technical Note 115.)

In addition to impacts on hydrology and geomorphology, increased water temperatures and pollutant-laden runoff from urban areas degrade water quality, causing public health risks and fish kills. The biodiversity of our streams declines with a loss of buffer zones and instream habitat, creation of fish barriers, shifts in the energy sources that drive streams, and explosive algae growth. The Center has developed an urban stream classification model that helps communities assess how impacted their water bodies might be.

Other solutions, explained in the Center publication *Better Site Design: Model Development Principles to Protect our Streams, Lakes and Wetlands*, focus on greatly reducing impervious cover and runoff to allow infiltration, protecting waterways with riparian buffers, and clustering homes to allow for protected open spaces of trees. Studies and experience show cost savings from this kind of new suburban development. But for this to happen, we have to be willing to sacrifice wide streets, excessive parking spaces, and large lawns. We must be willing to reduce the rapid runoff of water from our yards and not react with a "not in my backyard" attitude. The Center is currently planning a separate roundtable to address practices and zoning changes for existing developed areas. Other discussions during the roundtable covered the move to more environmentally responsive golf course development, use of volunteers to monitor urban waters, the role habitat

plays in our lives, coordinating our transportation links with development, creating the organization/institutions to support smart growth, building support with all stakeholders, implementing conservation practices on our home sites, and tribal watershed planning.

Finally, the last day provided an exercise in developing an integrated financial management approach for bringing together relevant water quality programs while creating a holistic context for long-term comprehensive financial planning. It illustrated our need for understanding how to design our rate structures for drinking water and waste water systems to effectively and affordably coordinate environmental and health needs. We need to look at all the alternative financing techniques and educate all stakeholders on the costs and benefits of our smart growth efforts. We also need to understand the negative cost from urban sprawl, i.e., not doing anything. Understanding costs and benefits must be part of the process from start to finish. Often times we want to pass this responsibility to someone else and thus lose the opportunity to identify and bring together all the funding sources at the start of our process to support a realistic smart growth project.

The roundtable allowed us to look at what we can do to protect our natural resources from urban sprawl. In my view, we are left with questions like, can we work together to change how we develop our landscape? Can we change our behavior to live in greater harmony with the land, water, and nature? We will need focus, energy, and tolerance to make these changes. We have to be real with each other, trust each other, be willing to compromise and to pay our share for what we want done. We have to be willing to put our energy and resources in support of water quality. A recent survey in the Chesapeake Bay area showed that many residents see themselves as environmentalists but do not pick up pet waste, do not test their lawns for fertilizer needs, and do not service their septic tanks.

To change our behavior we must understand the advantages of smart growth, to listen to the fears of giving up the familiar, understand the consequences of the new, and accept and understand that smart growth is a chance for a better quality of life that has its costs in what we give up of our current conveniences. These are exciting possibilities but the work will be difficult. Regulations are necessary but not the only answer. We have to understand the issues we face and be willing to change how we treat our land. We are its stewards and we will pass this responsibility to future generations. If we have the will and persistence to change our behavior, urban sprawl as we now know it does not have to happen.

The discussions from the workshop will be summarized for use in developing the National Watershed Forum scheduled for 2001 to examine institutional structures for watershed restoration and protection called for in CWAP. For more information on CWAP, visit www.cleanwater.gov.

Notes on the National Scene

Political Drama Surrounds Final TMDL Rule

EPA Administrator Carol Browner signed a final rule to strengthen the TMDL program on July 11. This important national program, established under section 303(d) of the Clean Water Act, provides the framework for identifying and cleaning up polluted waterbodies. The rulemaking had been under development for several years.



The rule is subject to a rider attached to the fiscal year 2001 Military Construction/Supplemental Appropriations bill that expressly prohibits EPA from using any funds to implement new rules to the TMDL program. Because the bill was still awaiting the President's signature when the Administrator signed the rule, the rider did not prevent promulgation of the rule. However, as a consequence, the final rule will not become effective until October 1, 2001. While implementation of the new rule is interrupted by enactment of the rider, the program will operate under the "old" rule.

In August 1999, EPA proposed changes to its existing regulations to clarify and strengthen the authorities of EPA, states, territories, and authorized tribes to implement the TMDL program. EPA considered more than 34,000 comments on the proposed rulemaking and talked with hundreds of people in public outreach and information-sharing sessions. EPA made many final

changes to the regulations as a result of public comment, including dropping the requirement to list “threatened” waters, eliminating the requirement that states give higher priority to certain impaired waters, and removing provisions that would have required new permits for forestry operations.

The final rule will

- strengthen states’ abilities to clean up polluted waters by identifying pollution reductions needed to meet clean water standards;
- provide for a comprehensive listing of all the nation’s polluted waters (i.e., those that fail to meet state water quality standards);
- encourage cost-effective cleanup by ensuring all sources of pollution are considered in the development of cleanup plans; and
- assure that TMDLs include implementation plans that define specific actions and schedules for meeting clean water goals.

Furthermore, cleanup plans must provide “reasonable assurances” that measures to address pollution, including polluted runoff, will be implemented within five years, when practicable. The public will also have more opportunity to comment on the methodology, lists, prioritized schedules, and TMDLs prior to submission to EPA.

For additional information, visit the TMDL web site at www.epa.gov/owow/tmdl.

A TMDL is essentially a “pollution budget” designed to restore the health of a waterbody not meeting state water quality standards. More than 20,000 waterbodies across America have been identified as polluted by states, territories, and authorized tribes. These waters include more than 300,000 river and shoreline miles and 5 million acres of lakes.

Federal Court Says Nonpoint Sources Require TMDLs

For the first time, a federal judge has upheld EPA’s longstanding interpretation and practice that EPA and the states have the authority to identify which U.S. waterways are polluted by runoff from urban areas, agriculture, and timber harvesting — nonpoint sources of pollution — and to identify the maximum amount of pollutants that may enter these waterways. The court stated that TMDLs are authorized for nonpoint sources and that “no substandard river or water was immune by reason of its sources of pollution.”

“This important decision allows us to build on our successes of completing the task of cleaning our nation’s waters,” said EPA Administrator Carol Browner. “The Clinton-Gore Administration has made delivering clean, safe water to all Americans a priority in our efforts to ensure greater protection for the environment in communities across the country.”

The March 30 opinion by U.S. District Judge William Alsup in San Francisco affirms the comprehensive scope of

the Clean Water Act’s TMDL program. In the first decision to squarely address the issue, Judge Alsup found that Congress intended to include nonpoint source pollution in the Clean Water Act’s water quality standards program, and he noted that nonpoint source pollution is the dominant water quality problem in the United States today.

“The court has affirmed a strong tool for restoring America’s rivers and cleaning up pollution, regardless of its source,” said Lois Schiffer, Assistant Attorney General for the Environment Division of the Justice Department.

The court heard a challenge to an EPA decision to put the Garcia River on a list of impaired waterways in California and define the amount of sediment that should be allowed to enter from land along its banks. Although salmon and steelhead once flourished in the Garcia River, excessive sediment from forestry operations now prevents the river from supporting healthy fish. In March 1998, EPA developed a TMDL for sediment for the river. The Agency

also defined the reductions in sediment that are necessary for the river to attain the water quality standard set by the state of California.

The American Farm Bureau Federation and other agriculture and timber groups filed suit, claiming that EPA and the states should calculate TMDLs only for pollutants that are discharged from pipes, known as point sources. The court rejected this argument, holding that the Clean Water Act is designed to provide a comprehensive solution to the nation’s water quality problems, “without regard to the sources of pollution.”

In California, only 1 percent of impaired waterways fail to meet water quality standards solely because of pollution that comes from pipes, municipal waste treatment works, or other point sources. According to EPA, 54 percent of California’s impaired waterways are polluted by nonpoint sources exclusively, while another 45 percent are impaired by a combination of point and nonpoint sources.

The Clean Water Action Plan: Making a Federal Case of Partnerships

The Clean Water Action Plan (CWAP) is based on establishing and strengthening partnerships to meet the goals set forth in the Clean Water Act. With the Plan as a catalyst, federal agencies are establishing more formal partnerships among themselves and expanding these partnerships to include states and tribes. In addition, the Plan's principles of cooperation and coordination are increasingly being adopted at state, tribal, regional, and local levels.

Federal Coordination Teams

While the Plan exhorts federal agencies to strengthen collaboration and partnership as well as to coordinate activities and assistance, it is largely silent on how federal agencies should go about accomplishing these goals, especially at the regional or field levels. Part of the answer is coming from Federal Coordination Teams, which have been formed by agencies' regional offices to advance the CWAP principles within the existing statutory authorities and programs of each agency. Some FCTs existed before the Plan was issued; in some cases they either have a broad scope, including the full range of federal program issues, or address multiple environmental issues. However, in most parts of the country no federal teams existed to address water quality and water resource issues. Not surprisingly, the more active FCTs are the ones that pre-existed the CWAP, such as the Southeast Watershed Forum. The Tennessee Valley Authority has been a leader among federal agencies in its support for the Southeast Watershed Forum by helping to coordinate regular meetings, producing a periodic newsletter, and using other means of communication and collaboration.

Some of the FCTs are maintaining a strictly federal membership, while others are beginning to invite states and tribes to join them. Interestingly, the newer FCTs, i.e., those formed after issuance of the CWAP, seem to be the ones most inclined to expand their membership by inviting state and tribal participants.

Multiple Partners Team Up at Regional Roundtables

To better support state, local, and tribal efforts in addressing watershed issues through federal programs and policies, the FCTs are drawing on local stakeholder expertise. With funding support from various agencies (U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Department of Interior, Tennessee Valley Authority, and EPA), and technical and logistical support from these and other agencies (including the Natural Resources Conservation Service, the National Park Service, and others), each FCT is sponsoring one or more roundtables this year to discuss watershed management issues with a broad range of stakeholders. In most cases, the FCTs are

organizing the roundtables; in others, the federal teams are coordinating with state agencies that have taken a lead role in involving a broad range of stakeholders. For example, the Heartland FCT (covering Iowa, Kansas, Missouri, Nebraska) is holding separate roundtables in each state. For its Missouri Roundtable, the FCT piggy-backed on that state's Missouri Watersheds Conference September 8-9.

Participation of all watershed stakeholders — from policymakers to developers to local landowners — is a prized accomplishment at the roundtables. The Northeast Watershed Roundtable, held in August to discuss the future of New England's watersheds, included participants from several federal, state, and nongovernmental organizations. These diverse participants came together to develop specific short- and long-term recommendations that have been shaped into a Regional Watersheds Strategy.

Findings and recommendations from more than 12 Regional Watershed Roundtables will be summarized and presented to federal agencies' managers at both regional and headquarters levels. These roundtables will also influence findings included in a Watershed Restoration Progress Report (CWAP action item #102), slated for publication by the end of 2000. The conclusions reached at the roundtables will also be addressed in a National Watershed Forum roundtable and other watershed-based representatives in mid-2001. The insights and experiences of the true watershed experts gathered during the roundtables will help guide the future direction of federal agencies in watershed protection.

Benefits of Regional Watershed Roundtables

- ✓ Enhance communication and promote integrated action among local watershed interests, business, agriculture, tribes, and state and federal government agencies to better protect, manage, and restore the region's watersheds.
- ✓ Provide forums for stakeholder discussion of barriers to and solutions for watershed management.
- ✓ Help stakeholders better understand each others' perspectives and assist in the development of innovative, non-regulatory solutions to water resource problems.
- ✓ Serve as clearinghouses to keep people in touch with innovative ideas, training opportunities, and resources for watershed protection.

Regional Watershed Roundtables		
REGION	WATERSHED ROUNDTABLE CONVENER	ROUNDTABLE DATES
Pacific Northwest	Washington State University's Center for Sustainable Agriculture <i>Don Nelson (509) 335-2922</i>	Sept. 13-14, 2000: Spokane Sept. 6-7, 2000: Portland Oct. 3-4, 2000: Boise
California	Watershed Management Council <i>Sari Sommerstram (510) 273-9066</i>	Sept. 1, 1999 Nov. 15, 1999 Feb. 2, 2000 May 17, 2000 All meetings were in Davis, CA
Intermountain	USDA Forest Service <i>Jack Blackwell or Leann Belnap (801) 625-5156</i>	October 16-17, 2000: Salt Lake City, UT
Heartland	Groundwater Foundation <i>Susan Seacrest (800) 858-4844</i>	July 2000: Kansas Sept. 8-9, 2000: Missouri Sept. 24-26, 2000: Nebraska Dec. 2000: Iowa
Rocky Mountain	Montana Watercourse <i>Mary Ellen Wolfe (406) 994-1910</i>	May 15-17, 2000: Bozeman, MT
South Central	LEAF Alliance <i>Laura Koesters (512) 328- 2202</i>	Sept. 6-7, 2000: Dallas, TX
Great Lakes	Conservation Technology Information Center <i>Lyn Kirschner (765) 494-9555</i>	May 9-11, 2000: Chicago, IL
Northeast	River Network <i>Pat Munoz (202) 364-2550</i>	1997 and 1998 Winter 2000
Southeast	Tennessee Valley Authority <i>Christine Olsenius (410) 849-2975</i>	Aug. 98, Aug. 99, Aug. 24-25, 2000: Birmingham, AL
Alaska	Nature Conservancy-Alaska Chapters <i>Paul Jackson (907) 276-3133</i>	Feb. 10, 2000 Oct./Nov. 2000 All meetings in Anchorage, AK
Appalachia	Canaan Valley Institute <i>Kiena Smith (800) 922-3601</i>	June 6-8, 2000: Shepherdstown, WV
Upper Mississippi	National Audubon Society <i>Dan McGuinness (651) 290-1695</i>	September 15-17, 2000: Sinsinawa, WI

States Follow Suit

There is naturally a wide range of views on the applicability of the CWAP to state and tribal programs addressing water resource issues. Some states have seen very clear advantages to adopting the federal agencies' CWAP principles and terminology as their own.

One state's endorsement of the CWAP is evident in a recent article in *Ecostates* (the journal of the Environmental Council of the States). Susan Sylvester, Administrator of Wisconsin's Water Division, states that "The CWAP articulates better than any other document in a long time why America needs to take a watershed approach, and broadly, what that will look like." She argues that states should have the lead role as CWAP is put into practice, and that they must have flexibility while being held accountable for carrying out CWAP's goals. In her view, such flexibility and accountability can be realized only if the various levels of government implement their water programs through a watershed approach.

Alabama also embraces the CWAP through its own Alabama Clean Water Action Plan. It has developed a CWAP process that echos the logic implicit in the federal CWAP. The process includes (1) identifying impaired waters; (2) identifying priority watersheds through the state's Unified Watershed Assessment; and (3) developing and implementing Watershed Restoration Action Strategies for those priority watersheds. Alabama's CWAP also envisions combining voluntary environmental stewardship with mandatory TMDL actions and schedules, incentive and market methods, strong stakeholder participation, and reliable environmental indicators.

Partnerships to be Spotlighted in New Report

This new era of watershed-level partnering will be highlighted in a new federal report on watershed success stories that will be available this fall from the CWAP partner agencies. The report will highlight these successes by looking at individual case studies from around the country that embody the principles and spirit of partnership of the CWAP. All of the case studies document the degree to which watershed restoration must be a cooperative effort. For example, restoration efforts in the Wissahickon Watershed in Pennsylvania have been successful because of the efforts of 120 partner organizations, and in one subwatershed of the Bad River in South Dakota, 9 of every 10 landowners have participated in watershed restoration activities.

Although considerable progress has been made in carrying out specific CWAP action items, the most lasting impact of the CWAP might very well be the adoption of CWAP principles through regional, state, and local partnerships. CWAP agencies hope that with their involvement these partnerships will grow and spark the creation of more partnerships in the future.

[For more information, contact Len Fleckenstein, Office of Water, U.S. EPA, 1200 Pennsylvania Avenue, NW, Mail Code 4101, Washington, DC 20460. Phone: (202) 260-5332; fax: (202) 401-3372; e-mail: fleckenstein.leonard@epa.gov. For additional information visit the CWAP web site at www.cleanwater.gov.]

USGS Science and Information: Helping Communities Manage the Effects of Urban Sprawl



The U.S. Geological Survey (USGS) is working hard to provide local officials with scientific data and information to help develop community-based watershed management solutions that meet both societal and environmental needs. Local government officials are often tasked with making important growth-related and resource-management decisions that directly or indirectly affect our water resources. Many times they are equipped with only a limited understanding of the watershed's natural resources and the potential consequences of new development. Decisionmakers need accurate, up-to-date information to provide for sustainable development and to manage competing societal priorities.

USGS Uses Watershed Models to Solve Real Problems

Natural resource management conflicts are often at the core of problems associated with growth. Resources that are taken for one use may also be needed and valued for other uses. In the Ipswich River Basin, a 155-square mile watershed that supplies water to more than 300,000 residents in northeastern Massachusetts, urbanization and increasing water supply demands have led to reductions in streamflow that threaten aquatic habitat, water quality, and recreational use of the river. USGS scientists, in cooperation with the Massachusetts Departments of Environmental Management and Environmental Protection, developed a numerical watershed model to simulate the hydrology and complex water use patterns in the basin. Model results are helping stakeholders — water suppliers, environmental groups, and regulatory agencies — understand that ground water and surface water need to be managed as a single resource and agree on minimum flow targets. Project partners are currently using the model to evaluate specific ground water withdrawal options and to evaluate the potential beneficial effects of increasing base flows by returning treated wastewater to the Ipswich River Basin.

Another byproduct of urban sprawl is local flooding. Increases in impervious surface area can drastically alter the hydrology of a watershed, leading to floods — the most costly natural hazard facing watershed managers today. Flooding can result in extensive loss of public and private property, erosion and sedimentation, contamination, health concerns, and loss of life. Quantifying changes in streamflow that result from urbanization is critical for planning and designing bridges, culverts, stormwater drainage systems, detention basins, and other stormwater management facilities. Oftentimes data on stormwater runoff volume and floodflow in specific areas are not readily available, and future changes in these flow characteristics that might result from urbanization are not easy to predict. For this information, planners and engineers have come to rely on computer-based models that predict the outcome of real-life situations.

In Camillus, New York, a suburb of Syracuse that has undergone recent growth and expects continued residential and commercial development, concern over the hydrologic effects of future development has prompted efforts to predict flooding. The USGS developed a precipitation-runoff model for the Ninemile Creek watershed to assess the timing and magnitude of peak discharges that might result from future development when stormwater detention basins are used. The model showed town planners and engineers the benefits that could be realized by installing detention basins and the potential adverse effects when basins are sized and placed so that their peak outflow coincides with the peak main channel flow. To date, the town has been using the modeling results to analyze flooding potential and to further investigate the potential effects of stormwater detention basins in the Ninemile Creek basin. Other communities in New York are recognizing the value of this type of analysis and are considering the use of hydrologic modeling in planning for future development.

USGS Provides Real Time Streamflow Data

In an age when so many demands are continually placed on our limited water resources, problems and solutions must be prioritized and addressed immediately. The availability of accurate, up-to-date information is critical in the decisionmaking process. The USGS maintains an extensive network of more than 7,000 gaging stations on streams throughout the nation, most of which can provide data on a real-time basis. Real-time data can be a tremendous asset before, during, and after a flood to help prevent, minimize, and assess flood damages.

As part of the Real-Time Hazards Initiative, the USGS is enhancing and improving the streamgaging network. With the assistance of the National Weather Service, state and local emergency managers, and other network cooperators, a number of sites have been selected at which either a new streamgaging station has been installed or a discontinued station has been reactivated in this year. In addition, several existing streamgaging stations are being “flood-hardened,” and many will have equipment upgrades to enable real-time data transmission.

USGS hopes to further improve and enhance the national streamgaging network in the future to ensure that the information critical to emergency forecasters and managers during extreme events is available when and where it is most needed. This information is also very valuable for drought monitoring and for many recreational and development planning activities. USGS real-time water data can be accessed at <http://water.usgs.gov/realtime.html>

[For more information on how the USGS can assist your local watershed planning effort, contact Dave Grason, Associate Regional Hydrologist, U.S. Geological Survey, MS 433, 12201 Sunrise Valley Drive, Reston, VA 20192. Phone (703) 648-5293; e-mail: dgrason@usgs.gov.]

Notes from the States, Tribes, and Localities

Nutrient Rules Adopted for Tar-Pamlico River Basin

North Carolina is taking another step toward reducing nutrients in its coastal watersheds. On July 13, the North Carolina Environmental Management Commission (EMC) adopted urban stormwater and nutrient management rules to curb excessive nutrient inputs in the 5,400-square-mile Tar-Pamlico River basin. This complements the adoption of an earlier riparian buffer rule and marks the second rule-making step in a progressive effort to limit nonpoint inputs of nitrogen and phosphorus to the Pamlico Sound on the North Carolina coast.

History

In 1989, the EMC designated the Tar-Pamlico Basin as a “nutrient-sensitive water” after increases in fish kills and harmful algal blooms were attributed to elevated nutrient levels in the water. Pursuant to the designation, the state developed a nutrient management strategy for the basin. The first phase of the strategy addressed point sources by establishing an innovative nutrient trading program between point and nonpoint sources (an association of point sources exceeding its annual nutrient loading cap would fund the implementation of best management practices by agricultural nonpoint sources to offset the cap exceedence). The second phase, adopted by the EMC in 1994, required that phosphorus contributions be held at 1991 levels (i.e., maintain 194,000 kg P/yr) and nitrogen contributions be reduced an additional 30 percent from 1991 levels (i.e., reduce the load

by 583,000 kg N/yr). The EMC intended these goals to be achieved largely through the point source nutrient loading cap and voluntary implementation of best management practices.

In 1998, after determining that a voluntary approach was not achieving the nutrient strategy's goals, the EMC called for development of nonpoint source reduction rules. Staff from the North Carolina Division of Water Quality assembled stakeholder teams to consider rules in seven subject areas (atmospheric emission of nitrogen, onsite wastewater, erosion and sedimentation from construction sites, restoration of wetlands, buffers and streams; agriculture, nutrient management, and urban stormwater). The teams produced draft rules on three subjects: agriculture, stormwater, and nutrient management. In addition, a fourth set of rules on riparian buffer protection was included based on the work of a legislatively mandated stakeholder committee on buffer protection in the adjacent Neuse River Basin. Public comments were taken from June through December 1999. Two public hearings in August and September 1999, drew a total of 287 attendees and 234 people submitted written comments.

In December 1999, the EMC adopted riparian buffer protection rules as a first regulatory step toward reducing basin nonpoint nutrient loading. In July 2000, the EMC adopted urban stormwater and nutrient management rules that will become effective April 1, 2001, pending review by the General Assembly in January 2001. The EMC has delayed adoption of an agriculture rule pending consideration of issues such as grazing requirements, the need for resources to support implementation of BMPs, and the need for a simple, easy-to-understand rule. However, adoption of an agriculture rule is anticipated in late 2000. The new rules complement ongoing efforts to meet a TMDL developed several years ago for the Tar-Pamlico basin. "The new rules are the next step in the management plan designed to achieve a 30 percent reduction in nitrogen," explained Richard Gannon, Nonpoint Source Water Quality Planner with the Division of Water Quality.

Similar Rules, Different Basin

The new riparian buffer, urban stormwater, and nutrient management rules for the Tar-Pamlico Basin mirror regulations that were enacted in the adjacent Neuse River Basin in 1998 (more information on the Neuse Basin rules is available in News-Notes Issue #58). The riparian buffer rules require that existing riparian areas remain intact in all future development projects or land-use changes. The stormwater rule will require six municipalities and five counties in the Tar-Pamlico Basin to develop and implement stormwater programs within two and a half years. These local programs will require that all new development be designed to meet the nitrogen and phosphorus loading goals, and achieve results in no net increase in flow from a 1-year, 24-hour storm event. The local programs must also educate developers, businesses, and homeowners, identify and remove illicit discharges, and make efforts to treat runoff from existing developed areas. Each program may be tailored to the needs of the locality, notes Gannon. "We've given the local governments flexibility to design their own programs, but many of the local programs will likely be patterned after the programs being put in place for the Neuse River Basin."

The nutrient management rule will require everyone who applies fertilizer in the basin, except residential landowners who apply fertilizer to their own property, either to take state-sponsored nutrient management training or have a management plan in place for the lands on which they apply fertilizer. The Division of Water Quality will implement an education program for residential fertilizer use. For more information on the new rules and the implementation strategy, see <http://h2o.enr.state.nc.us/nps/tarp.htm>.

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Process and Pitfalls — Awaiting Lessons from EPA Pilot TMDL Studies for Mercury

While TMDLs are often developed on a watershed basis, pollutants such as mercury involve sources spread over a much larger airshed. As of December 1998, 40 states had issued fish consumption advisories for mercury, and a number of states had specifically identified atmospheric deposition of mercury as a cause of water quality impairment. To determine how to take air sources

into account in developing TMDLs, EPA launched two pilot TMDL studies in early 1999. EPA chose sites in Florida and Wisconsin based on state interest and the availability of data on mercury to use in modeling, among other criteria. The technical process and results of the pilots were to function as examples for other states, tribes, and territories that are faced with developing TMDLs for waterbodies impaired by mercury. The pilots are cooperative efforts between EPA and the states of Wisconsin and Florida.

As part of the TMDL pilots, EPA also planned to examine legal and policy issues, such as approaches for addressing mercury from sources outside a state. Under the existing TMDL rule and policies, TMDLs identify how much a pollutant loading needs to be reduced in order to meet state water quality standards. However, TMDLs themselves don't provide the authority to address sources of pollutants, including air sources. Thus, other mechanisms to address sources need to be identified.

STUDY SITE: Devils Lake, Wisconsin

Although Devil's Lake is in a pristine 2.6-square-mile forested watershed in Wisconsin, it was listed on the state's 303(d) list in 1998 for elevated levels of mercury found in the walleye caught there. Within a 25-mile radius, two coal-fired power plants and incinerators emit mercury; some mercury may also be deposited from sources in surrounding states.

To conduct the pilot, EPA needed to find a site with existing data instead of having to collect new data. EPA chose the Devil's Lake site after an initial data gathering effort uncovered a rich mercury monitoring history. Doug Knauer of the Wisconsin Department of Natural Resources (WDNR) had been conducting studies in the area with a team of researchers experienced in mercury pollution, including scientists from Canada and Sweden. "Why a seepage lake with no aquatic tributaries would have mercury advisories was the scope of our problem," Knauer said. Other data from the Wisconsin Emissions Inventory and other state data repositories will also be used.

The Mercury Cycling Model (MCM) will be used for the aquatic modeling component of the pilot. The model traces mercury's geochemical and biological cycling at the air-water, water-sediment, water-biological, and sediment-biological interfaces. Using different levels of assumed mercury loads to the lake, the modelers plan to develop scenarios in which fish tissue concentrations could be brought down to acceptable levels.

"Devil's Lake was an ideal candidate to complete an atmospheric study," said Knauer. "We had the MCM model for how mercury was behaving in the lake — we just needed to know how much was being deposited to it."

To calculate atmospheric deposition, participants in the TMDL pilot project plan to use a numerical model called the Regulatory Modeling System for Aerosols and Deposition (REMSAD), which provides wet and dry deposition rates for mercury over the entire nation. The REMSAD model can account for different aspects of the air deposition process, including meteorological processes and chemical transformations of mercury in the atmosphere. The model will be used to examine the relative contributions of mercury from sources within the state as compared to

neighboring states and the nation as a whole. Sensitivity analyses will also be conducted to determine how changes in various parameters affect model results. Parameters to be examined include meteorological conditions, uncertainties in emissions inventories, and speciation, which is the amount of mercury emitted in the divalent form versus the elemental form. Divalent mercury tends to be deposited more locally, while elemental mercury is transported over longer distances. Thus, uncertainties regarding the speciation of mercury can translate into uncertainties regarding how much mercury is from local versus more distant sources.

Although some initial data and model preparation has been conducted for the Devil's Lake TMDL pilot, full-scale modeling has not yet begun in earnest for a number of reasons. For example, EPA

Steps in the Mercury Pilot TMDL

1. Data compilation & model calibration
2. Complete baseline model runs
3. Model mercury reduction scenarios
4. Initial analysis of federal and state programs
5. Draft pilot TMDL study reports
6. Stakeholder and expert review
7. Revised pilot TMDL study reports
8. Report on lessons learned from both pilots

has been making refinements in the most recent toxics emissions inventory, which contains estimates from each state of total mercury emissions, as well as mercury speciation from each source category. As REMSAD provides nationwide deposition, this national emissions inventory is one of the key inputs to the REMSAD model. When the inventory and other model inputs are ready, baseline conditions of mercury depositions can be simulated. EPA expects to begin baseline modeling by the end of this year. This will be followed by an analysis of the legal and policy options for addressing mercury from air in order to reduce mercury in fish tissue to acceptable levels. The analysis will include modeling of reduction scenarios that simulate the impact of existing or planned federal and state mercury reduction initiatives.

STUDY SITE: Florida Everglades

The Florida pilot TMDL covers a roughly 700-square-mile portion of the Everglades located about 30 miles west of Fort Lauderdale. This area is on the state's list of impaired waterbodies because of high levels of mercury in largemouth bass and other fish.

The atmospheric deposition model for this pilot is the Regional Meteorological Pollutant Chemistry and Transport Model developed by the University of Michigan Air Quality Lab. The model uses existing mercury data collected by the state of Florida during several studies, including the Florida Atmospheric Mercury Study (FAMS), the South Florida Atmospheric Monitoring Pilot Study, and the National Atmospheric Deposition Program, which has data for three sites near the Everglades.

These data, along with rainfall chemistry data, are used to evaluate weather conditions and atmospheric flows, and thus calibrate the model to monthly data available from FAMS. In the pilot TMDL, the model is further sensitized to variations in meteorology and thus provides both wet and dry deposition rates for the study area. The water model is an Everglades adaption of the Mercury Cycling Model used at the Devil's Lake site and renamed E-MCM.

Because of the availability of data, initial model results of the Florida TMDL pilot study have already been developed. Early model findings suggest that anthropogenic sources in south Florida are contributing mercury to the atmosphere that is then being transported over the Everglades. Based on comments received from peer review, the state of Florida will be further refining initial results by conducting additional model runs and sensitivity analyses. Once re-done, the TMDL modeling report will be available for stakeholder review.

According to Randy Waite of EPA's Office of Air Quality Planning and Standards, "The pilots are an opportunity for us to go through the process of full-scale development of an air-water interface model. We are trying to use these cases as examples in building the technical and programmatic tools that other states can use for this kind of complex pollutant." Ruth Chemerys of EPA's Office of Wetlands, Oceans, and Watersheds notes that "From a process standpoint the pilots have provided valuable lessons regarding what works and doesn't work when trying to link the results of the different models." For example, modelers found that it is important to be very clear about the specific elements of the data being shared.

Mercury Deposition on the Web

EPA's Mercury TMDLs site

<http://www.epa.gov/owow/tmdl/wrkpln2.html>

USGS Mercury Studies in the Florida Everglades

<http://snowball.er.usgs.gov/sfep/element6/task6.7/fs-166-96/index.shtml>

National Atmospheric Deposition Program

<http://nadp.sws.uiuc.edu> (Click on the Mercury Deposition Network Page)

South Florida Water Management Program

<http://www.sfwmd.gov>

Toxics Release Inventory

<http://www.epa.gov/tri>

Florida Atmospheric Mercury Study

<http://gill.tamug.tamu.edu/FAMS/Fams.htm>

EPA plans to develop a "Lessons Learned" document on both pilot projects by the summer of 2001. It will outline the processes and pitfalls to be expected in studying a pollutant whose effect is critical, and whose sources are hard to narrow down.

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Notes on Watershed Management

Source Water Protection Through Land Acquisition

How can you protect your water quality from the impacts of development? Manage the development with a plan that directs development away from sensitive areas. The Trust for Public Land (TPL), a national conservation organization, has helped many communities protect their watersheds with land and easement purchase programs. TPL recently released a report, *Building Green Infrastructure: Land Conservation as a Watershed Protection Strategy* (available on the Internet at www.tpl.org), that highlights some of its experience and findings. The report specifically details the water quality protection efforts of Austin, Texas (see box); Barneget Bay, New Jersey (see box); Mountain Island Lake, North Carolina; and Indian River Lagoon, Florida.

Austin, Texas

Austin has used a combination of regulatory and non-regulatory means to protect its drinking water supply over the past 20 years. When early efforts using restrictions on impervious cover, requirements for stream buffers, treatment of stormwater, and erosion controls proved unsuccessful, Austin residents adopted a resolution in 1992 requiring further limits on impervious cover. At the same time they approved a \$20 million bond act that would use land acquisition to protect the most critical area around Barton Springs, a large spring pool in the city of Austin. In 1998, residents went a step further and approved a \$65 million revenue bond to purchase land and easements within a designated drinking water protection zone over their drinking water source, the Edwards Aquifer. Residents agreed to pay slightly higher taxes to cover the expense because they felt land acquisition investments could protect their water, and the combination of land acquisition and regulation could guide growth away from sensitive areas in the watershed.

A New Tool and New Partnerships

TPL's report details efforts by these communities to protect areas important to the quality of their water — for both drinking water and clean water goals. All of the case study communities used a combination of regulatory and land acquisition tools to protect key lands and meet clean water goals, based on monitoring and data collection that identified the most environmentally sensitive areas of their watershed. Funding was leveraged from land acquisition and water protection programs, and in some cases raised through voter-approved state and local funding programs. The communities used both qualitative and quantitative data to target and prioritize parcels for conservation, as well as monitoring and modeling to measure the benefits of the investment in watershed protection.

All efforts included rigorous public education and community involvement. "In all of these communities, you had land-use planners, water managers, and habitat protection specialists talking to each other across the table, sharing goals, and leveraging resources in ways none of them thought possible," explained TPL's Kathy Blaha.

Using the four diverse case studies as models, TPL notes five common features that helped make these land acquisition programs successful:

1. Land conservation projects are usually driven by several motivations in addition to clean water protection, including habitat preservation, recreational opportunities, and growth management.
2. Decisions about land acquisition and public investment must be based on credible scientific or economic information, such as monitoring data, cost analyses, and modeling scenarios that project development impacts to water quality.
3. Polls and surveys consistently show strong public support for land conservation programs that protect water quality, especially as the public gains a greater understanding of where their drinking water comes from and how runoff affects their rivers, streams, and lakes.

Linking land protection programs to water quality protection programs requires partnerships between public and private players around planning and funding; this often requires ballot initiatives and broader public involvement.

4. Successful land acquisition often takes place in combination with a strong regulatory framework, such as zoning, and this complementary relationship works even better where state and federal programs are supportive.

Barnegat Bay, New Jersey

In the coastal watershed of Barnegat Bay, a partnership of federal, state, and local players has protected land and water resources by buying land with a mix of funding sources. Early efforts by the Pinelands Commission, TPL's Barnegat Bay "Century Plan," and EPA's designation of the Bay as part of its National Estuary Program (NEP) provided the background data, the forum for partnerships, and the momentum for implementing a major land conservation program. To date, approximately 120,000 acres have been acquired and are being managed cooperatively for groundwater protection, marine habitat, and public recreation and beach access. Most recently, TPL helped Ocean County develop its own open space trust fund to make it eligible for New Jersey's \$1.5 billion open space matching fund program. As a result of TPL's and the county's efforts, voters approved a Natural Lands Trust in 1997, funded by an increase in local property taxes. This tax is raising nearly \$4 million annually to match state and local funding for land acquisition. The key to the Barnegat Bay protection effort has been the NEP leadership and the volunteer monitoring programs that provide information on ecological data in the Bay for resource managers and elected officials to identify critical lands for protection.

The hard part is convincing water managers to take the first step, explained Blaha. "Often local water managers are unfamiliar with land acquisition. First, they are not familiar with negotiating and buying real estate and meeting the state and local acquisition requirements. Second, they are uncertain how they'll manage the land once they've acquired it; and, finally, they can't measure the water quality benefits of land conservation as easily as with other tools."

Fortunately, TPL and many other land conservation organizations are available to partner with local governments and water managers and help them through land acquisition and management. "The biggest challenge is linking conservation to reductions in pollutant loads. We need more opportunity to collect data and conduct modeling to show how land conservation can reduce and mitigate runoff with measurable results," explained Blaha. "We're continuing to work with public agencies and university-based research teams to more closely link land conservation with improved water quality. Our goal is to use demonstration projects to strengthen the case with more monitoring data to more easily measure what we know is happening."

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Gardeners Willing to Try Nonchemical Landscape Practices

By Sharon Omahen, Georgia Agricultural Experiment Stations



Georgia gardeners want lush lawns and award-winning vegetables. But they also care about the damage pesticides and fertilizers can cause the environment, says a University of Georgia survey. Researchers in the UGA College of Agricultural and Environmental Sciences (CAES) are crafting guidelines to help homeowners choose garden and landscape BMPs that don't harm the environment. But they needed information.

What Are Georgia Gardeners Doing?

"Before we can develop guidelines, we need to know how Georgia gardeners use pesticides and fertilizers," said Susan Varlamoff, the survey coordinator. "The survey results are helping us determine the level of information we need to put into the homeowner BMP manual." The survey was funded by the Pollution Prevention Assistance Division of the Georgia Department of Natural Resources. The BMP manual will be developed through an EPA grant.

Both projects are part of a five-year program aimed at educating homeowners on reducing the environmental effects of improper gardening. "Our goal is to reduce nonpoint source pollution," said Varlamoff. "We're also searching for ways to provide correct gardening information to homeowners."

Gardeners Want to Use Environmentally Friendly Products

During the summer of 1999, 400 Georgians took part in the survey, which was designed by a team of CAES researchers and implemented by the UGA Survey Research Center. The survey asked gardeners about general and specific practices. It asked, too, where they get their gardening information.

"We were surprised to find that people are already gardening to protect the environment," Varlamoff said. "Of the people we surveyed, 67 percent are choosing products they believe to be environmentally friendly." The survey showed that 45 percent of Georgians are composting household and lawn waste for use in their home landscapes.

But where do they learn about gardening? "Most of the people we surveyed said they get their information from neighbors," Varlamoff said. "Their second largest source was television."

The study also showed that they prefer to get their information where they buy their gardening supplies. "We need to know where our efforts need to be directed and how people want to receive this information," Varlamoff said. "Our goal is to educate the gardening public for everyone's benefit. People need to know, for example, not to apply fertilizers when a heavy rainstorm is expected," she said. "The chemicals won't have time to be absorbed into the soil before they're washed away. They also need to apply only as much as the grass or plants can use."

Open to Alternatives

Another key question was whether Georgia gardeners are open to using nonchemical ways to control pests. "It's one thing for our college's researchers to develop and test nonchemical methods of control," she said. "But this can be effective only if people are willing to adopt these methods. We needed to know if people are open to planting pest-resistant plant varieties or applying insecticidal soaps instead of spraying chemicals."

The answer? Most are very willing to try. Of the people surveyed, 69 percent said they want to learn more about alternative ways to control pests, and 72 percent are willing to plant pest-resistant varieties. "People are becoming more and more aware of alternative methods because they're becoming more available in gardening centers," Varlamoff said. "You can even buy lady bugs over the counter now."

Weed-free Lawns are a Top Priority

But the quest for the perfect, weed-free lawn is also a top priority. The survey found that:

- 67 percent rated a weed-free lawn as very important.
- 41 percent use herbicides to control weeds.
- 23 percent apply fungicides to control diseases.
- 63 percent apply insecticides to control insects.

"All these chemical controls can contribute to runoff pollution," Varlamoff said.

Varlamoff is confident a BMP manual would help Georgia gardeners and the environment. "Now that we know the kinds of information Georgia gardeners want and need, we're developing our BMP manual," she said. "The manual will first be used to train people who enroll in the University of Georgia's Advanced Master Gardeners Program through the county extension offices," she said. "The information will eventually be available through all media: newspapers, television, radio, fax, newsletters, and on the Internet at <http://ugacesc.ces.uga.edu>." CAES researchers expect to complete the BMP manual by fall 2001.

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Why Do (or Don't) Local Government Officials Participate in Watershed Planning Efforts

EDITOR'S NOTE: Adapted from *Coastlines*, a publication of the Urban Harbors Institute at the University of Massachusetts.

One of the problems facing any watershed planning effort is to engage people from local governments in the process. The National Estuary Program's (NEP) Comprehensive Conservation and Management Plan (CCMP) encourages the involvement of local governmental officials in both the planning and implementation phases. Local government officials include both town or city employees (planners, managers, etc.) and citizen board members (boards of health, conservation commissions, selectmen, etc.). They bring knowledge and expertise on local conditions and are uniquely positioned to rally public support needed to implement management plan actions. Despite the significance of their role, very little is known about the factors that encourage or constrain their participation in environmental policymaking.

To reveal more about the participation of local government officials in watershed planning, a team of social scientists with the nonprofit Social and Environmental Research Institute developed a study focused on NEPs with funding from the National Science Foundation. The involvement of three

NEPs was investigated: Massachusetts Bays, New Hampshire Estuaries, and Casco Bay. These three NEPs had expressed interest in pursuing this topic and had similar regional and political settings.

With assistance from the directors of the selected NEPs, the scientists compiled a list of local government officials, excluding, by definition, state and federal employees. Although regional or county government plays a smaller role in New England, several people from regional planning commissions were interviewed. Thirty-five local government officials were interviewed concerning the factors that entered into their decision to participate.

The results from the interviews can be grouped into three categories of factors influencing people's decisions. The first category included factors unique to an individual's experience, skills, interests, or beliefs. For example, important concerns in this category included knowledge of the other people involved in the project. Also significant were individual attitudes toward learning new things and meeting new people, and dealing with conflict. Some cited a strong environmental ethic or a sense of civic or social duty as important factors. Others spoke about whether their involvement would contribute to their own personal education and growth (Will I get anything out of this?) as well as the project's success (Are my skills needed here?) Are they just looking for free labor or will I get something from this?

A second category of factors influencing their decision involved issues beyond the control of the individual. These frequently related to social, political, or economic considerations. Some municipalities discouraged officials from participating because they "knew they had dirty laundry and did not want it aired." Other people were instructed by their town manager to attend as part of their job. Some people did not participate because citizen awareness of environmental problems with the estuary was low or nonexistent in their community. While a tradition of regional cooperation might be enough to encourage some local governmental officials to participate, others made a careful cost-benefit analysis of whether their time would be worth it for the community.

The third group of factors related to the way the NEP was managed. A prominent issue was the ability to make real progress based on clear objectives and competent leadership. Participating local government officials attributed their involvement to good group dynamics, a sense of camaraderie, and regular face-to-face contact that builds friendships and strong working relationships. Non-participating local government officials attributed their lack of involvement to a feeling of a lack of respect or that their input was not valued. Some felt that the NEP did not care about local problems, but was taking advantage of free labor. Others complained of poorly facilitated meetings, needlessly acrimonious discussions, a measurable lack of progress, and inconvenient meeting times and locations. Was I directly invited? Was I called? When I arrived, was I welcomed? Was my input valued? Was I respected?

What can coastal managers and watershed organizations like the NEP do to entice local government officials to participate? The study results suggest they could focus on the first and third groups of factors. This means focusing attention on producing a working environment that respects all voices, builds a sense of camaraderie, gives real power to the participants, clearly states the objectives and timetable, and makes clear progress on these objectives. They are more likely to participate if the watershed project first learns about local problems and incorporates these into the NEP's objectives. Going out into the communities, listening to concerns, and inviting local participation are much more productive ways to secure the involvement of local government officials than merely sending a form letter to the town clerk, mayor's office, or county commissioners.

NEPs and others should also use knowledge of the first group of factors to focus recruitment efforts on local government officials more disposed toward participating. This means seeking out people who have a strong environmental ethic, enjoy working collaboratively with peers, take a regional perspective, and pursue goals linked to the project's objectives.

Invitations to new participants should include announcements listing existing participants and provide opportunities for networking and learning. For NEPs, mini-grants have been tremendously successful because they enable a local government official to make progress on his or her local agenda while remaining connected to the watershed project.

"A lack of time" is everyone's first response to the question of why they don't become involved. But this research suggests that it is more a matter of setting priorities than the availability of time itself. People make time for things that are most important to them. The challenge for watershed planning and community-based environmental protection is to invigorate local support by addressing local problems, and do so in a coordinated manner that enhances mutual benefits and makes progress on regional problems.

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Agricultural Notes

Cattle to the Water or Water to the Cattle?



Until recently, Idaho water right law ran counter to environmental stewardship. Idaho ranchers who tried to improve stream and riparian health by building pipe diversions from a stream to water cattle away from a riparian zone stood to lose their existing water right date, known as a priority date. Historical precedence dictates the priority date, determining the order of access to the stream's water in the event of a shortage. In an area thirsty for water, a priority date is too precious to lose. Luckily, Idaho has recently passed a law that addresses the problem.

Water Right History

Before 1971, an Idaho water right, called an appropriation because it is the private right to the use of public waters, could be established simply by diverting water and putting it to beneficial use. Even though water was not diverted, in-stream livestock watering was also considered a beneficial use, and a valid water right. Each right came with a priority date, simply the date when the beneficial use was established. In 1978, a statute was passed requiring all pre-existing water rights and dates to be recorded by way of a statutory claim. The state has a public record of such claims, which is key in the arbitration of disputes. In the event of water shortage an older priority date has first claim to water over a more recent date.

After 1971, the process of acquiring a water right was formalized through a system of application, permit, and licensing. This required public notice, possible court hearings if protests were registered, and various filing and field examination costs. The appropriation process, though suitable for the modern time period, was time-consuming and expensive. Hence, if a rancher, despite beneficial use of a stream on his/her land wanted to build a diversion to water his cattle outside the stream, he/she would have to go through this new application process for acquiring a water right. The new water right would be assigned a current date. Economically, and in terms of priority access to water, it ran counter to environmental sense.

The law put farmers like Eric Davis, a cattle rancher near Bruneau, Idaho in a bind. "With all the concerns over streams on the 303(d) list" he said, "I knew I had to fence off my cattle from going into the stream. And when I did, I got myself into another box, because I had to pump water to my cattle, and that required a permit and I was going to lose my priority date." His priority date was from the early 1900s.

A Solution to the Dilemma

In response to cases such as Davis', a coalition composed of the Natural Resources Conservation Service, Idaho Department of Water Resources, Idaho Cattlemen's Association, and the Idaho Water Users (an association of irrigation districts and canal companies) successfully introduced Idaho senate bill 1419, known as the "off-stream livestock watering right." This bill will make it easier for ranchers to construct diversions from streams to water their cattle without losing their historical priority date.

Effective July 1, 2000, the new bill allows a rancher with a valid in-stream livestock water right to convert it to an off-stream right by filing a simple form along with a \$20 fee. The off-stream right essentially replaces the in-stream right and is not technically a new water right. The bill is also conscious of limiting consumption, stipulating that this water right is valid only for operations of up to 1,000 animal units and requiring that excess water be pumped back into the stream. All these

conditions worked well for ranchers like Erik Davis, who are making the effort to run a water quality conscious cattle operation.

Ranchers who are nudging their cattle watering out of the stream through this expedited method still have difficulties to contend with. They must still construct off-stream watering systems (tanks, troughs, pumps), and fence off riparian areas so stream quality can be restored. In drier areas, where trees only grow close to waterbodies, ranchers sometimes have to find ways to lure the cattle away from streamside shade.

Cattle behavior also poses obstacles. As is well known, it is easier to lead a horse, or in this case a cow, to water than it is to make it drink. However, recent scientific studies indicate that cattle will drink water that is brought to them and not necessarily drift back to the streams. Stan Boyd, the executive director of the Idaho Wool Growers Association, was enthusiastic about studies presented at a 1997 conference, showing that alternate watering sources near streams — with no fencing — resulted in cattle residency times in streams dropping by 70 percent or more (Southeast Sustainable Animal Waste Management Workshop, GA, 1997). Accordingly, sediment, phosphorus, and other loads were also reduced significantly — making the new Idaho water right conversion law encouraging news for both the ranchers and the streams.

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Atrazine Application Plan Improves Drinking Water



Monroe City's water supply was in trouble. Atrazine levels in the city's drinking water reservoir had hovered at or just below the water quality standard of 3 parts per billion several times during recent years. To address the problem, the Missouri city developed a watershed management plan to improve and protect water quality. Part of this plan called for the development and implementation of integrated crop and pest management programs to prevent field losses of pesticides, nutrients, and sediment. The Natural Resource Conservation Service (NRCS), in partnership with the Missouri Corn Growers Association, Missouri Department of Natural Resources, and the University of Missouri Extension Service, developed an innovative, two-pass atrazine management program. The program successfully reduced overall atrazine levels in the drinking water supply and maintained cost-effective weed control.

Atrazine Runoff Leads to Water Contamination

The Route J watershed, located in northeast Missouri, supports approximately 1,560 acres of corn and milo. Normally, crop growers control weeds by applying a blend of atrazine and other herbicides at the start of the growing season in May. The pre-emergent application of 1.5 to 2 pounds active ingredient atrazine per acre was sufficient to control weeds all summer; but the method came at a price.

Enough atrazine was running off the fields after application to threaten the drinking water supply of Monroe City. Instead of installing an expensive water treatment system to remove the atrazine, the city hoped to reduce the atrazine pollution at its source. Project managers determined that the heaviest rains in the region fall in May and June, during or shortly after the traditional atrazine application, increasing the likelihood that the herbicide would be carried away by stormwater runoff before being absorbed by the already saturated soil. Managers hypothesized that if the application could be held off until after the rain, and applied to drier soils, atrazine runoff might be reduced.

The Solution

Project managers worked with growers to develop a two-pass atrazine application program. Growers agreed to test the program on approximately 94 percent of the acres in production. Farmers applied the atrazine as part of a planned sequential herbicide program at a total rate of 1 pound of active ingredient atrazine per acre "post-emerge" in mid-June. "By applying the atrazine later in the growing season we hoped to miss the big rains that lead to runoff," explained Troy

Huntley, an integrated pest management specialist with the NRCS. “The drier soils experienced during the summer also allow the atrazine to infiltrate into the soil at a greater rate, reducing the potential for runoff while providing residual control of weeds.”

Technical and Economic Incentives Offset Costs

As might be expected, the two-pass program resulted in a higher price tag. First, to compensate for reduced application of the inexpensive atrazine, expensive replacement herbicides were sometimes used in combination with genetically resistant seed. These expensive replacement herbicides raised costs by up to \$10 per acre, depending on the herbicide program selected. Secondly, genetically modified seed can add to the cost if the growers had not used it previously. And lastly, an extra application raises the cost by approximately \$4 per acre.

These increased costs were offset by a series of economic and technical assistance incentives. Local agriculture chemical representatives provided a 10 percent cost-share on company-selected herbicide programs. NRCS secured grant funds to offset the additional \$4 per acre application cost. “The farmer’s financial outlay was nearly the same as it would have been had they used a conventional weed control program,” explained Huntley. Specialists from NRCS and the University of Missouri also provided technical services, including weekly field assessments. The farmers and custom applicators received weekly crop scouting reports that allowed them to target areas for pesticide application or identify areas that did not need additional treatment.

The two-pass program also presented risks to the farmer. As with any new technique, the farmer assumes a production risk by changing standard practice. Also, the weather dictates if the farmer is able to get the equipment back on the field to apply the second portion of the program containing the atrazine. “There is a weather risk — if they can’t get back on the field to control the weeds it might affect the overall yield,” explained Huntley.

Program Results

Despite the obstacles, the two-pass program proved to be an overwhelming success in 1999. Monitoring of the raw reservoir water indicated a 72 percent reduction in average atrazine concentrations for the period of April through July 1999, as compared to levels seen during the same months in 1995 to 1998. This impressive reduction occurred even though the overall number of acres in production had increased by 66 percent over the previous 6-year average. The success of the project is continuing into its second year. “Results this year also appear favorable so far. Although it has rained more this summer than last, we haven’t had large runoff events,” noted Huntley.

Area farmers like Tuley Elliot are pleased with the program. “It can be more expensive to go with a two-pass plan but we were happy with the weed control, and it definitely reduced atrazine runoff into the water. All in all, I’m proud of what we’ve done and I’m glad it has drawn the interest that it has.”

Unlike many pollution control programs, the atrazine abatement and management program has translated into economic gains for the farmer. “This program can improve environmental quality and increase farm income. In many cases better weed control can translate into higher yields for the farmers,” emphasized Huntley. Some farmers also had lower up-front costs when the scouting reports indicated that not all of the fields needed the second or post-emergence application.

Unfortunately, this is the last year of secured funding. Although NRCS is seeking additional funding to help support the program in the future, their ultimate goal is to sell it without the incentives. Would farmers continue to participate if the incentives were no longer provided? “Yes and no,” replied Huntley. “Some farmers were impressed enough by the weed control, and in some instances the reduced costs, to continue. We hope that the program will eventually be adopted by farmers on its own merit.” The Route J watershed project is a model for successfully attacking environmental problems while maintaining the economic viability of a watershed’s agriculture.

[For more information, contact Troy Huntley, NRCS IPM Specialist, 28898 US Hwy 63, Macon, MO 63552-9587. Phone: (660) 385-6359; e-mail: troy.huntley@mo.usda.gov.]

Laser Scanner Helps Prevent Soil Erosion

EDITOR'S NOTE: Adapted from an article printed in *Agricultural Research* by the Agricultural Research Service, USDA.

When people think of Manhattan, images of blustery, dry corn fields aren't the first things that come to mind. That is, unless they are thinking about Manhattan, Kansas. There, high winds and blowing dust cause several serious car accidents each year. That blowing dust causes other problems, too. Erosion removes more than 2 billion tons of soil from U.S. cropland annually, and wind erosion causes about 45 percent of this loss. Excessive erosion triggers worries about sediments, nutrients, and pesticides affecting water quality, as well as concerns about air quality and traffic visibility in wind-erosion-prone areas of the West, Midwest, and northern and southern plains. Two agricultural engineers in Manhattan are working on solutions.

Evolution of the Scanner

Larry Wagner and Fred Fox from the Agricultural Research Service (ARS) Wind Erosion Research Unit in Manhattan used the principles and technology developed by ARS soil scientist Chi-hua Huang in West Lafayette, Indiana to develop a small, lightweight laser scanner that measures standing crop residue. "Left standing, crop residue can be 10 times more effective in helping reduce wind erosion than if the same residue were flat," says Wagner.

In West Lafayette, Huang and co-workers measure soil surface roughness with sophisticated machinery. To measure faster and more accurately, Huang developed a laser scanner by combining a 35-mm camera and a low-power laser beam. Instead of film, the camera has electronic circuitry like a video camera. "This scanner makes just one pass with an advancing red line — like a copy machine light," says Huang. He speaks of landscape on the microtopographic scale — grains of sand, soil clods, rocks, and small depressions rather than mountains and valleys. Together, soil particles and rocks account for how rough a soil surface is, and roughness affects the amount of soil that can be carried away by wind and water. "Most of what is assumed about water erosion comes from studying water moving over a river bed. But erosion is different when you're looking at submerged soil," say Huang. From the first scanner, Huang and colleagues found that soil depressions slow erosion by holding water. But when the depressions get full, they start spilling into each other, concentrating the runoff into an erosive stream. The result is that erosion worsens.

Fox and Wagner's new scanner has a range of 10 inches to 15 feet. The laser optics are mounted on a traversing rail for row measurements or on a turntable to measure standing residue in a 10-foot circle. Fox and Wagner interact closely with farmers in erosion-prone areas of Kansas to team up against erosion. They encourage farmers to delay tillage during dry seasons and to consider no-till.

[For more information, contact Larry Wagner or Fred Fox, USDA-ARS Wind Erosion Research Unit, Throckmorton Hall, Kansas State University, Manhattan, KS 66506. Phone (785) 532-6807 (Wagner) and (785) 532-6694 (Fox); fax: (785) 532-6528. Chi-hua Huang is at the USDA-ARS National Soil Erosion Research Laboratory, 1196 Soil Building, Purdue University, West Lafayette, IN 47907. Phone (765) 494-8673; fax (765) 494-5948.]

Technical Notes

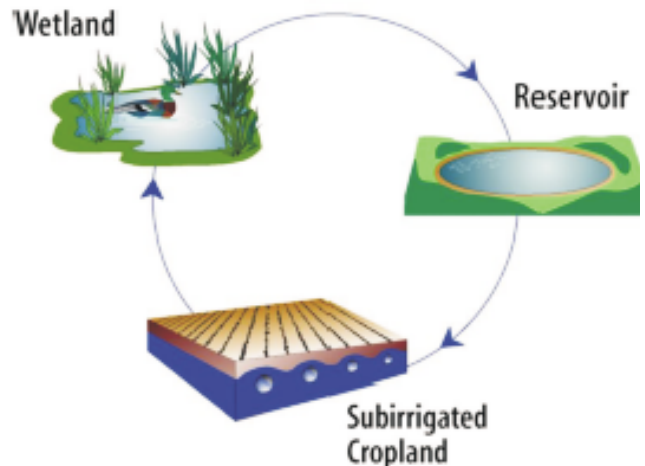
Innovative Irrigation System Implemented

Having a dry year? Some farmers participating in a demonstration project for a new irrigation system sure aren't. Researchers in the Maumee River Basin in Ohio developed a recirculating irrigation/drainage system that increases crop production while protecting water quality. The Wetland Reservoir Subirrigation System (WRSIS) is comprised of a subsurface drainage pipe network, a constructed wetland, and a water storage reservoir. The system applies irrigation water through the pipes to the roots, captures and treats subsurface and surface drainage, and stores the water for reuse. It operates in a closed loop, thereby minimizing runoff of sediment, nutrients, and pesticides into the Maumee River.

The Irrigation Loop

1. Irrigation water is applied through drain pipes to the roots of crops (subirrigation). Hydraulic control structures regulate the soil water levels during irrigation.
2. The same pipe network routes subsurface drainage to the constructed wetland. Surface runoff from rain is also directed to the wetland.
3. The wetland captures the sediment and absorbs some of the nutrients and pesticides from surface runoff and subsurface drainage. Hydraulic control structures regulate water depth in the wetland.
4. The water is then transferred into a water storage reservoir, where it is held until needed again for subirrigation.

Schematic of WRSIS, showing relationship between cropland, wetland, and reservoir. (Graphic by Leslie Zucker, Ohio State University Extension.)



WRSIS development involved collaboration between USDA's Natural Resources Conservation Service (NRCS) and Agricultural Research Service (ARS), the Maumee Valley Resource Conservation and Development Area (MVRCD), Soil and Water Conservation Districts, Ohio State University, and Michigan State University. Project planning, design, and construction, coordinated by the MVRCD, was funded primarily by grants from the EPA Great Lakes National Program Office, the Lake Erie Protection Fund, and the U.S. Army Corps of Engineers, with matching funds provided by each cooperating landowner. The ongoing research effort has been funded from a variety of university and government agency (federal, state, and local) sources, in turn providing support for five graduate students at Ohio State University.

Demonstration Sites

The project team installed systems at three demonstration sites in the Ohio portion of the Maumee River Basin — one each in Defiance, Fulton, and Van Wert counties. At each site, crop yields from subirrigated fields are compared against those of control plots with drainage pipes but no irrigation.

Overall system design is based on a number of criteria and varies somewhat depending on site conditions, such as topography, soil type, supplemental water supply, and subirrigated acreage. NRCS engineers used a computer program (DRAINMOD) to design the subirrigation system and estimate the size of the storage reservoirs needed. Wetlands were designed to receive surface runoff and subsurface drainage from a 3-inch rainfall over a 24-hour period. To prepare for rainfall events exceeding system storage capacity, managers also incorporated off-site effluent release mechanisms from both the wetlands and the reservoirs that allow water to overflow either directly into a local stream or into a drainage ditch that leads to a stream. For the Fulton and Van Wert locations, the project team installed additional irrigation/drainage pipes between pre-existing drain lines and equipped the whole network with irrigation capabilities. "Initial costs can be reduced substantially by installing these systems at locations that already have subsurface drains," explained Barry Allred, USDA Agricultural Engineer. The costs at each site (noted in the following paragraphs) included the labor and materials needed for system installation, as well as the income lost by removing some of the agricultural land from production.

Defiance County. Constructed in June 1995 at a cost of \$44,700, the Defiance County demonstration site contains two 3.5-acre subirrigated fields and 20 acres of control fields with conventional drainage. Subsurface drainage and runoff are funneled into a 0.30-acre wetland with a storage capacity of 185,000 gallons. Water is then pumped into a 0.39-acre storage reservoir with a capacity of 780,000 gallons. Here, the water is stored until needed for subirrigation. Crop yield data from 1997 and 1999 show a slight increase in the amount of corn and soybeans produced on the subirrigated fields versus the control plot (1997: an additional 26 bushels of corn per acre; 1999: an additional 16 bushels of corn per acre and 13 bushels of soybeans per acre). Project personnel installed an additional hydraulic control structure in the fall of 1999 that is expected to increase yields by removing a wet zone in one of the subirrigated fields.

Fulton County. Constructed in Spring 1996 at a cost of \$60,000, the Fulton County demonstration site contains two 20-acre fields — one that is subirrigated and a control plot with drainage pipes only. Subsurface and surface drainage from both fields is routed by gravity to a 1.4-acre wetland with a 1 million gallon capacity. Water is then pumped into a 1.57-acre, 2.3 million gallon storage reservoir and held until needed. The subirrigated fields showed increased yields during each of the growing seasons from 1996 to 1999 — an average of 44 more bushels of corn per acre and 10.4 more bushels of soybeans per acre than the control plot.

Van Wert County. Constructed in Fall 1996 at a cost of \$86,300, the Van Wert demonstration site contains three 15-acre fields — two that are subirrigated and one control plot with subsurface drainage only. Surface runoff and subsurface drainage run into a concrete sump and are pumped into either a 1.95-acre wetland holding 2.3 million gallons or a 3-acre storage reservoir holding 3.4 million gallons. In 1997 and 1998, little subsurface irrigation was needed because of normal or above average rainfall. The subirrigation that did take place actually damaged some crops because a wet zone formed in a poorly-drained area of the field. Project managers installed another hydraulic control structure before the growing season in 1999 to correct this wet zone. Once the problem was corrected, subirrigated field crop production exceeded that of the control plot by 33 bushels of corn per acre and 12.8 bushels of soybeans per acre.

System Success

Based on the typical maximum yields during a good farming year in northwest Ohio, the WRSIS project team set a crop yield goal of 200 bushels per acre for corn and 70 bushels per acre for soybeans. Although the Fulton County site has come close to that goal, with a four-year average total yield of 194 bushels per acre of corn and 66.4 bushels per acre of soybeans, the other two sites posted considerably lower yields (a corn and soybean average of 152 and 45.7 bushels per acre, respectively). These low numbers are partly due to a combination of wet years and poor drainage in certain areas. As the project team continues to learn about and correct these problems, the averages should increase. "At this point, the increased yields seen are probably not great enough to offset the start-up and operational costs. However, costs will decrease as we gain more experience with

design, construction, and management of these innovative systems," explained Allred. "Keep in mind that there are other benefits that are difficult to put a price on, such as reduced sediment and nutrient inputs into the river and increased wetland wildlife habitat."

An extensive monitoring program will provide information documenting WRSIS benefits to water quality, wildlife habitat, and crop yield at all three sites. They are currently gathering data on the quality of water being released offsite, the quality of the recycled irrigation water, and wetland treatment efficiencies. Notes Allred, "We'll have to collect data for a number of years before we can draw firm conclusions about WRSIS sediment and nutrient removal effectiveness. However, since they're mostly a closed-loop system, we're confident that offsite escape of sediment, nitrate, phosphate, and pesticides will be greatly reduced."

This technology is already being transferred to other places. Many of the design components from the first three WRSIS test sites have been incorporated at a new location presently operational on a private farm in the Big Darby Creek Watershed in central Ohio. This new location uses no pumps and is totally driven by gravity. An upland natural wetland, fed by surface runoff and subsurface drainage, provides subirrigation water for lower elevation agricultural fields. Subsurface drainage from these fields is then routed to a down-gradient constructed

Economic Benefits of New Irrigation System Will Be Gradual

To complement the WRSIS study, Ohio State University's (OSU) Department of Agricultural, Environmental, and Developmental Economics assessed the economic viability of the system using the Fulton County demonstration site as an example. Their 1997 study yielded both bad and good news. On the bad side, OSU's basic net present value analysis indicated that landowners would require a subsidy or transfer payment of some sort (such as an Ohio Wetland's Mitigation Program payment) before they could afford to invest in the system. Moreover, much of the current positive value of the system is tax-related, which poses uncertainty in the future as tax codes may change. On the good side, the study found that once system proponents get past the learning curve and are able to install and operate the system at a lower cost, the system will be more affordable and could be a viable investment. Articles detailing the study are featured at www.agecon.ag.ohio-state.edu/Faculty/mbatte/vanburen/PDF/ASAE-subirrigation.pdf and also in the *Journal of Production Agriculture*, 1999, Vol. 12, No. 4: 588-596.

For more information on the economic analysis performed by OSU, contact Dr. Marvin Batte, The Ohio State University, 2120 Fyffe Road, Columbus, Ohio 43210-1067; Phone: (614) 292-6406; e-mail: batte.1@osu.edu.

wetland for treatment before water is released offsite into a local stream. Other potential sites are now being evaluated in Indiana and Ontario, Canada. WRSIS construction and management concepts have recently been included in the Overholt Drainage School (www.ag.ohio-state.edu/~agwatmgt/overholt.htm), an annual short course offered to consultants, farmers, and drainage contractors that is coordinated by Larry Brown from the Food, Agricultural, and Biological Engineering Department at The Ohio State University.

[For more information, contact Barry Allred, Agricultural Engineer, USDA-ARS Soil Drainage Research Unit, 590 Woody Hayes Drive, Room 234, Columbus, Ohio 43210. Phone: (614) 292-9806; e-mail: allred.13@osu.edu. For more information on the project status, visit www.ag.ohio-state.edu/~agwatmgt/wrsis.htm.]

New Technology Measures First Flush of Runoff

A new low-cost First Flush Sampler® (FFS) that samples both surface sheet flow and concentrated flow from channels and gutters should provide watershed restoration practitioners with a low-cost NPS measurement device that can help make watershed research, compliance with NPDES regulations, and even establishing TMDLs easier.

The FFS consists of a five-port grate, a sample receptacle, o-rings, an insert, and a protective housing. These components make up the entire sheet flow water quality monitoring device, which is made entirely of plastic. The grate, insert, and protective housing are manufactured from glass-filled polycarbonate (strong and durable) and the sample receptacle from high-density polyethylene (HDPE), a chemically compatible material that will not compromise the analytical results. The housing is permanently installed at the site (i.e., a highway shoulder or a BMP inlet) by placing the insert body below grade so that its top is flush with the shoulder surface, with the top's long axis perpendicular to the direction of sheet flow runoff. Once installed, the unit can be used repeatedly to gather runoff water. The top must be flush with the surface to ensure proper operation.

To operate the FFS, the user removes the grate section and places the sample receptacle in the recess, then replaces the grate. The user tailors the sampling to meet the specific drainage area contributing to the sheet flow measurement site by removing the appropriate number of plugs from the sample ports (five maximum). The unplugged, or open sample ports, are selected to enable the 5-liter sampler to "just fill" when it experiences the desired rainfall depth (i.e., one-half inch). The known capture efficiency enables the user to approximate how much volume is captured for a given rainfall depth or how much rain corresponds to a given sample volume for a specific length of sheet flow and length of roadway. After a rain event, the user lifts the sealed sample receptacle from the recess beneath the grate, labels it, and places it in a cooler with ice for transport or shipment to the laboratory. If another sample is to be taken, the user places another sample receptacle in the recess. If no sample is to be collected, the user replaces the grate section and plugs all sample ports.

The principle of operation is simple; the known capture efficiency (developed through laboratory testing) allows the volume of the captured sample to be estimated:

$$\text{Vol.} = 6.35 D_{\text{Runoff}} L_{\text{Flow}} N_{\text{Ports}} \text{Eff}_{\text{Ports}}$$
, where:

Vol. = Required volume of sample, ml (up to 5000ml)

D_{runoff} = Desired rainfall capture depth, mm (i.e., 13 mm or ½ inch)

L_{Flow} = Runoff flow length, m

N_{Ports} = Number of sample-ports (5 max)

$\text{Eff}_{\text{Ports}}$ = Sample-port capture efficiency (0.7 for low-intensity rains and 1.5 for high-intensity rains of ¾ inch per hour or more)

FFS was developed under a grant from the Small Business Innovative Research (SBIR) program, a program that provides qualified small businesses with opportunities to propose innovative ideas that meet the specific research needs of federal government agencies. In this case, the Federal Highway Administration (FHWA) needed a low cost technology to gather runoff from impervious

surfaces with a low risk of vandalism. FHWA environmental managers Fred Bank and Pat Cazenias identified and secured a grant for \$600,000 from SBIR to develop, test, and manufacture the First Flush Sampler.

In addition to being small, cheap, and easy to install, the FFS has two important characteristics that make it valuable for establishing TMDLs:

- It provides a simple means to directly collect samples of surface runoff near where rain starts to flow downhill, thus securing samples that closely represent “pure” land use; and
- It provides an estimate of the rainfall depth based on the volume of the captured sample.

To evaluate FFS in the field, devices were installed at four sites in Maryland and five in Virginia. The Maryland sites were along roads serving from 5,000 to 10,000 Average Daily Traffic (ADT). Three of the five sites in Virginia were from 3,000 to 27,000 ADT. The other two Virginia sites were used for parking cars — a high school and a municipal office building lot. Three groups, University of Virginia, Virginia Tech, and GKY and Associates collected the samples from May through December 1999. The Virginia Tech Occoquan Water Monitoring Laboratory analyzed the samples for pollutant concentrations. The procedure for collecting samples is incorporated in an operations manual that comes with the FFS.

In independent studies, University of Virginia researchers found that the FFS “is an effective means for collecting edge of pavement samples.” They also found that the FFS “was relatively easy to maintain and monitor” and “extremely useful for collection of inflow samples for selected sites.” A Virginia Tech research team found that “the device is easy to install and service in the field” and “laboratory tests and field trials have shown that the device performs well.”

The FFS has already been used in real applications to

- evaluate BMPs (Texas A&M),
- evaluate biosolids application to fields (University of Florida),
- measure highway runoff (Minnesota Department of Transportation), and to
- test the product itself on highways and parking lots in Virginia and Maryland.

Preliminary results of these applications illustrate the strength of highway runoff and suggest a linkage to traffic volume.

What’s the catch? The only downsides of the First Flush Sampler are that some heavy trucks can crack the grating and that the grating “hold-downs” can be overtightened and dislodge themselves — a small price to pay considering the fact that each unit costs only \$200 to replace.

[Ken Young, Stu Stein, and Frank Graziano hold the U.S. patent and SBIR commercialization rights for FFS. For more information, contact either Young or Stein at GKY & Associates, Inc., 5411 E. Backlick Road, Springfield, VA. Phone: (703) 642-5080; e-mail: ffs@gky.com, kyoung@gky.com, or sstein@gky.com. The web site is www.gky.com].

Study Finds Low Nitrate/Nitrite Concentrations Deadly to Tadpoles

Researchers studying the responses of amphibians to nutrient levels in fresh waters have found that nitrate and nitrite concentrations well below water quality standards for drinking water and aquatic life lead to significant mortality rates for some frog and salamander larvae. In a study published recently in *Environmental Toxicology and Chemistry*, Andrew Blaustein of Oregon State University and two colleagues from Spain report that nitrite levels as low as 2 milligrams per liter (mg/L) killed half of the frog and salamander larvae tested after 15 days of exposure. The researchers noted that their study might implicate runoff of nitrogen fertilizers as part of the reason for the decline in amphibian species in agricultural regions.

The study team tested larvae of the Oregon spotted frog (*Rana pretiosa*), red-legged frog (*Rana aurora*), Western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), and Northwestern salamander (*Ambystoma gracile*). Test larvae were placed in water with varying concentrations of nitrate and nitrite; control groups were maintained in purified water for each test. Nitrate concentrations ranged from 0 to 25 mg/L, and nitrite levels tested ranged from 0 to 7 mg/L. The team monitored for larvae mortality, activity level and behavior, and the presence of abnormalities.

The researchers discovered significant differences in sensitivity among species. In higher concentrations of nitrate, Northwestern salamander and Oregon spotted frog larvae ate less, swam less vigorously, showed disequilibrium, and experienced abnormalities (mainly swelling and bent tails) and paralysis; many eventually died. Western toad and Pacific treefrog larvae experienced very low effects at all concentrations. After 4 days, Northwestern salamander larvae appeared to be the most sensitive species and showed significant mortality at the highest concentration. The three frog species tested did not experience significant mortality until after the initial 4-day period in any of the test containers. After 15 days, differences in sensitivity among the species were more apparent, with the Oregon spotted frog and Northwestern salamander groups showing the most effects.

Nitrite concentration tests showed similar impacts on larvae in all areas at higher concentrations. The observed effects increased with both concentration and time, and there were significant differences in sensitivity among species. The lethal concentration values for half (i.e., LC₅₀) of the test species indicate a high sensitivity of the five amphibians to nitrite. Again, significant differences among the species were evident.

The researchers discussed their findings in view of the decreasing distribution of test species throughout their native range in the Northwest. The Northwestern salamander is still present in lowland valleys of western Oregon and Washington, but the Oregon spotted frog is extremely rare in these areas. The experiments showed a strong sensitivity of Oregon spotted frog and Northwestern salamander larvae to relatively low levels of both nitrate and nitrite. The researchers speculated that runoff of nitrogen-based chemical fertilizers could be one reason Oregon spotted frog populations are declining in the lowlands.

Introduced bullfrogs, *Rana catesbeiana*, may also be contributing to the decline of Oregon spotted frogs and other amphibians in the Willamette Valley. Bullfrogs may compete with or prey upon native amphibian species and seem to alter their use of habitat. Bullfrogs might also be more tolerant of nitrogen-based fertilizers than other amphibians, allowing their number to increase in areas where there are other, more sensitive populations of amphibians. Previous research suggested that bullfrog tadpoles are relatively tolerant to nitrite, which may help them to survive in areas with intense agricultural uses.

Some surface water and ground water resources contain levels of nitrates that exceed the drinking water standard of 10 mg/L. The U.S. Geological Survey found recently in a nationwide study that nitrate concentrations in 15 percent of shallow ground waters sampled and levels in some streams in agricultural areas exceeded the drinking water standard, especially after spring fertilizer applications. Treatment is required if these water sources are to be used as potable water supplies. According to the researchers, these concentrations are highly toxic to the Oregon spotted frog and Northwestern salamander. The recommended level of nitrate for drinking water (10 mg/L) is moderately toxic to the Oregon spotted frog. The recommended level of nitrate for warmwater fishes (90 mg/L) is almost four times higher than the 15-day LC₅₀ for the Oregon spotted frog and two times higher than that for the Northwestern salamander. The recommended level of nitrite for drinking water (1 mg/L) is highly toxic for the Oregon spotted frog and Northwestern salamander and moderately toxic for the rest of the amphibians tested. The 15-day LC₅₀ for nitrite for all the studied species was mostly below the recommended level for warmwater fishes (5 mg/L).

The research conducted by Blaustein and his colleagues might have implications for nutrient criteria programs. EPA and agency stakeholders have devised the *National Strategy for the Development of Regional Nutrient Criteria* as part of the Clean Water Action Plan. The strategy seeks to use a regional and waterbody-type approach in developing water quality criteria for nutrients, which eventually would be incorporated into state and tribal water quality standards programs. Thomas Gardner, who is working on the strategy as part of EPA's National Nutrient Team, said his group is interested in Blaustein's findings and has discussed the study in their group meetings.

[The complete study, "Sensitivity to Nitrate and Nitrite in Pond-breeding Amphibians from the Pacific Northwest USA," can be found in *Environmental Toxicology and Chemistry*, Vol. 18, No. 12, pp. 2836-2839. See <http://setac.org/> to access the on-line version. For more information, contact Andrew Blaustein at (541) 737-5356 or Thomas Gardner at gardner.thomas@epa.gov.]

Notes on Education

Watershed Teaching Tool Hits Home in New Jersey

Thanks to the New Jersey Audubon Society (NJAS), middle and high school students are getting in touch with their watersheds. The NJAS has developed a guide called New Jersey WATERS (Watershed Approach to Teaching the Ecology of Regional Systems) that focuses on the ecological, social, and economic issues linked to New Jersey watersheds. The guide is designed to provide students the opportunity to collect, share, analyze, and compare scientific, cultural, economic, and historical New Jersey data.

The New Jersey WATERS guide is organized into 4 process-oriented chapters.

1. *Sense of place.* Which watershed do you live in?
 2. *Sense of time.* How does your watershed change over time?
 3. *Quality of watershed.* What factors determine your watershed's health (including surface water, ground water, habitat, etc.)?
 4. *Sense of connection.* How do you affect your watershed?
-

Watershed Partnership for New Jersey Formed

As in many states across the country, New Jersey has diverse organizations that support or participate in environmental education and outreach. Realizing that their effectiveness could be improved through cooperation, more than 70 New Jersey nonprofit, federal, state, county and local agencies, educational institutions, and private industries have joined to form a statewide nonprofit educational partnership that focuses specifically on watershed education. The Watershed Partnership for New Jersey (WPNJ) works through multiorganization committees to achieve the following goals:

- ◆ Establish a watershed resources network
- ◆ Enhance watershed awareness through education
- ◆ Encourage community watershed involvement
- ◆ Strengthen alliances and partnerships among watershed groups

For more information about the WPNJ, visit their web site at www.wpnj.org.

The NJAS is a nonprofit conservation organization (not affiliated with the National Audubon Society) that tries to preserve habitat and species diversity by fostering environmental awareness. "With the guide, we try to show that when you deal with any habitat issue it can always be translated into watershed terms," explains Dale Rosselet, NJAS Director of Education.

The guide focuses on a process-oriented approach to learning about New Jersey watersheds. For each general topic (chapter), the guide teaches a basic awareness of the subject, and, lesson by lesson, increases in complexity until the students are participating in activities that involve community outreach. According to Rosselet, this approach "encourages students to think, question, and discover on their own. The world changes so quickly. We want to give students the tools to adapt."

Funded by the Environmental Endowment for New Jersey, the 220-page guide has been available since November 1999. The NJAS hosted six workshops in the spring of 2000, training 132 teachers, state and local officials, and watershed professionals. Six more workshops are planned for spring 2001.

Dale Rosselet pointed out that "teachers usually don't have time to tailor general guides to reflect their region. We've done that for them in our guide. Other organizations could easily use our guide as a model to create something similar for their state — they would just have to collect the necessary background information."

[Copies of New Jersey WATERS are available for \$30 plus shipping and handling from the NJAS Scherman-Hoffman Sanctuary Bookstore, P.O. Box 693, Bernardsville, NJ 07924. Phone: (908) 766-5787. For more information, contact Dale Rosselet, New Jersey Audubon Society, Center for Research and Education, 600 Route 47 North, Cape May Court House, New Jersey 08210. Phone: (609) 861-0700; e-mail: dale@njaudubon.org.]

Virginia Governor's Academy for Environmental Stewardship

Virginia is preparing its young people to tackle future environmental issues. Thirty-two rising juniors from 28 Virginia high schools participated this summer in the first Governor's Academy for Environmental Stewardship, a week-long program to prepare young people for careers managing Virginia's natural resources in the future. The academy is part of Virginia Naturally 2000, the state's official environmental education initiative to promote lifelong learning about Virginia's environment and stewardship of the state's natural and historic resources.

Selected on the basis of an expressed interest in natural resources as well as academics and recommendations, the students were divided into two groups for week-long sessions (July 16-22 and August 13-19) at the new Cove Ridge Environmental Education Center at Natural Tunnel State Park in southwestern Virginia. "They spent a week learning about careers in natural resources," said Virginia Secretary of Natural Resources John Paul Woodley, Jr., "by working in field studies with forestry, fish and wildlife management, watershed management, water quality, threatened and endangered species, and geology."

Instructors from diverse natural resource disciplines offered students the opportunity to see first hand what they do. Activities included tagging and tracking wildlife, studying beds of threatened and endangered mussels, touring a power plant, comparing sinkholes on the ground surface with karst features underground, studying stream morphology, and participating in a career fair. "Students previously had no concept of the many careers that are available in industry, government, watershed groups, and so on. Because there were only 16 students at a time, they had more one-on-one time with the instructors to learn what they really do," explained Dawn Shank, who helped coordinate the academy for the Virginia Department of Conservation and Recreation.

Private industry, conservation organizations, and universities have joined the state to provide technical support, scholarships, and other resources to the academy. For example, Philip Morris contributed eight Enviroscapes, an interactive 3-D tabletop watershed model, to the academy at a May 30 event. Recognizing the value of hands-on education for all ages, Philip Morris also donated 15 Enviroscapes to Richmond city schools that same day. "These environmental models will help our students in elementary through high school learn about the science of water systems and the importance of water conservation," said Charles Agee, Community Relations Manager for Philip Morris in Richmond.

Virginia's Governor's Academy for Environmental Stewardship has bridged the gap for students between textbook learning and hands-on application. By encouraging private and public organizations to support the academy and other education efforts, Virginia provides an opportunity for those organizations to invest in students' environmental education and Virginia's environmental future.

[For more information, contact Dawn Shank, Virginia Department of Conservation and Recreation, 203 Governor Street, Suite 213, Richmond, VA 23219-2094. Phone: (877) 42WATER; e-mail: dshank@dcr.state.va.us; web site: www.vanaturally.com.]

Educational Resources Column

VIDEOS

Urban Stormwater Control Demo. This 14-minute video showcases the urban stormwater demonstration project designed and installed by the Environmental Center of the Rockies to manage rainfall on site. From its central location at Baseline and Broadway in Boulder, Colorado, the project, one of The National Forum on Nonpoint Source Pollution's 25 demonstration projects, continually shows passersby how to create a sustainable landscape and reduce nonpoint source pollution. Professionally produced by Channel 8 in Boulder, this excellent video can inspire other communities to control urban stormwater pollution. It can be purchased for \$25 (bulk rate available) by phoning (303) 441-3550 or e-mailing stientjesj@ci.boulder.co.us.

Treading Responsibly: Walking in the Shoes of a Water Drop! This comical video from the San Antonio Water System (SAWS) shows San Antonio residents how neighborhood activities affect regional water quality. The story line follows Jerry, a "water drop," through four unique scenes that address watersheds, lawn chemical use, pipes, and construction activities. It is available free of charge to homeowner associations. For more information, contact Suzanne M. Weedman, Environmental Services Supervisor, Watershed Protection and Management, 1001 E. Market Street, P.O. Box 2449, San Antonio, TX 78298-2449. Fax: (210) 704-7508; e-mail: sweedman@saws.org.

Reviews and Announcements

Send Us Your I&E Success Stories!

An upcoming issue of *News-Notes* will have a special focus on nonpoint source Information and Education (I&E), and we would like to feature your stories on innovative I&E projects occurring in your local watershed. In particular, if you have any stories on successful NPS media campaigns or integrating NPS curricula into schools, we would like to hear from you! Both of these topics are priority action items for a new State/EPA Nonpoint Source Management Partnership created by the Association of State and Interstate Water Pollution Control Administrators and EPA. We want to share and learn from your successes! Contact Stacie Craddock with questions at 202-260-3788 and e-mail your stories to craddock.stacie@epa.gov.

Third Edition of Handbook for Making Land-use Decisions

The third edition of *Common Groundwork: A Practical Guide to Protecting Rural and Urban Land* is now available. The book, a joint project of the Western Reserve Resource Conservation and Development Council, Seventh Generation, the Ohio Office of Farmland Preservation, and Chadbourne and Chadbourne, Inc., focuses on sustainability and smart growth. Topics include the role of planning in land preservation, land management tools, and how local government works with respect to land use. The price is \$28.50 per copy plus \$3 for shipping and handling; Ohio buyers must also pay \$1.57 state tax. Call (800) 484-7949 (plus the 4-digit code 1993), or mail payment to Chadbourne and Chadbourne, Inc., 18554 Haskins Rd., Chagrin Falls, Ohio 44023-1823.

GIS Proceedings Available

The proceedings from the conference Environmental Problem Solving with GIS held in Cincinnati, Ohio on September 22-24, 1999 is now available. For copies, contact Sue Schock at (513) 569-7551.

Maryland County Releases Environmental Assessment 2000

Maryland's Montgomery County Department of Environmental Protection recently developed its *Environmental Assessment 2000*. The report, presented on a glossy, fold-out poster, outlines indicators of environmental health and quality throughout the county. *Environmental Assessment 2000* identifies significant resource concerns throughout the county in key areas, including agriculture, air quality, biodiversity, energy, groundwater, hazardous material, noise, transportation, solid waste and recycling, and watershed quality. The poster identifies individual indicators that provide benchmarks that can be used in the future to assess program effectiveness, identify significant trends, and determine the need for new initiatives. For copies of the report, call the Montgomery County Department of Environmental Protection at (240) 777-7700 or e-mail: help@askDEP.com.

Tribal Wetland Program Efforts Shed Light in New Publication

The Wetlands Division of EPA's Office of Wetlands, Oceans, and Watersheds has published *Tribal Wetland Program Highlights* (EPA 843-R-99-002), a milestone in the Division's ongoing effort to support the development of comprehensive tribal wetland programs. Eleven case studies (each officially approved by its respective tribe or native organization) highlight the experiences of tribal organizations and feature varying components of tribal programs, including tools and strategies to protect and restore wetlands and watersheds. *Tribal Wetland Program Highlights* offers tribes and their partners (at the federal, state, and local level) an opportunity to examine techniques for water resource management and to explore the range of tools and strategies currently in use. The publication is also designed to encourage partners to discover sources of inspiration for new approaches to wetland protection that will achieve desirable wetland protection goals. Copies are available from the Wetlands Helpline at (800) 832-7828 (Fax (703) 748-1308) and will soon be on EPA's web site at www.epa.gov/owow/wetlands. For more information contact Kathleen Kutschenreuter at (202) 260-5356.

Correction

In the last issue of News-Notes (#61 July) we announced the availability of a new publication called *Recipes for Clean Water: A Homeowner's Stormwater Survival Guide*. In the announcement we mistakenly listed the wrong email address for author Bill Boudreau. His correct e-mail address is cremboudreau@uswest.net.

Web Sites Worth a Bookmark

<http://outreach.missouri.edu/mowin/>

The Missouri Watershed Information Network, or MoWIN, assists in locating and accessing information relative to Missouri watersheds. It provides information for state and federal agencies, non-governmental organizations, natural resources interest groups, and private industry working together to protect watersheds in Missouri. The site has information on current watershed events and upcoming meetings, ongoing watershed projects, local watershed contacts, financial information pertaining to grants and other funding sources, location of technical assistance, sources of educational resource information, and sources of natural resource facts, reports, and data.

www.plannersweb.com/sprawl/home.html

Sprawl Guide, maintained by the Planning Commissioners Journal's PlannersWeb web site, offers information on key issues associated with sprawl. It covers problems, solutions, resources, articles, books, and more. It also provides a mechanism to search by state for groups or projects working to curb urban sprawl.

www.smartgrowth.org/index2.html

The Smart Growth Network's (SGN) partners work collaboratively on outreach programs, technical assistance, research, publications, and other collaborative projects. The site gives the latest news on hot smart growth issues. It is a subset of www.sustainable.org and is maintained by the Sustainable Communities Network.

Datebook

DATEBOOK is prepared with the cooperation of our readers. If you would like a meeting or event placed in the DATEBOOK, contact the NPS News-Notes editors. Notices should be in our hands at least two months in advance to ensure timely publication.

Meetings and Events

October 2000

17-20

Wetland Training Institute's Wetland Construction and Restoration Course. Hastings, MI. Taught by G. Pierce and C. Newling. For more information, contact the Wetland Training Institute, P.O. Box 31, Glenwood, NM 88039; phone/fax: (877) 792-6482; e-mail: getinfo@wetlandtraining.com; web site: www.wetlandtraining.com.

17-21

Spanning Cultural and Ecological Diversity Through Environmental Education, 29th Annual Conference of the North American Association for Environmental Education, South Padre Island, TX. Visit www.naaee.org/html/conferences.html for more information.

24-26

Delaware Sediment and Stormwater Program Conference 2000, University of Delaware, Newark, DE. The conference will focus on erosion, sediment, and stormwater management. Registration \$235. Contact Jeanne Feurer, Conference Coordinator, Delaware Department of Natural Resources and Environmental Control, Division of Soil and Water Conservation, 89 Kings Highway, Dover, DE 19901. Phone: (302) 739-4411; fax: (302) 739-6724; e-mail: jfeurer@dnrec.state.de.us.

26-28

National Carbon Sequestrian Conference, Missoula, MT. Contact Karen Reiter or Ted Dodge, (406) 587-6965; e-mail: kreiter@mt.nrcs.usda.gov.

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Healthy Watersheds: Community-based Partnerships for Environmental Decisionmaking. Aurora, CO. Contact Phyllis O'Meara, (303) 671-1034, e-mail: paomeara@opm.gov.

November 2000

- 5-8 *Atmospheric, Surface and Subsurface Hydrology and Interactions*, Research Triangle Park, NC. For more information on this conference sponsored by The American Institute of Hydrology, visit www2.ncsu.edu/ncsu/CIL/WRRI/aihconf.html.
- 6-9 *2000 Annual Water Resources Conference Resources Conference*, Miami, FL. Contact Bob W. Higgins, Technical Program Chairperson, Higgins Engineering, Inc., 4623 Forest Hill Blvd., Suite 113, West Palm Beach, FL 33415. Phone: (561) 439-7807; fax: (561) 439-0026; e-mail: bhiggins@ix.netcom.com.
- 8-10 *NALMS 2000: 20th International Symposium of the North American Lake Management Society*, Miami, FL. Contact Terry Thiessen, NALMS Conference Coordinator, PO Box 5443, Madison, WI 53705-5443. Phone: (608) 233-2836; fax: (608) 233-3186; e-mail: thiessen@nalms.org; web site: www.nalms.org/symposia/miami/miami.htm.
- 8-10 *Facilitating and Mediating Effective Environmental Agreements*, Berkeley, CA. Contact CONCUR, Inc. (510) 649-8008; web: www.concurinc.com
- 13-15 *2000 Groundwater Foundation Fall Conference: What Difference Does Environmental Education Make?* Nebraska City, NE. Contact the Groundwater Foundation at (800) 858-4844; e-mail: info@groundwater.org; web: www.groundwater.org.
- 27-30 *Managing Watersheds in the New Century: The 8th Biennial Conference of the Watershed Management Council*, Monterey, CA. Contact Watershed Management Council, c/o PSRP, University of California, One Shields Avenue, Davis, CA 95616-8688. Phone: (760) 935-4903; e-mail: rick@icess.ucsb.edu; web: www.watershed.org/wmc.
- 28 *Wetland Training Institute's Wetland Delineation for Executives Course*. Seattle, WA. Taught by R. Pierce, C. Newling, J. Teaford. For more information, contact the Wetland Training Institute, P.O. Box 31, Glenwood, NM 88039; phone/fax: (877) 792-6482; e-mail: getinfo@wetlandtraining.com; web site: www.wetlandtraining.com.

December 2000

- 4-9 *Watershed Management to Protect Declining Species*, Seattle, WA. Contact AWRA, (540) 687-8390; e-mail: awrahq@aol.com; web site: www.awra.org.
- 5-8 *National Conference of Grazing Lands*, Las Vegas, NV. Contact Jon Peterson, (703) 455-6886; e-mail: jwpeterson@erols.com.
- 13-14 *Ground Water: A Transboundary, Strategic and Geopolitical Resource*. Las Vegas, NE. Contact Bob Masters, Conference Coordinator, Phone: (800) 551-7379, ext. 527; e-mail: rmaste@ngwa.org web site: www.ngwa.org.

January 2001

- 7-9 *International Symposium on Integrated Decisionmaking for Watershed Management*. Chevy Chase, MD. Contact Mary Leigh Wolfe, Department of Biological Systems Engineering, Virginia Tech. Phone: (540) 231-6092; e-mail: mlwolfe@vt.edu; web site: www.conted.vt.edu/watershed.htm.

April 2001

- 18-20 *4th National Mitigation Banking Conference*, Fort Lauderdale, FL. Contact Terrene Institute. Phone: (800) 726-4853; email: terrinst@aol.com; web site: www.terrene.org.

May 2001

- 16-18 *2001 Communities Working for Wetlands*. Orlando, FL. The Izaak Walton League of America. For more information contact Save Our Streams. Phone: (800) BUG-IWLA (284-4952); web site: www.iwla.org/SOS/awm/awmconf.html.

June 2001

- 10-15 *5th International Conference on Diffuse Pollution*. Milwaukee, WI. Sponsored by the International Water Association, Specialist Group on Diffuse Pollution. Contact Vladimir Novotny, Institute for Urban Environmental Risk Management, Marquette University, Milwaukee, WI 53201-1881. Phone: (414) 288-3524; fax: (414) 288-7521; e-mail: environment@marquette.edu; web site: www.mu.edu/environment/iwa-page.htm.

Correction

In the last issue of News-Notes (#61 July) we listed outdated information on the next meeting of the North American Lake Management Society (NALMS). The next NALMS meeting will be held November 8-10, 2000 in Miami, FL. For more information, contact Terry Thiessen, NALMS Conference Coordinator, PO Box 5443, Madison, WI 53705-5443. Phone: (608) 233-2836; fax: (608) 233-3186; e-mail: thiessen@nalms.org; web: www.nalms.org/symposia/miami/miami.htm.

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Nonpoint Source NEWS-NOTES is an occasional bulletin dealing with the condition of the water-related environment, the control of nonpoint sources of water pollution and the ecosystem-driven management and restoration of watersheds. NPS pollution comes from many sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural pollutants and pollutants resulting from human activity, finally depositing them into lakes, rivers, wetlands, coastal waters, and groundwater. NPS pollution is associated with land management practices involving agriculture, silviculture, mining, and urban runoff. Hydrologic modification is a form of NPS pollution which often adversely affects the biological integrity of surface waters.

Editorial contributions from our readers sharing knowledge, experiences and/or opinions are invited and welcomed. (Use the COUPON on page 31.) However, *NEWS-NOTES* cannot assume any responsibility for publication or nonpublication of unsolicited material nor for statements and opinions expressed by contributors. All material in *NEWS-NOTES* has been prepared by the staff unless otherwise attributed. For inquiries on editorial matters, call (202) 260-3665 or FAX (202) 260-1977.

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