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STORMWATER MANAGEMENT

Stormwater—runoff from rain and melting snow—can cause water pollution by carrying pollutants into the water supply. Active management of stormwater by local jurisdictions can protect public health and create a more attractive community.

The U.S. Environmental Protection Agency and the Clean Water Act lay out a phased approach to controlling stormwater discharges. This report provides a broad guide to the EPA permit process as well as sources of additional information and funding for local governments as they work to conform to requirements and provide citizens an unpolluted water supply. Four case studies highlight proactive, innovative local stormwater programs.

This report includes specific suggestions for local governments in the areas of public education, involving the public in accomplishing stormwater goals, eliminating illicit discharges, reducing runoff from construction projects and new development, and preventing pollution caused by local government operations.

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Author Contact Information

Wyatt Green
120 Taylor Road
Morris, NY 13808
607/783-2541
e-mail: lgean1@yahoo.com

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Stormwater Management

Wyatt Green is assistant project manager for the Local Government Environmental Assistance Network (LGEAN), an ICMA clearinghouse of environmental information for local government officials and their staffs. He conducts research on environmental issues and responds to regulatory and environmental management questions posed by local government officials.

WHAT IS STORMWATER?

Stormwater is runoff from a rainstorm or melting snow. Urban landscapes—unlike forests, wetlands, and grasslands that trap precipitation and allow it to filter slowly into the ground—contain great expanses of impermeable asphalt and concrete surfaces that prevent water from seeping into the ground. Large amounts of water therefore remain above the surface, accumulate, and run off. Storm sewer systems channel this runoff from roads and other impermeable surfaces and route it—often with little or no treatment—into local water bodies.

Stormwater that runs over cityscapes of streets, parking lots, rooftops, construction sites, golf courses, and lawns picks up and transports pollutants that accumulate in these areas. Pollutants from streets and parking lots include grease and oil drippings from cars; lead, zinc, and asbestos from tire wear; asbestos, lead, chromium, copper, and nickel from clutch and brake lining wear; and salts from winter road management. Improperly managed lawns, golf courses, and urban parks can contribute pesticides and herbicides. Construction sites and other projects also produce sediment—typically a large percentage of stormwater pollutants. Stormwater also often includes viruses and bacteria from failing septic systems and pet waste, paint and other household chemicals, organic matter such as leaves and grass clippings, and floatable trash that is carried away by the runoff. All these pollutants are transported by the runoff into gutters, storm drains, and onward into bodies of water.

After stormwater reaches a storm drain, it can come into contact with additional pollutants—illicit discharges—intentionally or accidentally introduced directly into the drain. Municipal storm sewer systems are not designed to handle these wastes. Illicit discharges can include sanitary wastewater systems illegally connected to the storm drain system; effluent from septic tanks; car wash, laundry, and other industrial wastewaters; auto and household toxics such as used motor oil and pesticides that are dumped illegally; and spills from roadways. These discharges contribute high levels of heavy metals, toxic substances, oil and grease, nutrients, viruses, and bacteria to local water bodies.

Water pollution threatens the drinking water supply, but it also affects recreation. Illicit wastewater discharges and pet waste can introduce viruses, bacteria, and other disease-causing agents and create a health threat for swimmers.

> **Approximately 40 percent of the rivers, lakes, and estuaries that have been assessed by environmental protection agencies are not meeting water quality standards.**

A 1995 study of Santa Monica Bay, California, reported that pollutants from storm drains increase the chance that swimmers will experience fever, nausea, and gastroenteritis as well as cold and flu-like symptoms.[1] Sediment that clouds the water also increases the chances of boating, swimming, and diving accidents.[2] Toxic metals such as lead can harm fish or can be absorbed by other organisms and accumulate in the food chain, making fish and other game unfit for human consumption. Salts from road deicing washed into bodies of water can render water unfit for drinking. Chemical fertilizers and organic matter that get washed into storm drains add excessive nutrients to water bodies, causing excessive growth of algae and other aquatic plants. The increased growth and subsequent decay of these organisms can deplete the oxygen in the water, killing fish and other wildlife. Sediment can cloud wa-

What are stormwater best management practices?

The EPA stormwater phase II final rule requires local governments to develop a stormwater management program, which consists of six minimum measures to reduce stormwater pollution. Local governments must determine appropriate best management practices for each.

Stormwater best management practices can be divided into two categories:

- **Structural** approaches to managing stormwater are actual structures that physically prevent, inhibit, or slow the rate at which pollutants reach water bodies.
- **Nonstructural** management practices accomplish the same goal but, instead of physical structures, they make use of preventive actions, strategies, and policies.

The following examples have been excerpted from *National Menu of Best Management Practices for Storm Water Phase II,* www.epa.gov/npdes/menuofbmps/menu.htm.

Public education and outreach

Environmentally friendly lawn and garden activities. Nonstructural. Gardening can result in contamination of stormwater through pesticide, soil, and fertilizer runoff. Municipalities can encourage environmentally friendly practices such as landscape planning, integrated pest management, planting indigenous species, soil testing, and reducing or eliminating the use of fertilizers and pesticides.

Public participation/involvement

Community hot lines. Nonstructural. Local governments that find it difficult to monitor numerous bodies of water can rely on the public to keep them informed of polluters. Community hot lines allow concerned citizens and agencies to contact the appropriate authority when they see water quality problems. A hot line can be a toll-free telephone number or an electronic form linked directly to a utility or government agency such as a water quality control board.

Illicit discharge detection and elimination

Eliminating industrial/business connections. Nonstructural. This management practice involves the identification and elimination of illegal or inappropriate connections of industrial and business wastewater sources to the storm drain system. Illicit connection detection and elimination programs attempt to regulate, inspect, and remove these connections.

Construction site runoff control

Wind fences/sand fences. Structural. Sand fences are barriers of small, evenly spaced wooden slats or fabric erected to reduce wind velocity and trap blowing sand. The spaces between fence slats allow wind and sediment to pass through but the fences reduce the wind velocity, which causes the sediment to fall along the fence. Such fences can be used around open construction sites to prevent wind from blowing sediment off the site and into adjacent properties, roads, and water bodies.

Ordinances. Nonstructural. Local governments can enact erosion and sediment control (ESC) ordinances to guide, regulate, and control the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land. ESC ordinances consist of permit application and review, and they can also require an erosion and sediment control plan.

Postconstruction runoff control

Wet ponds. Structural. Wet ponds (also known as stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or throughout the wet season). Ponds are used to treat incoming stormwater runoff by allowing pollutants to settle to the bottom of the pool or be taken up by algae or other biological activity. Wet ponds are among the most cost-effective and widely used stormwater practices.

Conservation easements. Nonstructural. Conservation easements are voluntary agreements that allow an individual or group to set aside private property in order to limit the type or amount of development on the property. By restricting development, easements can limit the amount of impervious surfaces, thus reducing stormwater runoff.

Pollution prevention/good housekeeping for municipal operations

Road salt application and storage. Nonstructural. Local governments can cover salt storage piles to reduce potential contamination to local water bodies and can locate storage piles outside 100-year floodplains for further protection against surface water contamination. During road salt application, the amount of road salt applied should be regulated to reflect site-specific characteristics such as road width and design, traffic concentration, and proximity to surface waters. Alternative materials such as sand or gravel should be used in especially sensitive areas.

For more information on stormwater best management practices, see:

National Menu of Best Management Practices for Storm Water Phase II. Produced by the EPA, this document provides guidance to regulated small MS4s on the types of practices they could use to develop and implement their stormwater management programs. See www.epa.gov/npdes/menuofbmps/menu.htm.

National Stormwater Best Management Practices (BMP) Database. Designed by the American Society of Civil Engineers under a grant from the EPA, this searchable database provides access to BMP performance data in a standardized format for more than 113 BMP studies conducted over the past 15 years. See www.bmpdatabase.org/.

ter and settle to the bottom, destroying the feeding and spawning grounds of fish.

The volume and velocity of water flow during storms can threaten public health and endanger local aquatic systems. Massive runoffs can result from impervious surfaces. Because runoff picks up speed when it enters storm drains, great volumes of water can enter local water bodies at a high velocity, eroding stream banks, widening stream channels, damaging property, and flooding downstream areas. This can lead to lower water levels in dry weather, higher levels during wet weather, increased pollution from sediment, and higher water temperatures—changes that are often fatal to fish and other aquatic wildlife.

According to a recent report on water quality by the U.S. Environmental Protection Agency (EPA),[3] approximately 40 percent of the rivers, lakes, and estuaries that have been assessed by environmental protection agencies are not meeting water quality standards that have been set by states and territories. The report found that urban runoff and discharges from storm sewers are major sources of water quality problems.

BENEFITS OF STORMWATER MANAGEMENT

By more effectively managing stormwater runoff, local governments can protect public health and spur economic growth. Contamination of community drinking water threatens public health and causes significant cleanup expense. Preventing contamination of drinking water avoids the costs of additional treatment facilities, locating new drinking water sources, and restoring citizens' confidence in their drinking water, public utilities, and community leaders.

Reducing pollution can prevent the closure of shellfish beds and ensure the continuation of commercial open water fishing by maintaining healthy fish habitat. Sport fishing, swimming, and boating provide revenue from tourism and recreational activities. Because stormwater causes many beach closings in the United States,[4] reducing these pollutants can help ensure that money from beach goers continues to bolster local economies.

Many techniques that local governments use to address stormwater can also double for recreational purposes. Natural vegetation buffers preserved along rivers and other bodies of water can provide ideal locations for hiking trails. Stormwater detention ponds can double as bird-watching hot spots. Open spaces preserved for drainage can be used for soccer fields, golf courses, and picnic spots.

WHAT CAN LOCAL GOVERNMENTS DO?

Local governments play the critical role in protecting local water bodies. They can educate and involve the public, take steps to reduce illicit discharges, place limits on runoff from construction sites and new development, and prevent stormwater pollution in municipal operations.

Public Education

Citizen behavior can have a significant impact on water quality, and it is important to increase community awareness of the relation between the storm sewer system and the health of local water bodies. When citizens understand that poor water quality can result from common activities such as washing cars or dumping oil or other household substances down storm drains, a major source of pollutants in stormwater can be voluntarily eliminated. Perhaps more important, an educated public can be a broad base of support for a stormwater management program, especially the potentially unpopular aspects such as the added cost of a stormwater utility or the enactment of ordinances.

Local governments can reduce illicit discharges, place limits on runoff from construction sites, and prevent stormwater pollution in municipal operations.

Public education to reduce stormwater pollution is limited only by the creativity of the local government. Educational themes can include proper septic system maintenance, use and disposal of landscape and garden chemicals and fertilizers, disposal of pet waste, and disposal of used motor oil and other household hazardous wastes. Signs can warn of the effects of dumping. Educational messages can be distributed through brochures, utility inserts, or newsletters. Local government staff can make presentations before community groups or schoolchildren. Innovative programs can use stream-section adoption programs. Local governments might also find it effective to target businesses—such as restaurants or automotive garages—that have a significant impact on runoff.

Involving the Public

Involving the public goes hand in hand with a local government's public education efforts and can help accomplish some of the same goals. Citizens who are involved with a stormwater program often feel a sense of ownership and are thus less likely to object to its potentially unpopular aspects—for example, the added cost of a stormwater utility and the enactment of ordinances.

Citizens can also serve as important resources in the development and implementation of a stormwater program. They may attend public hearings, serve as citizen representatives on stormwater management panels, and educate other citizens. Some citizens might have experience in water quality issues that local gov-

ernments can tap for free, and local governments will find many citizens to be willing and enthusiastic volunteers for monitoring, storm drain stenciling projects, and stream cleanups. In volunteer monitoring programs, citizens take and analyze water samples, evaluate habitats, and inventory streamside conditions and land uses that can affect water quality. Local governments can gain valuable data they do not have the time or staff to collect themselves.

Local stormwater stenciling programs recruit citizens to paint warnings against illegal dumping on storm drains. Such projects are highly visible and attract community attention to the program.

Stream cleanups are an effective use of volunteer citizen labor to remove trash from sections of streams that are designated—perhaps by volunteer monitoring projects—as polluted. Stream cleanups reinforce the connection between citizen actions and water quality and, because no experience or skill is required, they can involve a wide variety of citizens.

Eliminating Illicit Discharges

Permanent illicit connections to storm sewers—connections that often originate from businesses—allow wastewater to enter directly into storm drains and provide a continuous source of pollutants. Local governments can work toward eliminating illicit discharges to their storm system by educating citizens and businesses, updating or developing storm sewer maps, establishing local ordinances that bar the improper discharge of pollutants into the stormwater system, developing specific plans to detect and address illicit discharges, and perhaps targeting specific businesses.

> **An up-to-date storm sewer map is crucial to detecting and removing any illicit sewer connections.**

Because storm sewers in many cities are quite old, local officials might not have complete data on the size and condition of the systems. An up-to-date storm sewer map is crucial to detecting and removing any illicit connections and thereby eliminating illicit discharges. To effectively detect the discharges, local governments should develop an ordinance that grants the local government the authority to inspect the properties of people suspected of releasing contaminated discharges. The ordinance can also establish enforcement actions for entities found to be in noncompliance or that refuse to allow access to their facilities. Well-conceived plans for detecting and addressing illicit discharges include procedures for locating areas likely to have illicit discharges, tracing the source of an illicit discharge, removing the source, and evaluating and assessing the program.

Reducing Construction Runoff

During construction activity, vegetation and topsoil can be stripped away, making the area especially vulnerable to erosion and additional sediment in local water.

To reduce construction runoff, local governments can develop ordinances for control of erosion and sediment,[5] educate construction site operators about erosion and waste control practices, and inspect sites to ensure that appropriate management practices are followed. Ordinances can mandate best management practices for erosion and sediment control and, to ensure compliance, prescribe fines, bonding requirements, and/or permit denials in cases of noncompliance. Local government staff can educate construction operators about specific erosion and sediment control measures such as land grading, berms, and riprap, as well as general construction site waste management techniques such as trash disposal, recycling, proper material handling, spill prevention, and cleanup measures. In their review of construction site plans, local governments can look for potential problems, and they can perform inspections to ensure that construction site operators are complying with local ordinance provisions.

Reducing Runoff from New Development

New development can also have a significant effect on water quality because during the course of development natural landscapes are often replaced by impermeable roads, parking lots, sidewalks, and other paved surfaces that lead to increases in both the volume of stormwater runoff and the accompanying pollutants that reach local water bodies. To mitigate this, local governments can use preventive practices such as buffer zones, zoning, or requirements that new development implement specific structural best management practices (see sidebar). Buffer zones are areas along water bodies where development is restricted or prohibited; they separate water bodies from development, making it more difficult for polluted stormwater to reach the body of water. The natural terrain of the buffer zone can also absorb excess runoff and cleanse pollutants as runoff moves through it. Zoning ordinances can prevent development in sensitive areas and direct that projects that have the potential to create large amounts of discharge be shifted to areas that can better accommodate them. Local ordinances can require developers to use porous pavement or swales and can grant local governments the authority to inspect development plans and sites and enforce the ordinances.[6]

Preventing Pollution during Local Government Operations

Many opportunities for preventing stormwater pollution can be found within a local government's own operations. Altering daily operations that have the potential to contribute pollutants to stormwater and establishing schedules for cleaning and maintaining

infrastructure can have positive effects on water quality. When local governments take advantage of pollution prevention opportunities within their own operations, results are often swift because improvements do not have to rely on gradual changes in citizen behavior.

When local governments take advantage of pollution prevention opportunities within their own operations, results are often swift because improvements do not have to rely on gradual changes in citizen behavior.

Fleet maintenance, winter road management, and cleaning and maintenance of storm drains provide opportunities to reduce stormwater pollution. By training municipal fleet workers to properly handle solvents, antifreeze, brake fluid, motor oils, lubricants, and other potential water quality hazards and to prevent spills from reaching storm drains, local governments can reduce pollution. Local governments that deice roads in the winter can also train employees in the safe application and storage of road salt—properly locating and covering salt piles, avoiding oversalting of roads, and using alternative deicing materials for especially sensitive areas. Pollution can also be prevented by establishing schedules for the periodic cleaning of storm drain systems. Regular cleaning of catch basins, drain pipes, and other system components can reduce suspended sediment and oxygen-dissolving materials in stormwater as well as prolong the life of the system.

HISTORY OF STORMWATER REGULATION

Since 1972, the Clean Water Act and its amendments have prohibited the discharge of any pollutant to a water of the United States unless it has been authorized by a national pollutant discharge elimination system (NPDES) permit. The NPDES program is designed to track point sources—single identifiable sources that discharge pollutants into the environment—and require the implementation of controls necessary to minimize the discharge of pollutants.

The NPDES program initially targeted easily detected sources of water pollution such as municipal sewage and industrial process wastewater and was successful in improving water quality. However, the NPDES program was not addressing other significant sources of water quality impairment—nonpoint sources such as runoff from agricultural and forestry operations, and stormwater runoff.

Clean Water Act Amendments

As part of the Clean Water Act amendments of 1987, Congress addressed the environmental impact of stormwater by adding section 402(p), which established a comprehensive, two-phase approach to stormwater control. Phase I and phase II stormwater regulations took a new approach and began to treat stormwater discharges from municipalities as point sources of pollution. As a result, local governments covered by the phase I and II regulations must—like all point source dischargers—obtain federally enforceable NPDES permits under the Clean Water Act.

NPDES stormwater permits are issued by an NPDES permitting authority, which may be a state—if it has been authorized to run the NPDES program—or an EPA region if the state is not authorized. Once an NPDES permit is obtained, the conditions of the permit must be satisfied and periodic reports must be submitted to the NPDES permitting authority on the status and effectiveness of the local government program.

Phase I. Promulgated on November 16, 1990, the phase I stormwater regulations require large sources of stormwater discharge to apply for NPDES permits. Large sources include medium and large municipal separate storm sewer systems usually serving 100,000 people or more as well as several categories of industrial activity including construction activity disturbing five or more acres of land. The NPDES permits require cities to develop a stormwater management program, track and oversee industrial facilities that are also regulated under the NPDES stormwater program, conduct monitoring, and submit periodic reports.

An NPDES permitting authority may be a state—if it has been authorized to run the NPDES program—or an EPA region if the state is not authorized.

Phase II. Promulgated on December 8, 1999, phase II of the stormwater program expanded the scope of the NPDES program to include smaller local governments—municipal separate storm sewer systems (MS4s) serving populations of less than 100,000. The stormwater phase II final rule requires local governments that fall within the scope of the rule—primarily local governments with small MS4s in urban areas—to obtain NPDES permit coverage. These local governments must design a stormwater management program to include the development and implementation of six specified measures that reduce stormwater pollution. Evaluation and reporting measures are also required. In addition, the rule sets requirements for construction activity that disturbs between one and five acres and extends a previously set permit requirement deadline for certain municipalities that operate industrial activities regulated under phase I.

What is an MS4?

An MS4 is a **m**unicipal **s**eparate **s**torm **s**ewer **sy**stem.

According to the Code of Federal Regulations, an MS4 means a "conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

(i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law)...including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States.
(ii) Designed or used for collecting or conveying storm water;
(iii) Which is not a combined sewer; and
(iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."

Source: Storm Water Phase II Final Rule: Who's Covered? Designation and Waivers of Regulated Small MS4s, report no. EPA 833-F-00-003, fact sheet 2.1, citing 40 CFR 122.26(b)(8) (Washington, D.C.: EPA, Office of Water, January 2000), 1, www.epa.gov/npdes/pubs/fact2-1.pdf.

STORMWATER PHASE II COMPLIANCE REQUIREMENTS

The following compliance information was condensed from the EPA's *Storm Water Phase II Compliance Assistance Guide* for a general overview of the regulatory requirements of stormwater phase II as they apply to local governments.[7]

Who Is Regulated?

MS4s are conveyances owned or operated by local governments or other public bodies for collecting or transporting stormwater; they include roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, and storm drains. The stormwater phase II rule regulates only certain small MS4s—those that are located within the boundaries of urbanized areas as defined by the Census Bureau, specifically designated for regulation by the NPDES permitting authority, or physically interconnected to an MS4 that is already regulated by the NPDES stormwater program (see the sidebar on page 7).

Permit Options

Local governments that are covered by the stormwater phase II final rule are required to acquire NPDES permits. The rule is flexible, allowing local governments to choose from three permitting options: general permits, individual permits, or co-permits with a currently regulated stormwater phase I permittee. Local governments may also choose to partner with other local governments that are regulated by stormwater phase II and share general or individual permits.[8] All permit applications must be submitted to the EPA by March 10, 2003, unless the NPDES permitting authority sets other deadlines.

General permit. General permits prescribe one set of requirements for all local governments. To apply for a general permit, a local government must submit a notice of intent to the NPDES permitting authority that describes its proposed stormwater management plan, including best management practices and measurable goals. Local governments are allowed the flexibility to develop an individualized stormwater program as long as the requirements of the general permit are met.[9]

Individual permit. Individual permits set requirements that are tailored for a specific MS4. To apply for an individual permit, a permit application more comprehensive than for a general permit must be submitted to the NPDES permitting authority. After the application is received, the NPDES permitting authority drafts a permit that must be published for public comment before being finalized and issued.

Co-permit with existing phase I MS4. A local government may also participate as a limited co-permittee in a neighboring phase I MS4 stormwater management program by seeking a modification of the existing phase I individual permit. The local government would then be responsible for compliance with the permit's conditions applicable to its jurisdiction. If a local government chooses this option, it must comply with the terms of the modified phase I individual permit instead of the minimum control measures in the phase II final rule.

Permit Waivers

Local governments that fall within the scope of the stormwater phase II rule but whose discharges have an insignificant effect on water quality may be eligible for a waiver.[10] Two waivers are available: for MS4s that serve jurisdictions of up to 1,000 people, and for MS4s that serve up to 10,000 people. Specific criteria for the two waivers differ, but both seek to ensure that the MS4 does not substantially affect water quality. Although schedules may vary if a permit authority chooses to phase in permit coverage based on a comprehensive watershed plan, NPDES permitting authorities are required to make waiver determinations by December 9, 2002.

Am I regulated?

Local governments that operate small MS4s may be designated as regulated under the stormwater phase II rule in one of the following two ways:

- Automatic nationwide designation by the rule. The phase II final rule requires automatic nationwide coverage of all small MS4s that are located within the boundaries of a Bureau of the Census–delineated urbanized area; these urbanized areas contain the country's largest and most dense areas of settlement. A list of governmental entities that are located either fully or partially within an urbanized area according to the 1990 census can be found within Appendix 6 of the final rule; see www.lgean.org/documents/Appendix6.pdf. An updated list that includes data from the 2000 census is expected to be available in March 2002. Note that once an MS4 is designated as regulated because it falls within the boundaries of an urbanized area, it cannot be waived from the program later if it is no longer within the boundaries of an urbanized area in a subsequent calculation. Local governments without Internet access may call the Local Government Environmental Assistance Network toll-free at 877/TO-LGEAN for a free copy of this list.
- Potential designation by the NPDES permitting authority. The NPDES permitting authority may designate a small MS4 not within an urbanized area as regulated for two reasons:

(1) The MS4 meets specific criteria designed by the NPDES permitting authority. The phase II final rule requires NPDES permitting authorities to develop a set of criteria and use them to evaluate all small MS4s located outside an urbanized area that serve a population of at least 10,000 with a population density of at least 1,000 people per square mile. The EPA recommends that the following criteria be used by NPDES:

- Discharge to sensitive waters
- High population density
- High growth or growth potential
- Contiguity to an urbanized area
- Significant contributor of pollutants to U.S. waters
- Ineffective protection of water quality concerns by other programs.

A listing of governmental entities located outside of an urbanized area that have a population of at least 10,000 and a population density of at least 1,000 people/square mile can be found in Appendix 7 of the final rule, located on the Internet at www.lgean.org/documents/Appendix7.pdf. Local governments without Internet access may call the Local Government Environmental Assistance Network toll-free at 877/TO-LGEAN for a free copy of this list.

(2) The MS4 is physically interconnected with a regulated MS4. NPDES permitting authorities will designate any small MS4 located outside of an urbanized area that contributes substantial stormwater pollution to a physically interconnected regulated MS4. Small MS4s located near the boundary of an urbanized area should determine whether they discharge pollutants into a regulated MS4.

For more information on coverage by the stormwater phase II final rule, see, "Storm Water Phase II Final Rule: Who's Covered? Designation and Waivers of Regulated Small MS4s." report no. 833-F-00-003, fact sheet 2.1 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-1.pdf.

Requirements for a General Permit

General permits require local governments to develop and implement a stormwater management program that includes the following six minimum control measures:

- Public education and outreach
- Public participation/involvement
- Illicit discharge detection and elimination
- Construction site runoff control
- Postconstruction runoff control
- Pollution prevention/good housekeeping for municipal operations.

Local governments must determine the best management practices they will use to accomplish each measure. If the chosen best practices do not result in effective control of pollutants, the NPDES permitting authority may require changes.

Local governments also must determine measurable goals for each minimum control measure and provide a timetable in their NPDES permit application of actions toward these goals.

Local governments have the option of fulfilling their obligations by relying on other entities that are already performing minimum control measures. For example, if a county already has an illicit discharge detection and elimination program, a local government within the county may rely on the county program instead of developing a new program. Although the local government itself would not be carrying out this program, the EPA would hold it responsible.

Public education and outreach on stormwater impacts. To satisfy this minimum control measure, local governments must implement a public education pro-

Important compliance dates for stormwater phase II program

Activity	Deadline
EPA issues guidance on measurable goals for small MS4 programs	October 2001
NPDES permitting authority determines designation of small MS4s located outside of an urbanized area that serve a jurisdiction with a population of 10,000 and population density of 1,000 per square mile	December 9, 2002; or December 8, 2004, if designation involves comprehensive watershed plan
NPDES permitting authority determines waivers for regulated small MS4s in urbanized areas	December 9, 2002
NPDES permitting authority issues general permits for regulated small MS4s and small construction activity	December 9, 2002
Operators of regulated small MS4s and small construction activity designated by the rule must obtain permit coverage	March 10, 2003
Operators of regulated small MS4s and small construction activity designated by NPDES permitting authority must obtain permit coverage	Within 180 days of notice
The NPDES permitting authority may phase in coverage for small MS4s serving jurisdictions with a populations less than 10,000 on a schedule consistent with a state watershed permitting approach	Completion of phase-in by March 8, 2007
The regulated small MS4s must fully implement their stormwater management programs	By the end of the first permit term—typically a 5-year period
Reevaluation of the phase II small MS4 regulations by EPA	December 2012
NPDES permitting authority determination on a petition for designation of a nonregulated stormwater discharger	Within 180 days of receipt

Source: For a more detailed chart, see *Storm Water Phase II Compliance Assistance Guide*, report no. 833-R-00-002 (Washington, D.C.: EPA, Office of Water, March 2000), 13, www.epa.gov/hpdes/pubs/comguide.pdf.

gram. They can distribute educational materials to the community or conduct equivalent outreach activities about the impact of stormwater discharges and reducing stormwater pollution.[11]

Sample Measurable Goals for a Public Education Program

Year No.	Activity
1	Develop brochures and distribute in water utility bills; create a stormwater hotline; train volunteer educators
2	Create a Web site for school curricula; stencil storm drains
3	Be able to certify that a specific percentage of restaurants no longer dump grease and other pollutants down storm sewer drains
4	Be able to certify that litter or animal waste detected in discharges has been reduced by a specified percentage

Public participation and involvement. Local governments need to comply with all applicable state, tribal, and local public notice requirements. Local governments are also encouraged to include all economic and ethnic groups in developing, implementing, and reviewing their stormwater management programs.[12]

Sample Measurable Goals for Public Participation and Involvement

Year No.	Activity
1	Organize and advertise a public meeting in several different print media and bilingual flyers; establish a citizen panel; organize volunteers to locate outfalls/illicit discharges and to stencil drains
2	Review final recommendations of citizen panel; create radio spots promoting program and participation
3	Be able to certify that a specific percentage of the community is participating in community cleanups
4	Establish citizen watch groups in a specific percentage of neighborhoods; complete outreach to every population sector

Illicit discharge detection and elimination. Local governments are required to develop and implement an illicit discharge detection and elimination program that includes:[13]

- A storm sewer system map, showing the location of all outfalls within the jurisdiction and the names and locations of all waters of the United States that receive discharges from those outfalls

- An ordinance or other regulatory mechanism prohibiting nonstormwater discharges into the MS4, and appropriate enforcement procedures and actions
- A plan to detect and address nonstormwater discharges, including illegal dumping, into the MS4
- Education of public employees, businesses, and the general public about the hazards associated with illegal discharges and improper disposal of waste.

Sample Measurable Goals for Illicit Discharge Detection and Elimination

Year No.	Activity
1	Complete a map of the sewer system; establish a recycling program for household hazardous waste
2	Approve an ordinance that prohibits nonstormwater discharges into the MS4; train public employees; identify and rectify a certain percentage of sources of illicit discharges
3	Detect a certain percentage of illicit discharges; eliminate a percentage of illicit discharges; ensure that a certain number of households participate in special collection days for household hazardous waste
4	Certify that most illicit discharge sources have been detected and eliminated

Construction site stormwater runoff control. To satisfy this minimum control measure, local governments are required to:

- Have an ordinance or other regulatory mechanism requiring contractors at applicable construction sites to implement proper erosion and sediment controls as well as control for other wastes
- Review construction plans for potential water quality impacts
- Institute procedures for site inspection and enforcement of control measures
- Establish in the ordinance or other regulatory mechanism sanctions to ensure compliance
- Establish procedures for the receipt and consideration of information submitted by the public.[14]

Sample Measurable Goals for Construction Site Stormwater Runoff Control

Year No.	Activity
1	Approve an ordinance or other regulatory mechanism; institute procedures for acting on information submitted by the public
2	Implement procedures for site inspections; establish a certain percentage rate of compliance to be achieved by construction operators
3	Arrive at maximum compliance with ordinance; document improved clarity and reduced sedimentation of local water bodies
4	Document increased numbers of sensitive aquatic organisms in local water bodies

Postconstruction stormwater management in new development/redevelopment. For this requirement, local governments must:

- Develop and implement strategies that include a combination of structural and/or nonstructural best management practices (see sidebar on page 2)
- Enact an ordinance or establish another regulatory mechanism requiring the implementation of postconstruction runoff controls to the extent allowable under state, tribal, or local law
- Ensure adequate long-term operation and maintenance of controls.[15]

Sample Measurable Goals for Postconstruction Stormwater Management

Year No.	Activity
1	Develop strategies for making use of structural and/or nonstructural best management practices
2	Enact an ordinance or regulation to codify first-year strategies
3	Oversee new development projects so that they make use of fewer impervious surfaces
4	Measure and document improved clarity and reduced sedimentation in local water bodies

Pollution prevention/good housekeeping for municipal operations. This measure requires local governments to examine and alter their own actions to help reduce the amount and type of pollution that (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm sewer systems. To satisfy this minimum control measure, local governments are required to:

- Develop and implement an operation and maintenance program with the goal of preventing pollutant runoff from municipal operations or reducing the amount of pollutants that reach the storm sewer system
- Train employees to incorporate pollution prevention/good housekeeping techniques into municipal operations such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance.[16]

Sample Measurable Goals for Pollution Prevention and Good Housekeeping Best Practices

Year No.	Activity
1	Complete a pollution prevention plan (with new best management practices and revised procedures); assemble or develop employee training materials; clean catch basins after each storm; sweep streets regularly
2	Train appropriate employees; implement recycling program
3	Incorporate some pollution prevention measures into master plan; reduce use of pesticide and sand/salt by a specified percentage; establish maintenance schedule for best management practices
4	Reduce floatables discharged by a specified percentage; comply at a stated rate with recommended maintenance schedules; establish controls for all areas of concern

Program Requirements: Evaluation, Assessment, and Reporting

After a permit is acquired, local governments are required to perform certain evaluation, assessment, reporting, and record-keeping tasks.[17] Reports must be submitted annually during the first permit term—typically a five-year period. For subsequent permit terms, reports must be submitted in years two and four only, unless the NPDES permitting authority requests more frequent reports. Records required by the NPDES permitting authority must be kept for at least three years and be made accessible to the public, but records need not be submitted to the NPDES permitting authority unless the local government is requested to do so.
The reports must include:

- The status of compliance with permit conditions, including an assessment of the selected best management practices and progress toward the measurable goals
- Results of any information collected and analyzed, including monitoring data, if any
- Summary of stormwater activities planned for the next reporting cycle
- Change in any best management practices or measurable goals
- Notice (if applicable) of reliance on another governmental entity to satisfy some permit obligations.

WHERE CAN LOCAL GOVERNMENTS GET HELP?

Some local governments may find it challenging to implement the stormwater phase II final rule because they lack financial resources, technical resources, or both. Maintaining the staff, equipment, and materials to develop and implement stormwater programs requires funds, and implementing effective stormwater best management practices requires technical expertise and experience that not all local governments have. Local governments seeking information on technical and financial options can take advantage of a variety of resources.

Financial Resources and Assistance

Finding the resources to support a stormwater management program is a critical and sometimes challenging step. Funding is needed for additional staff and educational materials, and local governments may need to be creative to gather the necessary funding.

Although many local governments fund aspects of their stormwater program through their general fund, this can be difficult because other important—and politically more popular—projects and programs compete for funding. In addition, financing programs through the general fund means that stormwater programs may be threatened at each new budget cycle. Local governments can receive grants or loans from federal sources, but these funds are limited and stormwater programs will face competition from other projects. In addition, federal funds often support only costs to develop a specific best management practice or project and will not provide the continuous funding needed for implementation. Local governments therefore should develop alternative funding.

Clean Water State Revolving Fund (CWSRF). Under the CWSRF, the EPA provides grants to states, which can then make loans for high-priority water-quality activities to local governments and others. The CWSRF program funds projects for publicly owned wastewater treatment facilities as well as a variety of nonpoint source and estuary management projects. For more information, see www.epa.gov/OWM/finan.htm.

Section 319 nonpoint source implementation grants. Clean Water Act section 319(h) funds are provided to state agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs. Section 319(h) funding decisions are made by the states. For more information, local governments should contact their state nonpoint source coordinator; a list can be found at www.epa.gov/owow/nps/319hfunds.html.

> **Stormwater management programs that are funded through the general fund may be threatened at each new budget cycle. Local governments therefore should develop alternative funding.**

Other grant and loan sources. States and regions offer various types of financial assistance. For information, contact the state or regional stormwater official; a list of federal, regional, and state-specific stormwater officials can be found on the LGEAN Web site at www.lgean.org/documents/stormwatercontacts.pdf. Other Internet resources with funding information that may be useful in implementing the stormwater phase II final rule include:

An Internet Guide to Financing Stormwater Management. Developed by the Center for Urban Policy and the Environment at Indiana University-Purdue University Indianapolis in cooperation with the Watershed Management Institute, Inc., this guide seeks to help communities find ways to pay for stormwater management projects. It includes an annotated bibliography of existing stormwater finance materials, archives that contain previously published materials about stormwater finance, a manual that discusses the financing options available to communities, and a set of seven case studies of successful finance mechanisms across the country. See http://stormwaterfinance.urbancenter.iupui.edu/.

Financial Assistance Web page of EPA Office of Wastewater Management. This Web page provides funding information on a variety of wastewater-related issues. See www.epa.gov/owm/finan.htm.

A State and Local Government Guide to Environmental Program Funding Alternatives. With a special emphasis on nonpoint projects, this EPA guide provides an overview of traditional funding mechanisms and introduces state and local governments to innovative alternatives. See www.epa.gov/owow/nps/MMGI/funding.html.

How to Create a Stormwater Utility. Created by the towns of Chicopee and South Hadley, Massachusetts, this guide describes how local governments can address legal issues, community outreach and public development, management, assessment, and rate setting. See www.pvpc.org/library/docs/environment/stormwater/storm_util.pdf.

Catalog of Federal Funding Sources for Watershed Protection. This EPA catalog provides a comprehensive summary of federal grant and loan programs that can be used at the local level to support watershed projects. The catalog also contains references to other publications and Web sites on funding assistance. See www.epa.gov/owow/watershed/wacademy/fund.html.

A Guidebook of Financial Tools. This guidebook presents information on approximately 340 financial aids that can assist local governments in funding environmental programs and activities. See www.epa.gov/efinpage/guidbk98/index.htm.

Establishing a Stormwater Utility in Florida. Produced by the Florida Association of Stormwater Utilities, this Internet guide is designed to assist communities that are considering a stormwater utility to provide funding for their stormwater management program. See

Funding strategies

Debt financing. Local governments can issue revenue bonds to finance capital-intensive stormwater management programs and facilities. Alternatively, a general obligation bond can be issued that is backed by the full faith and credit of a municipality (based on ability to generate revenues though taxes and other fees).

Grants and loans. Federal, state, or regional grant or loan funds might be available for some elements of the stormwater program, depending on the best management practices selected and the location. Grants and loans usually apply to specific projects and not ongoing activities such as operation and maintenance.

Users/utility fees. Utility fees for providing stormwater management services are charged at flat rates or variable rates based on classes of customers; they represent a dedicated source of funding and an ongoing method of funding some or all stormwater management programs.

Special assessment. Properties can be assessed annually to fund stormwater management programs. Special assessments often are used to fund a special district or authority that can implement all or portions of a region's stormwater management program.

Local improvement. Individual properties that benefit from stormwater projects are assessed to fund the project. Some states require special enabling legislation to establish this type of special-benefits district.

General fund. General fund monies are used for many stormwater programs, but the programs are at risk in each budget cycle. To increase funding for the stormwater program, other government services may be affected or a general tax increase may be required.

Inspection fees. Plan review and inspection fees allow the community to recover some or all of the direct costs associated with design reviews for preconstruction and postconstruction best management practices.

Developer fees. Developers construct needed facilities as a condition of development, and they bear associated costs.

Alternative fees. Instead of constructing on-site facilities to meet development requirements, developers may be given the option of paying a comparable fee to be used by the local government to build regional facilities that are designed to meet the same objectives as the developer-constructed on-site mitigation.

Connection fees. This is a one-time charge assessed at the time of development to recover a proportionate share of the cost of existing and planned facilities. The applicability depends upon legislation in each state.

Source: For a more detailed discussion, see *Storm Water Phase II Compliance Assistance Guide,* report no. 833-R-00-002 (Washington, D.C.: EPA, Office of Water, March 2000), 59, www.epa.gov/hpdes/pubs/comguide.pdf.

www.fasu.org/publications/manual/sitemap.html.

Texas Nonpoint SourceBOOK. This Web site advises on best management practices, planning stormwater management programs, and funding. Although designed for Texas, the Web site contains information that can be valuable to public works professionals throughout the United States. The sourcebook was developed through funding from the EPA, the American Public Works Association, and various Texas municipalities. See www.txnpsbook.org/default.htm.

Technical Resources and Assistance

Local governments that want to develop an effective stormwater management program need a certain amount of technical expertise. A variety of best management practices exists, but without experience in their proper use—or without knowledge of their existence—local governments may find it difficult to develop an efficient and effective program. Local governments with little experience in stormwater management will find case studies, guides, and Web sites valuable to their water protection efforts.

Also, complying with the stormwater phase II final rule requires knowledge of the rule's specific requirements. Without this information, local governments may find themselves in a state of noncompliance—perhaps without realizing it. The following section provides information on sources of stormwater technical assistance, compliance assistance contacts, and helpful Internet resources.

Local Government Environmental Assistance Network (LGEAN). LGEAN is a clearinghouse of environmental information for local government officials and their staffs; it provides information on stormwater as well as a variety of other environmental topics. LGEAN's services include a Web site, toll-free phone number, and free electronic newsletter (see the sidebar for more information). See www.lgean.org.

Federal, regional, and state contacts. Contacts at the proper federal, regional, and state environmental agency are excellent sources of compliance information; a list of federal, regional, and state-specific stormwater officials can be found on the LGEAN Web site at www.lgean.org/documents/stormwatercontacts.pdf.

Web site of EPA Phase II NPDES Storm Water Program. This EPA site is a comprehensive source of information on stormwater phase II. See http://cfpub1.epa.gov/npdes/stormwater/swphase2.cfm?program_id=6.

Storm Water Phase II Compliance Assistance Guide. This comprehensive guide describes clearly the requirements of the stormwater phase II final rule. See www.epa.gov/npdes/pubs/comguide.pdf.

Stormwater Manager's Resource Center. Created and maintained by the Center for Watershed Protection, the Stormwater Manager's Resource Center is designed specifically for stormwater practitioners, local government officials, and others who need technical assistance on stormwater management issues. See www.stormwatercenter.net/.

National Menu of Best Management Practices for NPDES Storm Water Phase II. Produced by the EPA, this document provides guidance to regulated small MS4s on the types of practices they could use to develop and implement their stormwater management programs. See www.epa.gov/npdes/menuofbmps/menu.htm.

> **Local governments may find themselves in a state of noncompliance with the stormwater phase II final rule—perhaps without realizing it.**

Model ordinances to protect local resources. This EPA site offers both model and real-life examples of ordinances that address aquatic buffers, erosion and sediment control, open space development, stormwater control operation and maintenance, illicit discharges, and postconstruction runoff control. See www.epa.gov/owow/nps/ordinance/.

Stormwater Strategies: Community Responses to Runoff Pollution. In this report, the Natural Resources Defense Council highlights effective and efficient watershed and municipal examples of nonpoint source and stormwater control programs and activities. Local governments can use these as models. See www.nrdc.org/water/pollution/storm/stoinx.asp.

National Stormwater Best Management Practices Database. Designed by the American Society of Civil Engineers and the EPA, this database allows water quality professionals to apply proven management practices to local water quality projects. The database is available on the Internet at www.bmpdatabase.org/index.html.

STORMWATER MANAGEMENT CASE STUDIES

The following four case studies provide information on local government stormwater reduction strategies. The first three—Boulder, Colorado; Kootenai County, Idaho; and Murray City, Utah—describe the experiences of local governments that have completed successful stormwater projects.[18] Boulder, Colorado, provides an example of an innovative stormwater education program. Murray City, Utah, is an example of collaboration between a municipality and a state department of transportation that has resulted in a mutually beneficial and popular stormwater project. Kootenai County, Idaho, demonstrates how stormwater can be managed with a well-enforced site disturbance

ordinance. The final case study—Lenexa, Kansas—describes a current comprehensive stormwater reduction strategy.[19]

Boulder, Colorado: Stormwater Education Program

Population: 95,000

"This creek is in your care." Boulder residents and visitors see these words every time they travel on a major road that crosses Boulder Creek or one of its tributaries. This waterway signage is one of several strategies used by the Boulder public works department's stormwater education program that, in 1992, received the administrator's award for pollution prevention from the EPA and, in 1997, received the outstanding project award from the Colorado Association of Stormwater and Floodplain Managers.

Boulder Creek originates in the Rocky Mountains and flows through the center of Boulder. The Boulder Creek watershed is under extreme pressure from mining operations, wastewater treatment, agricultural runoff, and urban stormwater runoff, a situation that has caused elevated water temperatures, high pH, and increased concentrations of un-ionized ammonia and nutrients. This condition has contributed to low species diversity and density. Stormwater is a major concern because all city drains connect to Boulder Creek or its tributaries.

The stormwater quality education program is part of the city's effort to meet federal, state, and community-based water quality standards. Education complements other city programs such as the Stormwater and Flood Management Utility, the Comprehensive Drainage Utility Master Plan, the Stormwater Quality Program, and the Boulder Creek Enhancement Project. Through these efforts, the city is beginning to see improvements in the quality of Boulder Creek, including reductions in sedimentation, garbage, rubble, and petroleum products. The city notes reductions in improper disposal of household hazardous waste and an increased awareness of pollution prevention activities.

Boulder began its stormwater education campaign in 1989, expanded the program in 1991 by establishing a stormwater quality educator position, and expanded still farther in 1996 by including the entire 440-acre watershed. The education campaign now reaches more than 3.1 million people each year through programs such as WatershED, STREAMTEAM, the Boulder Creek Public Library display, the Boulder Creek Path, and the Boulder Creek Watershed Forum.

Through the flagship program, WatershED, students adopt a nearby section of creek to clean up and monitor. They participate in a variety of classroom and outdoor stormwater-related activities, including the classroom aquarium project in which students raise and release native tiger salamanders to local streams. To date, 16 Boulder schools (K–12) use the WatershED curriculum, which every semester reaches approximately 600 students and their parents because the curriculum includes take-home family activities.

Another program, STREAMTEAM, is oriented toward neighborhoods, youth groups, and small businesses. It provides neighborhood workshops, trash pickup, aquatic insect surveys, stream monitoring, storm drain stenciling, and directions for reporting spills and other problems. Participating groups include two neighborhood organizations, the Boulder Creek Watershed Initiative, the Colorado Youth Program, and a local chapter of Trout Unlimited.

Much of the public learns about the stormwater education program from the aquarium display in the Boulder library and while walking on the Boulder Creek Path. The aquarium is a three-tiered, 420-gallon cold-water aquarium and a 225-gallon warm-water

LGEAN—A helpful stormwater resource

The Local Government Environmental Assistance Network (LGEAN) is a free source of information for local governments on the subjects of stormwater and other environmental topics. With resource professionals on hand to assist with situation-specific environmental questions, LGEAN can be a valuable guide in dealing with the complexities of federal and state regulations as well as the daily challenges of protecting the environment and public health.

Managed by the International City/County Management Association (ICMA), LGEAN is an information clearinghouse that provides clear, concise, and relevant environmental management, planning, and regulatory information for local government officials and their staff. Through an Internet Web site (http://lgean.org), a toll-free telephone number (877/TO-LGEAN), and a biweekly free electronic newsletter, LGEAN provides information on the environmental issues that impact local governments.

LGEAN can provide local governments with plain-English answers to specific compliance-related stormwater questions and can direct local officials to the appropriate regulatory authority. LGEAN is also a source of stormwater funding information, providing local government officials with information on grants, loans, and other funding options that may be suitable for the situation. Finally, LGEAN can assist local government officials with general stormwater management strategies by providing helpful publications or Web sites or simply contact information for other local governments that have successfully dealt with similar issues.

Launched in the fall of 1998, LGEAN is formed from a partnership of the American Water Works Association, Air & Waste Management Association, Environmental Council of the States, ICMA, National Association of Counties, Public Entity Risk Institute, Solid Waste Association of North America, U.S. Environmental Protection Agency, and the Water Environment Federation.

tank installed in the main branch of the Boulder public library in 1992. The aquarium display is used as a forum to present environmental information, including potential impacts of urban runoff. Between 3,000 and 4,000 people visit the library each day.

The Boulder Creek Path, an interpretive walk that is one of the most popular amenities in Boulder, attracts nearly 2 million visits each year. To take advantage of the path's popularity, in 1993 the city created an interpretive creek walk that uses signage to display information about the creek and the environment. In 1994, the city developed a trail guide for use with the walk, which helps raise awareness of the creek as an important resource.

In addition, residents can attend the Boulder Creek Watershed Forum where area experts discuss Boulder Creek watershed issues. Attendance at these lectures at the public library averages between 75 and 100 people; the largest attendance was more than 500. A local television channel has videotaped these lectures and plans to produce a series of 30-minute segments. The program also hosts a children's water festival, attended by over 1,000 fifth graders in 1998; sets up an information booth at the Boulder Creek Festival; and organizes a storm drain stenciling program that is in its seventh year. So far, 300 storm drains have been stenciled.

Denver Urban Resources Partnership provided funding for WatershED, which received $9,500 in 1996 and $9,000 in 1997. Funding for the other programs comes out of the education budget of Boulder's stormwater quality office. This budget receives half its support from the city's general account and half from Boulder's stormwater and flood management utility. Utility fees are charged to all owners of developed city property on the basis of the anticipated use of stormwater and flood drainage facilities. In addition, a developer fee is charged to all newly developed properties.

The stormwater education program, combined with the city's other stormwater management programs, has resulted in benefits to the ecology and the local community. While the public works department is still evaluating the education program's success, there is anecdotal evidence of its effectiveness. Annual telephone surveys reveal that Boulder citizens are increasingly aware of stormwater issues and the city's stormwater management system. As part of the public works department's involvement with the fifth-grade science curriculum, students who are given both pretests and posttests of their basic knowledge about stormwater show considerable improvement in their awareness. Program Director Donna Scott feels that this gain in knowledge is largely due to the program's experiential approach.

Kootenai County, Idaho: Regulation of Construction Projects

Population: 108,500

Kootenai County has nearly doubled its population in the past 20 years. The county's scenic beauty and natural resources make it an attractive place to live and a popular recreation destination. However, residents have grown concerned about the impact of rapid growth on the county's water resources.

After the county identified construction sites as a threat to the region's water resources, it adopted a site disturbance ordinance in 1997 to address grading, erosion control, and stormwater management. To implement the ordinance, the county designed a program to assess the project's potential to affect water quality and adjacent properties, and to prevent adverse effects.

The program has two key components: a risk assessment and a site disturbance plan. Permits are required for all sites except for minor projects regulated by other agencies that meet exemptions. As part of the permit process and according to details about the site and activities proposed for it, the county conducts a risk assessment and rates the site as high, moderate, or low risk for potential problems, including adverse effects on water quality. A site inspection is often required. The level of risk in turn determines the detail and complexity of the site disturbance plan.

Site disturbance plans outline specific actions to be taken at a site. Plans for high-risk sites as well as all commercial and industrial developments, installations of subdivision infrastructure, and large excavation projects involving more than 5,000 cubic yards of material or disturbing more than two acres of land must be prepared by a design professional. For moderate-risk properties, a report prepared by a person knowledgeable about the site and erosion control is sufficient. Low-risk sites and sites located on the extremely flat land overlying the Rathdrum Prairie aquifer that extends from the Idaho panhandle into eastern Washington that are not within 500 feet of a lake or other surface body of water are exempt from site disturbance plans.

The 1997 site disturbance ordinance includes additional site requirements that protect water resources, prevent erosion, and control stormwater runoff. The county established protection zones around streams and natural drainages—zones that vary in width from 10 to 150 feet, depending on their class. Lots with frontage along designated lakes and rivers are considered waterfront lots and require maintenance of a 25-foot-wide natural buffer above the high-water mark. Erosion- and sediment-control best management practices are required for all sites and must be installed as indicated in the plan before the site is disturbed. Ordinance requirements include treatment for stormwater that runs off all impervious surfaces; the ability to convey runoff from a 50-year storm without causing damage to other properties or infrastructure; no increase in the peak rate of runoff from the site for a 25-year storm; and no net increase in pollutant export at sites with existing site improvements, where stormwater treatment has not been previously required. The site owner or managing entity is responsible for maintaining site disturbance plans in perpetuity.

Kootenai County has legal authority to stop work

at a site. If a violation continues, the person or company involved can be charged with a criminal misdemeanor and fined or sued. To enforce the ordinance, the county inspects a site at least twice during a project's lifetime. The ordinance also has a financial guarantee; contractors and designers are bonded to one-and-one-half times the costs of implementing the erosion prevention and stormwater management plan.

Kootenai County issued approximately 1,000 site disturbance permits in 2000. County personnel typically issue approximately 20 to 40 stop-work orders to sites found to be out of compliance with the ordinance.

Rand Wichman of the Kootenai County planning department believes the program is helping to increase compliance. He remembers when it was common to find people working directly in streams, and a contractor once completely lost a 30-foot culvert to slope failure. Wichman cites a change in the program's administration as a major factor in improving the program's effectiveness. Since the spring of 1998, the program has been administered jointly by the planning department and the building department. Wichman feels that, although differences in mission, philosophy, and enthusiasm exist between the two departments, having more eyes in the field will continue to increase compliance.

Improving stormwater management and preventing erosion at construction sites are not without challenges. Because diverse land-use activities fall under the ordinance—from subdivision developments to recreational bulldozing on private lands—inspectors and program administrators are not always able to find adequate solutions to problems at unique sites. Political sensitivity is a frequent barrier: some developers and contractors, arguing that the ordinance restricts desirable growth, still look for ways around the reforms.

Public support for the program is strong and growing, mainly because of a recognition of the health and economic benefits associated with cleaner water. Because lakes are a major recreational attraction, keeping water quality high and ecological health good is important. The Kootenai Environmental Alliance and other citizens are positive about the program, feeling that enforcement remains strong and that the program has been effective at preventing erosion and stormwater runoff problems.

Murray City, Utah: Golf Course–Interstate Highway Combination Project

Population: 34,000

Murray City mayor and former recreation director Lynn Pett began planning for a municipal golf course in 1973 at the same time that the Utah Department of Transportation (UDOT) was planning a new stretch of the I-215 beltway in southwestern Salt Lake County. Looking for dirt to add contours to the flat farmland and improve the golf course, the city struck a deal with UDOT for the golf course to receive 550,000 cubic yards of freeway dirt at no cost. In return, UDOT could use the golf course to control stormwater runoff from 4.5 miles of I-215. The project saved Murray City approximately $1 million in construction costs and UDOT $300,000 in land acquisition and stormwater piping costs.

This stormwater control system consists of a series of constructed settling ponds and wetlands integrated into the golf course. Highway runoff and subsurface waters are conveyed to a distilling basin, which removes most of the associated salt, sediment, oil, grease, dissolved metals, and trash. Water is then circulated through streams and wetlands to four additional ponds for further treatment. The city reports approximately 90 percent removal of oil, grease, and dissolved metals from runoff. The ponds and wetlands double as water hazards and enhance the beauty of the golf course while they provide wildlife habitat. The distilling basin is dredged every two or three years. The golf course uses clean dredge spoils as fill; contaminated spoils are disposed of as required by the EPA.

Water collected in the ponds is used to irrigate the 135-acre golf course, saving Murray City approximately $100,000 annually. In addition, the project provided 7 acres of flood retention and created nearly 11 acres of wetlands. The system has successfully handled runoff from several 25-year storms.

Mayor Pett has been pleased with the outcome of the project, telling the *Salt Lake Tribune* that "the golf course has done more for the quality of life in the entire west side of our city than any one thing we could have done." The city has also observed an increase in property values around the golf course.

The stormwater control–golf course project is a critical piece of a larger effort to restore Utah's Jordan River—which is surrounded by an urban population—and create a recreational greenway system, the Jordan Parkway. In addition to preventing pollutants from entering the river, the success of the golf course has helped fund other projects and land acquisition. The golf course is the busiest in the state and takes in over $1.7 million annually. This revenue has enabled the city to issue bonds for the purchase of 150 acres along the Jordan River and to leverage state and federal matching grants to preserve this system.

The Jordan Parkway project is improving the Jordan River as an urban recreational river system and community asset. The goal of the project is to reestablish the predevelopment structural, functional, and visual characteristics of the river system. Projects such as the golf course are helping improve water quality and allow a quality trout fishery to develop. Wildlife biologists note that, since the 1970s, water quality has improved. The parkway system consists of wildlife habitat area, riparian buffers, trails for walking and horseback riding, and wildflower gardens, as well as limited traditional park development. The system is also being used as an outdoor classroom, and the city has plans to build a community education center.

Lenexa, Kansas: Comprehensive Approach to Stormwater Management

Population: 40,200

The city of Lenexa has developed a proactive, integrated, watershed-based approach to stormwater management. Through the implementation of new policies and practices, the city seeks to reduce flooding, conserve water quality and wildlife habitat, and provide new recreational opportunities while accommodating new development.

This program resulted from the city's long-range planning process, Vision 2020, which was completed in 1998. The Vision 2020 plan seeks to "maintain a balance between our natural and manmade environments…by preserving key natural features while promoting quality growth and development."

Several factors stimulated Lenexa's new watershed management initiative. First, being proactive in preventing problems will save money for Lenexa citizens in the long run. The city evaluated the cost over a 15-year period for three alternatives and found that the new approach is about 25 percent less expensive than the conventional, reactive approach to stormwater management. Second, the program will provide improved water quality, flood reduction, environmental preservation, wildlife habitat preservation, and new opportunities for recreation, including new lakes, ball fields, and open spaces. And finally, by establishing a quality stormwater management program, the city will exceed the new NPDES phase II permit requirements.

The watershed and stormwater management program will use a mix of innovative policies, incentives, regulations, and investments to encourage a more environmentally sound approach to development.

The city will build a series of regional stormwater detention facilities while it conserves stream corridors and other natural assets. In addition, Lenexa will provide technical assistance and financial incentives to developers to use more environmentally sensitive site designs and conduct broad-based educational programs to build awareness and support for the program. New policies and regulations will address erosion and sediment control, stream setbacks, stormwater drainage requirements, and other issues found at the intersection of watershed, land-use, and transportation planning.

Lenexa is translating citizen support into on-the-ground projects that meet local needs. For example, the creation of regional stormwater detention and retention facilities also will provide many active and passive recreational uses, from bird watching and picnics to soccer. The conservation or restoration of streamways will facilitate the expansion of the greenway trail system. Subdivision designs may conserve natural spaces and encourage walking and biking. Road right-of-way projects may use native perennial grasses for landscaping to decrease runoff and improve aesthetics, water quality, and community identity.

A diversified funding strategy underlies this program. In addition to funds conventionally derived from the local property tax, officials are planning for three new funding sources that will support this initiative: a new stormwater utility, a 1/8-cent sales tax, and a capital development charge for new development that also will serve as an incentive program: developers will be rebated a portion of their development charge in exchange for adoption of innovative site design practices that protect water quality.

Several accomplishments have been achieved in the early stages of the program. The funding package underlying the program is nearly complete. A new watershed and stormwater management master plan was completed in April 2001. In May 2001, the governing body approved eight new watershed management principles consistent with program goals. In June 2001, the city's new land disturbance ordinance was adopted. This regulation supports the city's new Erosion and Sediment Control Program. Staff anticipate that a new stream setback ordinance will be presented to the governing body for adoption by October 2001.

Many projects are in the design or construction process. More than $10 million in funds have been spent in recent years to solve flooding problems in the developed portion of the community. Further, three regional detention/retention facilities are in the preliminary design phase. Each project is being formulated in collaboration with community partners. In addition, several innovative stream restoration projects are in the design phase, including wetland construction, preservation of stream banks with natural vegetation instead of concrete or riprap, and urban forestry.

This broad program has received strong community support that derives in large measure from the community partnerships used to formulate this initiative. In a local survey, more than 70 percent of residents indicated that water quality and environmental quality were either extremely or somewhat important to them; and, in August 2001, voters by a margin of 3 to 1 approved the new 1/8-cent sales tax to support the program.

One measure of program success over the long term will be the extent to which watershed program objectives are incorporated into the plans and projects of other departments. Ongoing interdepartmental collaboration has been strong among city staff, including the departments of public works, planning and development, parks and recreation, and legal affairs. Given the many city functions that affect water quality, such cooperation is imperative in order to meet project goals.

A 15-year financial plan estimates total program costs will be approximately $78 million, which is estimated to be 25 percent less than the cost of conventional approaches to stormwater management. These costs will include land acquisition, design and construction of regional stormwater detention/retention facilities, stream restoration initiatives, and maintenance of existing storm sewer infrastructure. Costs for specific regional facilities may vary from $250,000 to $10,000,000, depending on real estate, environmental, geotechnical, and engineering issues.

NOTES

1 See www.epa.gov/OWOW/estuaries/coastlines/coastlines6.3/monicbay.html.

2 T. R. Schueler, "Impact of Suspended and Deposited Sediment," *Watershed Protection Techniques* 2, no. 3 (February 1997): 443.

3 *National Water Quality Inventory, 305(b) Report to Congress 1996/1998*, report no. 841-R-97-008 (Washington, D.C.: EPA, Office of Water, 1998), www.epa.gov/ow/resources/9698/chap6.html.

4 See www.epa.gov/ost/beaches/faq.html.

5 Model erosion and sediment control ordinances can be found on the EPA Web site at www.epa.gov/owow/nps/ordinance/erosion.htm.

6 Model postconstruction runoff control ordinances can be found on the EPA Web site at www.epa.gov/owow/nps/ordinance/postcons.htm.

7 *Stormwater Phase II Compliance Assistance Guide*, report no. EPA 833-R-00-002 (Washington, D.C.: EPA, March 2000), www.epa.gov/npdes/pubs/comguide.pdf.

8 See "Stormwater Phase II Final Rule: Permitting and Reporting, The Process and Requirements," report no. EPA 833-F-011, fact sheet 2.9 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-9.pdf.

9 The EPA provides a model general permit on the Internet at www.epa.gov/npdes/pubs/ms4_genpermit_102500_draft.pdf.

10 See "Stormwater Phase II Final Rule: Who's Covered? Designation and Waivers of Regulated Small MS4s," report no. EPA 833-F-00-003, fact sheet 2.1 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-1.pdf.

11 See "Stormwater Phase II Final Rule: Public Education and Outreach Minimum Control Measure," report no. EPA 833 F-00-005, fact sheet 2.3 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-3.pdf.

12 See "Stormwater Phase II Final Rule: Public Participation/Involvement Minimum Control Measures," report no. EPA 833 F-00-006, fact sheet 2.4 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-4.pdf.

13 See "Stormwater Phase II Final Rule: Illicit Discharge Detection and Elimination Minimum Control Measure," report no. EPA 833 F-00-007, Fact Sheet 2.5 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-5.pdf.

14 See "Stormwater Phase II Final Rule: Construction Site Runoff Control Minimum Control Measure," report no. EPA 833 F-00-008, fact sheet 2.6 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-6.pdf.

15 See "Stormwater Phase II Final Rule: Post-Construction Runoff Control Minimum Control Measure," report no. EPA 833 F-00-009, fact sheet 2.7 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-7.pdf.

16 See "Stormwater Phase II Final Rule: Pollution Prevention/Good Housekeeping Minimum Control Measure," report no. EPA 833 F-00-010, fact sheet 2.8 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-8.pdf.

17 See "Stormwater Phase II Final Rule: Permitting and Reporting: The Process and Requirements," report no. EPA 833-F-011, fact sheet 2.9 (Washington, D.C.: EPA, Office of Water, January 2000), www.epa.gov/npdes/pubs/fact2-9.pdf.

18 *Stormwater Strategies: Community Responses to Runoff Pollution* (New York: Natural Resources Defense Council, 1999), ch. 8, 9, www.nrdc.org/water/pollution/storm/stoinx.asp.

19 Tom Jacobs, "Turning Rain into Recreation: A New Approach to Stormwater Management in Lenexa, Kansas" (2001).

ADDITIONAL ICMA RESOURCES

Introduction to Infrastructure Financing. Offers more than 20 funding sources and mechanisms, including bonds, impact fees, user charges, and special districts. Each is described in terms of the type of project for which it is best suited, its advantages, and its disadvantages. Examples from local governments. IQ Report. 1999. 15 pages. Item no. 42457. $14.95.

Pollution Prevention: A Guide for Local Government. How to develop proactive pollution prevention programs that improve efficiency, reduce risk, and save money. Includes worksheets, model ordinances, and sample policies. Special Report. 1994. 100 pages. Item no. 40951. $28.00.

Water and Wastewater Services: Meeting Current Challenges. How to provide water and wastewater services in the face of aging infrastructure, federal requirements, and rising demands for service expansion. A case study from Charlotte, North Carolina, describes reducing costs at a water treatment plant using managed competition. IQ Report. 1999. 17 pages. Item 42513. $14.95.

Wetlands and Watersheds: Six Case Studies. This report includes six case studies from six local governments—large and small, urban and rural, in a variety of environments—that provide ideas for mitigation, financing, building partnerships, working with regulatory agencies, reducing costs, and building public understanding and support for wetland and watershed management. IQ Report. 1999. 13 pages. Item no. 42440. $14.95.

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