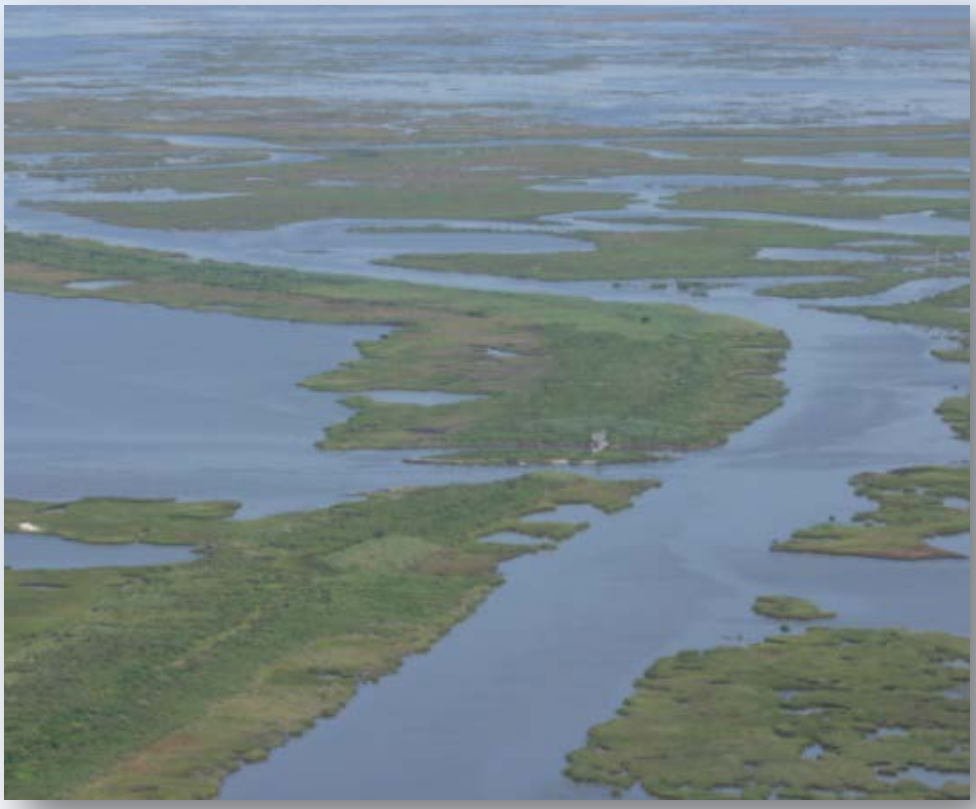
Tool-Box Approach to Wet Growth

Module 1

Watershed Planning



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Introduction

Increased pressure on water resources from development has led to recognition of the need for comprehensive strategies to manage water resources. People in many areas are now beginning to focus on entire watersheds as the appropriate scale of focus of planning activities to guarantee the integrity of water resources. This type of water resources management is called the *watershed approach*. The U.S. Environmental Protection Agency (EPA) describes the watershed approach as "a flexible framework for managing water resource quality and quantity within specified drainage areas, or watersheds" (U. S. Environmental Protection Agency [EPA] 2008). In an effort to provide advice to professionals and members of communities who seek to incorporate good water management principles into planning efforts using the watershed approach, this module:

- outlines the characteristics of watershed planning;
- explains important federal and state sources of support and authority;
- discusses case studies of regional efforts to address watershed issues;
- explains steps propagated by EPA for watershed planning; and
- ends with a brief exposition of available planning and regulatory tools.

Characteristics of Watershed Planning

Watershed planning is different than other types of planning in scale and duration. Watersheds are geographical units that ignore political boundaries. This means a watershed may be contained within many political jurisdictions and comprise land owned by many private individuals. Watersheds are nested. Smaller watershed drains are part of larger watersheds which drain into even larger watersheds. Issues affecting smaller watersheds are also important, both since these smaller watersheds will into the larger watershed and because smaller watersheds offer the opportunity for a more manageable project with potential for a more comprehensive information gathering process. Addressing issues with an entire watershed requires understanding the appropriate scope of a project. The ultimate goal of watershed planning is to ensure a healthy watershed, but this necessarily entails addressing issues more directly affecting subwatersheds. The duration of watershed planning also sets it apart from other planning efforts. EPA (2008) recommends that a watershed plan should plan 5-10 years into the future. Any longer than this time frame and the plan risks becoming outdated.

EPA (2008) discusses the watershed planning process as *iterative*, *holistic*, *geographically defined*, *integrative*, and *collaborative*:

- Iterative: The process is constantly re-defining goals based on performance. If a policy is ineffective, it should be revised. Some information may not be available in the beginning, and gaps in research will likely become apparent based on need as the process continues.
- Holistic: Watershed planning involves all stakeholders in the watershed and considers all uses of a waterbody, not just as a source of water and for aesthetic

value. Human and ecological uses of the watershed are important in the process for an outcome that will satisfy conflicting interests.

- Geographically defined: The scope of the plan should be large enough to address all major sources and causes of impairments and threats to the water sources and causes of impairments and threats to the waterbody under review. At the same time it is important to remember there is a tradeoff: demands for data and cooperation between important stakeholders become more complex as the scale of a plan increases.
- Integrative: Many other agencies will likely be simultaneously working on issues affecting the watershed. Forming partnerships with other agencies prevents wasted effort and helps streamline the process.
- Collaborative: A watershed plan is more likely to be effective when all of the stakeholders are brought into the process early on as active participants in the planning process.

Federal and State Support for Watershed Planning

After years of focus on water issues at the federal and local levels, much focus has been placed on watershed issues involving point-source pollution, or pollution emitted by a single polluter. (Stoner, Weiss, and Lindsey, 1994). However, nonpoint source pollution sources, such as agriculture and construction, needs to be addressed for communities to attain unpolluted watersheds.

Additionally, growing concerns about potential watershed scarcity is making it essential for watershed management to exist. Nearly every region has experienced water scarcity over the past 10 years (Arnold, Norton, and Wallen, 2009). Water scarcity played out in a protracted legal battle over the rights to withdraw water in Georgia, Florida, and Alabama. The battle takes on enormous stakes for participating communities since access to water is the key to growth, which is perceived as key to economic prosperity for communities depending on overextended watersheds (Goodman, 2010). In a testimony before the House of Representatives Subcommittee on Transportation and Infrastructure, Steven L. Stockton, Director of Civil Works for the U.S. Army Corps of Engineers, emphasized the importance of developing a watershed based plan before an actual crisis began (Subcommittee on Water Resources and Environment, 2008). These are but two examples of the need for watershed management. What follows in this section of the module are important federal sources of support and recommended resources available through many state governments.

Section 729 of the Water Resources Development Act of 1986

Section 729 of the Water Resources Development Act (WRDA) was implemented to allow more holistic water resource planning by authorizing the U.S. Army Corps of Engineers (USACE) to conduct a study of watershed and river basin needs. Amendments

to the measure (Section 2010 of the Water Resources Development Act [WRDA] 2007) have increased the federal share for these studies to 75 percent of the cost of the study. The remaining 25 percent must be paid by non-federal sources coming from states, tribes, or non-governmental organizations. This change means entities wishing to participate in a study with the USACE may satisfy their required contribution to the process with in-kind service contribution (The Water Resources Coalition, 2011). According to testimony presented to Congress by the USACE, they can assist in a watershed based planning approach by bringing to bear technically sound planning and management programs (U.S. Army Courps of Engineers, 2008).

Clean Water Act Section 319

The Federal government, seeing the need for some leadership on issues of water management has created opportunities through the Clean Water Act (CWA) to offer financial assistance and expertise to help achieve effective watershed planning. In 1987 Congress amended the CWA to address nonpoint sources of pollution through the federal Nonpoint Source Management Program in Section 319. According to the EPA website:

> "*Under Section 319, states, territories and tribes receive grant money that supports a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects and monitoring to assess the success of specific nonpoint source implementation projects*" (EPA, 2012).

In 2011, this program administered $175.5 million in grants (Environmental Protection Agency, 2012). This funding may contribute up to 60 percent of the funding required to complete an approved project is administered through state or tribal governments.

Section 319 can provide important support for development of watershed plans, but requires significant legwork from the applicant. This challenge will, in many circumstances require interested groups to follow the steps of successful watershed planning identified by EPA in their Watershed Planning Handbook, which provides a wealth of useful information for complying with Section 319 requirements. These steps are quoted from another source on page 15.

In the assessment report required for grant approval, governing units must, after notice and opportunity for comment from the communities:

- identify causes and sources of pollution;
- estimate expected load reductions;
- develop management measures and target critical areas;
- estimate technical and financial assistance needed;
- develop an education component;
- develop a project schedule;
- describe interim measurable milestones;
- identify indicators to measure progress; and
- develop a monitoring component (Arnold, Norton, & Wallen, 2009).

State Support

Many states, including California, Indiana, Texas, Maryland, and Washington, also provide support and expertise for watershed planning. Local communities should check to ensure that support is provided at the state level. Additionally, many universities provide valuable location specific support and expertise for planning efforts, especially as a source for Geographical Information Systems (GIS) resources.

Case Studies

Watershed protection and restoration is a broad category (when it comes to implementation) that has many social processes, which play a vital role in community based watershed work. Though the bulk of the work is done on a local level, the federal government has a significant role in the process. Generally this role involves providing technical and financial support.

While the federal government has an important role in watershed management, public participation at the local level is even more important. There should be a broad spectrum of participation from the community. If community based watershed management is to be effective, all stakeholders need to understand their role in maintaining their watershed.

What follows are case studies that illustrate these points.

Norwalk River Watershed

Introduction

The Norwalk River Watershed Initiative (NRWI) began in Connecticut in 1996. It was formed to be a "community-based approach to comprehensive watershed planning and management." The NRWI initiative found they needed to "fundamentally understand and develop processes that built relationships, reduced or minimized conflict, and set priorities that can be implements." And based on those principles, these two goals were the primary goals of the initiative:

1. To develop a Watershed Action Plan using a voluntary, collaborative locally based effort to restore and protect the watershed's resources.
2. To enhance community capacity to implement the plan.

Background of Watershed

The Norfolk River Watershed faced many problems: water quality degradation from nonpoint source pollution; fragmented, degraded or lost fish and wildlife habitats; and

high flood risk that was increasing. The Norwalk River watershed was unique in that it was already "built-out." This limited the usefulness of traditional solutions because since so much privately owned land was involved, any attempts at watershed management quickly become controversial. The NRWI used an existing plan, the *Long Island Sound Study Comprehensive Conservation Management Plan* for the states of New York and Connecticut, as the framework for their ideas and plan.

The players that were involved in the NRWI were a mixture of local citizens, town officials, state government representatives, federal agency representatives, local and regional scientists and a mixture of other individuals and groups. The first order of business for the NRWI was to formulate a NRWI Committee. This committee then organized four subcommittees with one major resource issue as each of their individual focuses. Through this process they created the Norwalk River Action Plan. This plan provided a set of goals and objectives and identified tasks to accomplish these goals and objectives; essentially this was a guidebook for interested community members and stakeholders to follow to successfully clean up and sustain a healthy watershed.

The Norfolk River Watershed is characterized by the following:

- It is comprised of roughly 40,800 acres located primarily within the southwestern Connecticut area with a small portion in New York.
- It encompasses seven municipalities: New Canaan, Norwalk, Redding, Ridgefield, Weston, and Wilton, which are in Fairfield County, Connecticut and Lewisboro in Westchester County, New York.
- 66,000 people live on the watershed (1990 census).
- It is a coastal watershed.
- Originally, the watershed had a harbor for commerce. The land use of the watershed inland was mainly agricultural. As time progressed, the river inland was developed and now urban and suburban land uses predominate.
- The source of the Norwalk River is at the Great Swamp in Ridgefield and flows northerly, then south into Norwalk Harbor and Long Island Sound. There are two major tributaries to the river, the Silvermine River and the Comstock Brook. The main stem of the Norwalk is about 20 miles long, the Silvermine is about 8 miles long, and the Comstock is about 3 miles long. Homeowners along the tributaries have installed numerous low-head dams for view enhancement. These create aesthetical shallow ponds, but provide barriers to migrating aquatic species. The soil along the river is predominantly glacial till. Annual mean temperature is 51 degrees F and the average annual precipitation is roughly 47 inches. The harbor is important for wildlife habitat, boating and recreation. Its waters flow directly into the largest oyster production area in Long Island Sound.
- Over time, land use changes resulted in an increased amount of nonpoint source pollution, the loss of fish and wildlife habitat, and an increase of flooding.

In the early 1960s, there was a watershed plan aimed at reducing flooding developed by what used to be known as the Soil Conservation Service, with help from the Connecticut Department of Environmental Protection (CT DEP) and the Fairfield County Soil and Water Conservation District. Congress then authorized the plan in 1965 under the

requirements of Public Law-566. But since then, only two of the five dams that were cited as flooding control have been built and a USACE channel that exists in the lower reaches of the river in Norwalk has been developed to the edge of the channel.

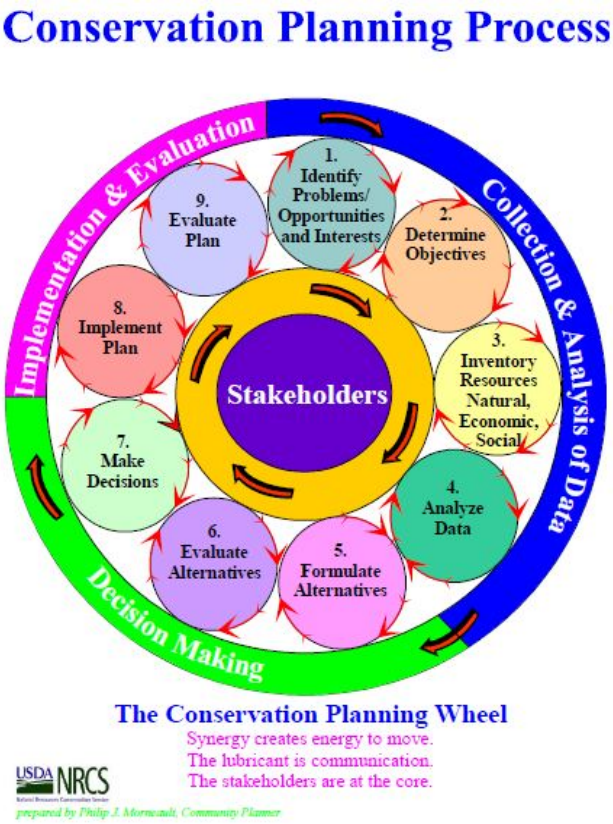
Parts of the watershed were relatively unaffected, but some problems were identified. Issues ranging from poor water quality mostly from developed areas with a high percentage of impervious surfaces, to extremely disturbed habitat conditions. A citizen watch group monitored water quality eight times a year to gain empirical data about the condition of the river. They tested for bacteria and pathogens, dissolved oxygen, conductivity, temperature, and benthic invertebrates. Further observations made about the river through this process included excessive algae growth, impoundments from small commercial and residential dams, stream bank manipulations, lack of riparian zones, and sedimentation issues.
Just over half of the households in the watershed were on sanitary sewer at the time of the writing with the rest using on-site septic. About 60 percent of residents were using public water systems as their water source. The remaining 40 percent were using wells, making a healthy watershed extremely important. Because Connecticut was actively engaged in the coastal nonpoint source pollution management under Section 6217 of the Coastal Zone Reauthorization Amendment of 1990, the remediation of the Norwalk River was vital for the state to stay in compliance with that amendment.

There have been an abundance of non-native invasive plants species planted along the river for ornamental purposes. These species of plants have overtaken many native species resulting in reduction of food sources in the natural habitat. The roughly 15 percent of the watershed considered wetlands are under constant pressure from development.

Planning Process Used in Study

The NRWI Committee modeled their planning process on the nine-point Conservation Planning Wheel used by the Natural Resources Conservation Service (NRCS):

1. Identify Problems/Opportunities and Interests
2. Determine Objectives
3. Inventory Resources Natural, Economic, Social
4. Analyze Data
5. Formulate Alternatives
6. Evaluate Alternatives
7. Make Decisions
8. Implement Plan
9. Evaluate Plan



(Natural Resources Conservation Service.
Prepared by Philip J. Morneault)

Early Development of the "Initiative"

By working with NRCS, EPA's Long Island Sound Office, and the CT DEP, NRWI determined that the initiative should demonstrate:

- a watershed approach with a goal to improve, protect, and restore the water quality, habitat, and condition of other resources contributing drainage to Long Island Sound;
- a voluntary, collaborative partnership effort among federal, state, regional, and local authorities with a high degree of public involvement;
- a comprehensive approach watershed management focusing on the resource needs of the watershed; and
- an emphasis on implementing solutions to high priority issues.

Local governments and organizations also wanted to emphasize building a greater capacity to improve management and water quality with a structure put in place that would empower and enable municipalities, organizations and citizens to continue implementation long after the plan was developed. During these early deliberations, sustainability was viewed as the top priority.

In order to gauge the interests of many different agencies, nongovernmental groups, individuals, and governments in the watershed's condition the NRCS, CT DEP, and EPA formulated a series of questions which garnered positive results and started to build relationships. The questions were:

1. Would you be interested in working in a partnership effort to model collaborative, locally-led (community-based) watershed planning?
2. Would you commit resources to the effort?
3. What are you issues and interests relating to the watershed?

A Technical Advisory Group (TAG) was formed to lay the groundwork and draft a framework for necessary actions and timelines for the initiative. The highest priority of the TAG was to formulate a planning committee to assist in "locally-led" efforts and also to create an Initiative Committee. TAG created the initiative committee by soliciting advice from local leaders and organizations on who should take part in these committees and who would fund the position of Public Outreach and Education Coordinator whose job it was for getting the public involved and interested. TAG had seven objectives:

1. Gauge the interest of the community in proceeding with a collaborative watershed planning effort (a go/no go decision).
2. Develop a list of potential participants and advertise for participation in the effort.
3. Develop an 18-month adaptable planning process for the initiative committee to agree to or modify.
4. Add to the list of issues and interest that had been developed over the initial discussion phase.
5. Develop a set of meeting agreements for the committee to agree to or modify at the first meeting.
6. Organize the Streamwalk program, an early goal in which every foot of perennial stream was walked and the conditions alongside the stream were recorded by volunteers; hire a Public Outreach Coordinator; and organize the first meeting.
7. Set the tone for the collaborative partnership approach the initiative committee would use.

Subcommittees organized around four topics: (1) water quality; (2) habitat restoration; (3) land use, flood protection, and open space; and (4) stewardship and education. The subcommittees were responsible for developing the issues and interests, set priorities, prepare goals and objectives, and develop recommendations and action items to support the goals and objectives in the form of a plan. There were three guidelines subcommittees were asked to follow when formulating their plan:

1. Was it measurable?
2. Was it achievable?
3. Was it presented within a watershed context?

After review, each subcommittee plan became a part of the overall NRWI Action Plan. While the subcommittees were creating their plans and the NRWI Action Plan was being formulated, they found that it was imperative for partners of the plan to start action on the initiative. These steps increased citizen involvement as participants saw the restoration of the watershed was actually happening and not just an idea. Activities completed during the planning phase included:

- Riparian area restoration
- Flood alert system approval and installation
- Stream walks
- Water quality monitoring
- GIS Mapping
- A review of municipal environmental regulations in the watershed
- Developing brochures
- A series of workshops for each watershed community from the Nonpoint Source Education for Municipal Employees (NEMO) Project
- A series of focus groups on community perception of riparian areas.

The initiating agencies (NRCS, EPA, CT DEP) did not direct the process, but instead created the crucible, or framework through which the planning process occurred. The crucible was carefully designed to be equitable so no stakeholder had more to say than others. This contributed to a common understanding and agreement on what was necessary and achievable among all stakeholders (Smith, Morneault, and Noonan, 2003).

For more information about the Norfolk River Watershed, go to http://www.blackcreekwatershed.org/docs/wicasestudy.pdf .

Rocky River Watershed

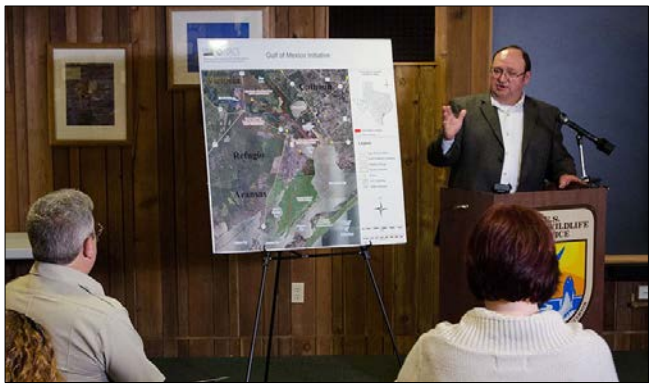
The Rocky River Watershed located in southwestern Michigan is made up of four counties (Cass, St. Joseph, Van Buren, and Kalamazoo) and comprises an area of 175 square miles. Agriculture is the predominate land use in the area.

A steering committee was formed to ensure fair input from stakeholders in the process. The Rocky River Watershed Steering Committee members represented a diverse background with representatives from the NRCS, the St. Joseph County Health Agency, St. Joseph County Park and Recreation, townships within the watershed, and road commissions serving many of the municipalities in the affected area.

Press releases in local publications and a 10-part newspaper series in the local paper were used to alert people and build interest. A website provided information on the project and goals, adding an opportunity for people to make comments. Additionally, tables were set up at events as an outreach activity that allowed informal participation while raising interest in the project.

The watershed committee identified seven goals to improve the water quality of the watershed:

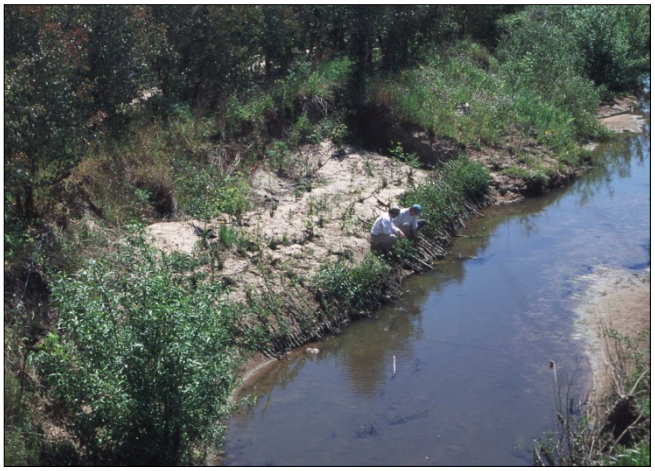
Objective 1: "To improve and protect the navigability, aquatic life and other indigenous wildlife, and the fishery of the watershed by reducing the amount of sediment entering the system" (Keiser and Associates, 2004, p. 48)



(Photo: U.S. Department of Agriculture)

One of the first tasks of the committee was to limit erosion on banks of priority streams. Stabilization of the banks is an important goal to reduce sediment, the major pollutant in the river, resulting in improved water quality. To do this, the committee implemented best management practices (BMPs), such as stabilization of shorelines and stream banks in critical areas. The cost to implement these changes was approximately $20.00 per linear foot.

The second task was to educate landowners on conservation programs to protect and improve water quality. This was accomplished through newsletters and workshops. This type of activity is necessary, effective, and economical.



(Photo: U.S. Department of Agriculture National Resources Conservation Services.)

Objective 2: "Establish a road/stream crossing improvement program to correct identified problems" (Keiser and Associates, 2004, p. 48).

The first task identified to complete this objective was the stabilization of roads near streams to prevent erosion. Culverts were replaced, roads were paved, the grade of approaches was reduced, and vegetation around the road was restored. This reduced sediment by .17 tons a year at one site. The cost for these implementations was approximately $50,000 per site.

The second task to mitigate erosion issues along roads near streams was to implement the use of a road-stream crossing form updated with current procedures to

be used by road commissions. The form outlined techniques for road commissions to evaluate the impact to streams located near roads.

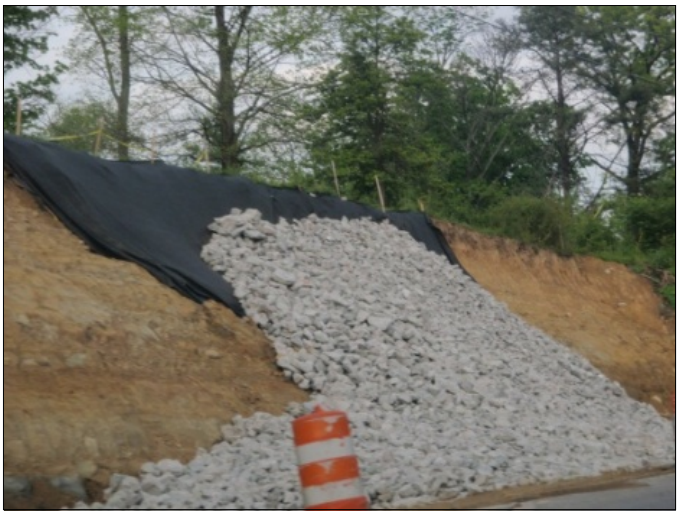
The third task the committee identified was to host workshops to inform road commissioners of techniques used to improve water quality in streams near roads. Workshops were effective in training commissioners in the use of BMPs and were very economical. This particular workshop cost $500.

(Photo: U.S. Department of Agriculture National Resources Conservation Services).

Objective 3: "Work directly with landowners to eliminate livestock access to the river" (Keiser and Associates, 2004, p. 48).

Achieving this objective required the committee to work directly with landowners to reduce erosion caused by livestock. The committee educated landowners on agricultural BMPs such as fencing methods, stream crossings, watering devices, and revegetation to stabilize river banks. BMPs implementation at two sites reduced erosion by 1.1tons/year.

Objective 4: "Reduce/eliminate construction site erosion" (Keiser and Associates, 2004, p. 48)



(Photo: Justin Quinn, University of Louisville)

Erosion at or near construction sites is a problem facing many municipalities. The Rocky River Watershed committee estimated there are 15-20 sites a year within 500 feet of a water source. The committee decided to offer workshops and training to contractors on BMPs to prevent erosion.

Objective 5:
"Reduce/eliminate erosion at human access points" (Keiser and Associates, 2004, p. 48).

Waterways are great sources of recreation, but human traffic at access points increases sediment entering waterways and contributes to erosion. Destabilized soil and removal of vegetation in these areas further compounds the problem. The committee decided to secure and develop access sites at key recreation access points. The committee implemented BMPs at four sites within six years at a cost of approximately $10,000 per site. These changes reduce sediment by .0025 tons/year from entering waterways.

(Photo: Justin Quinn, University of Louisville)

Objective 6: "Prevent/reduce erosion from farm fields" (Keiser and Associates, 2004, p. 48).

(Photo: Justin Quinn, University of Louisville)

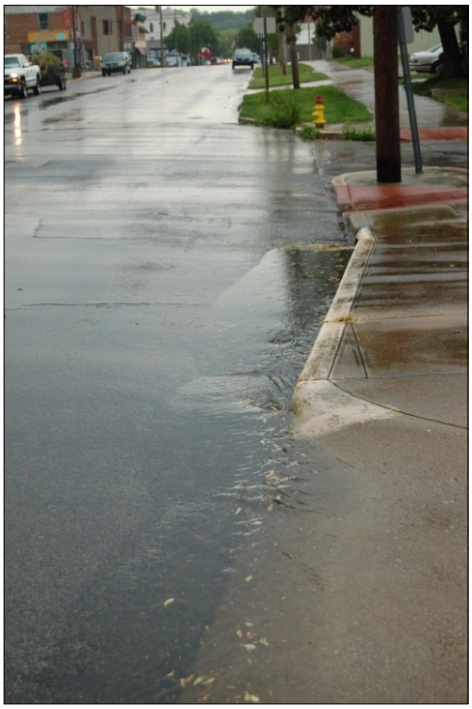
A freshly plowed field can result in increased sediment during rainfall. Sediment, pesticides, and fertilizers are a large source of pollution when BMPs are not used. The committee estimated 18,300 acres of farmland were within one kilometer of the river in their watershed. Participants agreed implementing BMPs on this farmland was the highest priority for achieving the objective.

The committee held "field walks" to introduce local farmers to agricultural BMPs. The following image portrays no-till farming, one BMP effective for reducing sediment run-off from fields.

Objective 7: "Prevent/reduce sediment entering the river from storm drains" (Keiser and Associates, 2004, p. 48)

The committee estimated that two square miles of land in the watershed was developed for urban uses. They decided that educating the urban public on the storm water system would provide landowners with knowledge of BMPs that would reduce the amount of sediment entering the storm drains and therefore the river (VanDelfzijl).

For more information about the Rocky River Watershed, go to www.stjoeriver.net/wmp/docs/RRPlan.PDF .



(Photo: Justin Quinn, University of Louisville)

Portland Watershed Management Plan

In 2005, the city of Portland, Oregon developed their Portland Watershed Management Plan (PWMP), to address three main concerns. These concerns were the *improvements of water quality*, *overall watershed health*, and *protection of natural resources*. A committee developed six strategies to improve the overall watershed. They are:

1. Stormwater Management
   - Using green infrastructure to reduce water entering the stormwater system
   - Issuing Underground Injection Control (UIC) and Municipal Separate Storm Sewer System (MS4) Permits
   - Developing incentives for landowners to reduce runoff
2. Aquatic/Terrestrial Enhancement
   - Conducting a natural resources inventory update describing features and rankings of habitats
   - Implementing the Terrestrial Ecology Enhancement Strategy, a model for decision making to ensure goals and objectives are met
   - Planning for fish and habitat monitoring
3. Revegetation
   - Removing invasive plant species
   - Reducing presence of wildfire fuel and flammable plants from city parks

4. Protection/Policy
    - Amending local codes to allow for infill development
    - Issuing bonds to fund protection of natural areas near waterways
    - Purchasing property from sellers in the Johnson Creek floodplain
5. Operations/Maintenance
    - Developing sloughs to reduce the number of CSOs
    - Designating Lower Willamette River part of Portland Harbor Superfund Site to increase cooperative water quality monitoring
    - Repairing damaged sewers near Stephens Creek
6. Education, Involvement, Stewardship
    - Studying future needs of stormwater facilities
    - Educating K-12 students on water protection through the Clean Rivers Education Program
    - Encouraging citizens to get involved in watershed projects (City of Portland Environmental Services, 2005)

The Portland Watershed Management Plan is available at:
http://www.portlandonline.com/bes/index.cfm?c=38965&a=107808.

Sibley Lake, Louisiana

Sibley Lake is the water source for the city of Natchitoches, Louisiana, and several nearby unincorporated municipalities. The water quality of Sibley Lake was threatened by individual sewage systems in residential areas that were located within the lake's watershed that lay outside the city limits (Coner, 2007).

By partnering with a state agency, Natchitoches was able to mitigate future threats to its water source from failing individual sewage systems outside of its normal jurisdiction.. Its water quality was threatened by individual sewage systems in residential areas surrounding the lake, but outside city limits. Much of the lake's watershed is outside of the city limits (Coner, 2007).

In order to mitigate future threats to its water source from failing individual sewage systems outside of its normal jurisdiction, Natchitoches, in partnership with the Louisiana Department of Environmental Quality, obtained a Section 319 grant for the Sibley Lake Watershed Individual Sewage Treatment System Improvement Project (Louisiana Department of Enviornmental Quality, 2011). The project involved inspecting all sewage systems within a half-mile of the lake and, as funding permitted, systems within one half-mile of lake tributaries. Failing or malfunctioning sewage systems were identified and owners were required to repair or replace their systems. Funding was provided with a cost-share requirement for repairs. In return, owners signed agreements stating they would abide by city ordinances governing maintenance of sewage systems.

Left Hand Creek, Colorado

Threat of a federal superfund National Priorities List (NPL) designation spurred an effort to clean up contamination after a long history of mining operations within the Left Hand Creek watershed near Boulder, Colorado (EPA, 2003). Mining in the area began in the 1850s and continued until the second half of the 20th century. Pollution concerns have been ongoing, and the creek was considered "dead" in the 1930s, until it was cleaned with natural attenuation in the 1960s.

EPA investigations in the 1990s determined that some mine sites in the watershed qualified for NPL designation. A task force on the issue recommended the establishment of a watershed oversight group (WOG), which became the watershed planning entity. One site was ultimately placed on the NPL which in turn made WOG eligible to obtain several sources of funding. Voluntary cleanup efforts were also made by site owners which helped improve water quality.

(Photo: U.S. Department of Agriculture National Resources Conservation Services.)

The Left Hand plan addresses special concerns with respect to mining and contamination (Lefthand Watershed Oversight Group). The plan creates a quantitative system for prioritizing site cleanup. It also addresses BMPs for mining in order to minimize future contamination.

These include consolidation and stabilization of waste rock, moving waste rock away from areas with likely contact with water, regarding waste rock piles to a gentle slope to reduce erosion, capping waste rock with earth, growing vegetation on waste rock piles, using bulkhead seals to seal closed mines, and using diversion ditches to redirect water away from potentially reactive waste. Passive practices include chemical treatment of contaminated waters, using anoxic limestone drains to lower pH of contaminated waters, precipitating out harmful contaminants in aeration/settling pools, and treating wastewaters in sulfate-reducing wetlands (EPA, 2003).

Steps of the Watershed Planning Approach

As the case studies illustrate, there is no “correct” way to conduct watershed planning. No matter what method is used by groups interested in conducting a watershed planning process the method needs to be adapted to the exact characteristics of stakeholders who participate in the process. The following steps, originally propagated in the EPA’s

Handbook for Developing Watershed Plans to Restore and Protect Our Waters (U.S. EPA 2008, available at http://water.epa.gov/polwaste/nps/handbook_index.cfm#contents), are quoted directly with redaction from the Kentucky Wet Growth Guide (Arnold, Norton, and Wallen, 2009).

Watershed planning generally involves a process that moves from initial identification of problems and concerns to the implementation of actions that will help achieve established watershed goals (U.S. EPA 2008, ch. 2 and 3). Prior to the development of the plan, it can be valuable to conduct informal scoping and collect preliminary information. Scoping activities, such as discussions with stakeholders and pre-planning data review, can help define the area to be involved in the planning process, identify additional stakeholders, and gather input about how to proceed before the actual plan development process is initiated.

The EPA has identified six major steps in the watershed planning process (U.S. EPA 2008). Each step includes several activities that are conducted before the following step is initiated, and many activities are repeated in different steps. Because the watershed planning process can be so intimidating, undertaking smaller tasks early in the planning process can help communities engage stakeholders, demonstrate progress, create momentum for the plan.

The six major steps in the EPA watershed planning process (U.S. EPA 2008) are as follows:

1. Build partnerships.
   For a watershed plan to be effective, involvement of stakeholders should be encouraged early, and should continue throughout the process. It is crucial that communities work from the outset to build credible partnerships with key stakeholders. Informational and educational outreach activities should be implemented to build awareness for the watershed planning process and to help implement the plan. These activities should be initiated very early in the planning effort to ensure that potential partners and stakeholders are aware of the issues, to help recruit participants, and to educate possible partners and stakeholders about the watershed planning process.

   In the beginning stages of the watershed planning process, communities should identify stakeholders. Stakeholders include decision-makers, community members affected by the decisions made, and anyone who has the capability to either assist or impede in the plan's implementation. It is important that communities identify and include all types of stakeholders instead of simply relying on those that volunteer or have political power. Additionally, a diverse cross-section of the community should be involved, including minorities, people with disabilities, and low- and moderate-income residents. Efforts to involve young people – both children and teenagers – should be pursued thoughtfully, as these efforts have often worked well when attempted. In addition, as stakeholders are identified,

they should be consulted to assist in identifying other stakeholders who should be involved.

Categories of participants to consider for involvement include stakeholders with the following characteristics:

- those who are responsible for the watershed plan's implementation;
- those who will be affected by the watershed plan's implementation;
- those who can provide information on any issues and concerns in the watershed;
- those who have knowledge of existing programs or plans that could be integrated into the watershed plan; and
- those who can provide technical and financial assistance in the development and implementation of the watershed plan.

After stakeholder identification has occurred, the roles and responsibilities of stakeholders should be determined. The various skills and resources of different stakeholders should be identified to help determine participants' roles and responsibilities. Stakeholders can participate in a number of roles, including as decision-makers, advisors, or simply supporters. Methods to be used for the facilitation of stakeholders should also be decided.

In addition to stakeholder involvement, partnerships should be built with various local, state, and federal programs and officials. These entities often can provide technical and financial resources. Furthermore, many of these programs and officials have worked on various aspects of the watershed or components of the watershed planning process, and thus can provide valuable, relevant information. Partnerships with federal programs can be especially beneficial. Many federal programs and agencies are involved in activities that focus on watershed protection, such as data collection, regulation development, technical oversight, and public education. Others have experience with watershed planning and management processes. Examples of such federal entities include the EPA, abandoned mines programs, agricultural conservation and support programs, federal transportation program, the U.S. Geological Survey, threatened and endangered species protection programs, and wetland protection programs. In particular, the EPA's nonpoint source program, under Section 319(h) of the Clean Water Act, can be a source of funding. Many watershed planning projects are initiated to acquire EPA funds for stream improvement projects under Section 319(h). EPA Section 319(h) funding can be requested to implement strategies recommended in the watershed plan once the plan has been developed. EPA will also fund development of watershed plans through this program. To be eligible for 319(h) funds, a community's watershed plan must meet certain requirements, which includes adequately addressing nine specific elements in the plan. The EPA watershed planning process discussed in this section addresses all of these elements.

The nine key elements are:

1. Identify causes and sources of pollution;
2. Estimate load reductions expected;
3. Describe management measures and target critical areas;
4. Estimate technical and financial assistance needed;
5. Develop education component;
6. Develop project schedule;
7. Describe interim, measurable milestones;
8. Identify indicators to measure progress; and
9. Develop a monitoring component.

Stakeholders should be utilized to identify issues of concern, which will help to determine the goals of the watershed plan, the types of data that will be needed for the plan, and the geographic extent of the watershed that will be involved in the planning process. Identification of issues of concern should be anything related to conserving, protecting, or restoring water resources. Community leaders may feel that they can identify issues of concern on their own. However, gathering input from stakeholders will help to determine those issues that are important to community members.

Stakeholders should then identify preliminary goals that they believe should be addressed in the watershed plan. Making the goals more specific at this stage will help make it easier to develop concrete objectives to achieve the goals later in the process. The preliminary goals will be enhanced as the watershed planning process continues with the development of indicators to measure the progress made toward achieving the goals, the development of specific management objectives to show how the goals will be achieved, and the development of measurable targets to show when the goals have been achieved.

Finally, stakeholders should select indicators to measure environmental conditions and to measure progress that is being made toward meeting the watershed goals. Indicators are "direct or indirect measurements of some valued component or quality in a system." (U.S. EPA 2008, p. 4-9) They can help to assess and communicate the health of the watershed. Indicators should be quantitative to ensure that the effectiveness of management measures can be adequately predicted.

Communities seeking to engage in watershed planning may find it helpful to bring in expert facilitators or experts who can assist with data, analysis, and information sources. Many states offer support, and local universities should be consulted to determine what expertise is available for the planning effort.

2. <u>Characterize the watershed to identify problems.</u>

Characterizing the watershed, along with its problems and pollutant sources, provides the basis for the development of effective management strategies to meet

watershed goals. The characterization and analysis process helps communities focus planning efforts to address the most pressing needs, and also aids in targeting data collection and analyses to a specific watershed.

Characterizing the watershed begins with gathering and organizing data. This helps to determine the condition of water resources, identify pollutant sources, and support quantification of the pollutant loads. Data gathering should be focused, and communities should determine the types and amount of data needed to complete the watershed plan. The scoping done earlier in the process can help to focus data gathering efforts, as can the issues of concern and goals that were previously identified by stakeholders.

A wide variety of data can used to characterize the watershed. Information on the watershed's physical and natural characteristics will help to define the watershed boundary and provide a basic understanding of watershed features that can play a role in the health of the watershed. Sensitive or critical features, such as floodplains, wetlands, forests, riparian zones, aquifer recharge zones, and ridges and steep slopes, should be mapped.

Land use and population data are also helpful. Land uses influence the watershed's physical conditions and indicate the watershed's active source types, while population characteristics can help gain an understanding of potential growth and development in the area and possible changes in land uses and sources. Growth projections should include population, location, density, new or upgraded infrastructure, and changes in land use patterns, among other characteristics. Data on the amount and location of impervious cover in the watershed should be gathered or projected, and maps of impervious cover percentages should be generated. Land use data should include existing land uses, zoning designations, and planned development. Land use data should also include parcel sizes, land ownership patterns, land cover (vegetation found on the surface of non-urban land), existing and planned infrastructure, locations and widths of roads, streets, and highways, and build-out analysis.

Data on waterbody and watershed conditions can give a general overview of the health of the water resources in the watershed and what uses should be supported. Data on water quality, pollutant loads, and sources of pollutants should be obtained. Watershed planners will also find useful data on water supply uses (types and quantities) and sources, including the types, locations, and capacities of water supply, water treatment, and wastewater treatment infrastructure.

After the type of data needed is established, sources of that information must be identified. Local data sources are often helpful. These include sources such as information on zoning, development guidelines, master planning, wastewater plans, and future land use plans.

Federal government sources of information can be particularly helpful. Various federal agencies, such as the EPA, the U.S. Department of Agriculture (USDA), and the U.S. Geological Survey (USGS), can provide information that can be useful in characterizing the watershed. Many of the handbooks and websites referenced in this chapter contain listings of various databases on federal agency websites.

Identifying, characterizing, and quantifying pollutant point and nonpoint sources are crucial to successfully developing and implementing a watershed plan because they can be used to control pollutant loading to a stream. This can provide information on the magnitude and impact of each source and its effect on water quality. Monitoring data can help in the evaluation of the condition of water resources in the watershed.

Once the data has been collected, it should be documented in a data inventory. This inventory will provide an ongoing list of available watershed and monitoring data. The data inventory should be updated throughout the watershed planning process. It can be used to identify any significant gaps in the data.

The next step in the process of characterizing the watershed is to identify data gaps and find additional information. The data that has been gathered should be reviewed to ensure that the types of data collected can correctly identify pollution causes and sources, and that the data is of high quality.

After all data collection has occurred, the data should then be analyzed to characterize the watershed, as well as any pollutant sources. Thorough data analysis can help communities have a better understanding of major sources of pollution and their impacts on water resources. Suspected impairments to water resources should be confirmed and additional problems identified. The results of the data analysis can then be used to identify causes and sources of problems in the watershed.

Pollutant loads from watershed pollutant sources should then be estimated so that future management efforts can be targeted. Methods that can be used to estimate pollutant loads include watershed modeling and using monitoring data or literature values. Watershed pollutant loads can be quantified using the information gained from this loading analysis. The pollutant loads that have been calculated will help to identify the load reductions necessary to meet watershed goals and to select appropriate management practices.

3. Set goals and identify solutions.

The third major step in the watershed planning process is to set goals and identify load reductions. This is in the context of general goals like improved water quality, water conservation and sustainable supplies, overall watershed health and integrity, and protection of specific sensitive resources or threatened waters. After

data has been analyzed, problems in the watershed have been identified, and sources that need to be managed have been identified and quantified, watershed goals can be refined and management objectives can be developed that are targeted at specific pollutants sources. The process of developing specific objectives and targets began with the preliminary watershed goals identified by stakeholders. As the watershed planning process continues, participants will obtain more information on the watershed problems, waterbody conditions, causes of impairment, and pollutant sources. Each step in the process will provide a clearer focus and will better define watershed goals, until eventually specific objectives with measurable targets can be developed. These management objectives will determine how the goals will be achieved.

After specific management objectives have been established, quantitative indicators should be developed to track progress toward meeting the management objectives. The indicators identified by stakeholders earlier in the process to determine the current health of the watershed will now be refined to measure implementation. Some indicators should be linked to the cause-and-effect relationship of pollutant sources so that the load reductions needed to meet the targeted goals can be identified.

Determination of these load reductions occurs next. An understanding of the cause-and-effect relationship between pollutant loads and water resources will help communities estimate the load reductions that are expected to result from the implementation of management measures. This estimation allows evaluation of how much of a load reduction is necessary to meet watershed targets. The identified indicators, numeric loading targets, and associated load reductions can then be incorporated into the management objectives for the watershed plan's final goals.

After watershed conditions have been analyzed, pollutant loads quantified, and the loading targets necessary to meet goals and objectives determined, potential management measures and practices that can help achieve the goals can be identified. Management measures are categories of management practices that can be implemented to achieve watershed goals. Management practices are more specific and typically site-based. They can be structural or nonstructural, and often include regulatory actions. The collection of potential management practices should be screened so that it can be narrowed to include the options that are likely to be most feasible and effective. Criteria used in this screening process can include estimated load reductions, legal and regulatory requirements, site constraints, and costs.

After screening potential management practices, the plan's final management strategies should be selected. The five major steps to selecting the final management strategies are:

- identify factors to be used in the selection of the final strategies;

- determine the appropriate means to evaluating the ability of the management techniques to meet the watershed objectives;
- quantify load reductions from existing conditions that are expected to result from the management strategies;
- identify capital costs, as well as operation and maintenance costs, and compare initial and long-term benefits; and
- select the final management strategies.

4. Design an implementation program.

After effective watershed management measures have been identified, the remaining elements of the implementation program can be developed. Designing an implementation program involves the following processes:

a) Development of an information and education component. The information and education component should make the public aware of the issues facing the watershed, educate the public on the problems facing the watershed, and inform the public of the actions they can take to help address those problems. This can help to enhance public participation and can build capacity to implement management measures.

b) Establishment of an implementation schedule. A schedule for implementing the management measures should be established. The implementation schedule will provide specific information on how to turn goals and objectives into specific tasks.

c) Development of interim measurable milestones. Interim, measurable milestones should be identified to determine if management practices and other control actions are being implemented.

d) Establishment of a set of criteria to measure progress toward meeting watershed goals. Criteria should be established to help determine if load reductions are being achieved and progress is being made toward meeting overall watershed goals. These criteria are often expressed as quantitative indicators.

e) Development of a monitoring component. A monitoring component should be developed to track and evaluate the effectiveness of plan implementation. The criteria developed above can be used for monitoring.

f) Estimation of the technical and financial resources that are necessary for implementation, as well as the sources and authorities for these resources. The estimate of financial resources needed should include administration and management services, informational and educational outreach efforts, costs associated with management measures, and monitoring, data analysis, and data management activities. Technical assistance needs should also be identified, as

should any authorities or legislation that allows, prohibits, or requires a particular activity.

g) Development of an evaluation framework. An evaluation should help demonstrate that implementing the management measures is achieving watershed goals. It should also help to continuously improve the watershed program.

After these processes have been completed, the implementation plan can be developed. The implementation plan is a subset of the overall watershed plan. It serves as a guide for turning selected management strategies reality and for deciding how progress toward meeting the plan's goals will be measured. The implementation plan should include detailed tasks that need to be completed, identification of who will complete the tasks, identification of the funding and technical assistance needed, and the development of a process to measure the effectiveness of the program.

5. Implement the watershed plan.

After developing the watershed plan, the plan must then be implemented in the watershed. Plans are mere laudatory goals and idealistic aspirations if they are not implemented, including in tough choices about land uses and development, modified actions to prevent harms, and allocation of resources. Key aspects of implementation include:

- ensuring technical assistance in the design and implementation of management measures;
- providing stakeholder training and support for operating and maintaining the management measures;
- managing funding mechanisms and tracking expenditures for individual actions and the entire project;
- conducting monitoring activities and interpreting and reporting the data;
- using schedules and milestones to measure progress;
- communicating the status and results of the project; and
- coordinating implementation activities.

In particular, local governments that participate in a watershed planning process should expressly incorporate the watershed plan into their local comprehensive plans, modifying land use plans and other elements of the local planning documents to ensure consistency with the watershed plan content. In addition, local governments should adopt ordinances expressly requiring that zoning changes, conditional use permits, variances, site plan review, and other development project approvals be consistent with the watershed plan. If zoning decisions and proposed land development projects do not consider the impacts of these land uses on watersheds in light of the watershed plan objectives and criteria, the plan will be largely undermined by incremental project-by-project decisions that allow watershed degradation.

In addition, watershed work plans should be prepared to outline implementation activities in 2- to 3-year time frames. Implementation progress should be publicized to increase awareness. Communication throughout the implementation process helps to build credibility and support. It also keeps watershed partners actively engaged, thus strengthening their accountability.

6. Measure progress and make adjustments.

   The program should then be evaluated. After the watershed plan has begun to be implemented, both water quality and land treatment need to be monitored to ensure that implementation is progressing smoothly and to measure the progress being made toward meeting the plan's goals. The evaluation will include a periodic review of the work plan activities and the monitoring results to determine if progress is continuing to be made toward achieving the plan's goals. If the implementation milestones or interim targets that were set for load reductions and other goals are not being met, adjustments should be made to the plan to make it more effective.

Regulatory Tools

Several tools are available for planners seeking to incorporate watershed planning into existing comprehensive plans or to create new land use planning programs that will benefit the target watershed. In fact, in determining what types of regulatory implementation might be needed to accomplish planning goals, planners should first examine existing land use programs and determine what changes can be made. While the watershed planning process can identify problems and set goals, policies will likely be set into place through local land use codes (Arnold, Norton, and Wallen, 2009).

Modification of Existing Codes and Ordinances

- Identify Regulatory Gaps and Opportunities
  - Assess existing regulation and the goals of the new watershed plan. Several types of questions can be asked in order to determine whether a comprehensive plan adequately provides for the protection of water sheds or water resources.
  - EPA has promulgated a Water Quality Scorecard that can help make such an assessment. The scorecard is a comprehensive tool that can be used to determine areas of concern in existing plans. The scorecard is available at: http://www.epa.gov/smartgrowth/pdf/2009_1208_wq_scorecard.pdf
  - Subdivision
- Better Site Design (Low-Impact Development) Assessments and Regulatory Goals

    - Communities seeking to protect the watershed they are a part of should look for ways to reduce the impact of development on watershed health.
    - Many Low-Impact Development practices (described in the Low Impact Development Module) and Green Infrastructure updates (Green Infrastructure Module) have been developed that significantly increase the amount of water processed on site and decrease the water demands of a site.
- Watershed based zoning
    - Zoning based on watershed boundaries reduces development that could harm water resources.
    - The steps to watershed based zoning are:
        - Conduct a comprehensive stream inventory.
        - Refine/verify impervious cover/stream quality relationships.
        - Map existing and future impervious cover at the subwatershed level.
        - Designate subwatersheds into stream quality categories based on growth patterns and attainable stream quality.
        - Modify existing comprehensive plan to meet subwatershed targets.
        - Incorporate any management priorities derived from larger watershed planning efforts.
- Areas without existing zoning
    - Watershed based planning may still be possible without comprehensive plans. In some states it is possible to adopt zoning codes without comprehensive plans.
    - Counties or cities may be allowed to regulate through subdivision codes and other sources of land use regulation.
- If no existing code exists within your jurisdiction, examine state law to find the requirements for a comprehensive zoning plan. In the alternative, inter-local partnerships could be formed, working towards mutual planning goals (Arnold, Norton and Wallen, 2009).

Ordinances Commonly Used in Watershed Planning[1]

1. Stormwater management ordinances
    a. Cities or counties add stormwater management ordinances to their land development codes.
    b. Should focus on minimizing runoff rates and volume on private land developments.
    c. Can be a crucial part of achieving compliance with the federal Clean Water Act requirements for combined sewer system management.
    d. Ordinances usually limit the area of impervious surfaces allowed in developments.

[1] A more detailed explaination is available in the Low Impact Development Module 2

    e. Can also set standards for stormwater control facilities such as retention ponds, bioswales, rain gardens, or other low impact developments (see Low Impact Development Module 2).
    f. Effective ordinances will include:
        i. Best management practices (BMPs) for stormwater management
        ii. Requiring a construction and post-construction stormwater management plans for developments.
        iii. Plans for maintaining stormwater management techniques. This is important because poorly maintained BMPs are not as effective as well maintained BMPs.
        iv. Enforcement measures.
2. Sediment and erosion control ordinances
    a. These ordinances prevent damaging pollution from sediment.
    b. Ordinances may require:
        i. Consideration of topography and soil types
        ii. Retention of natural vegetation when possible.
        iii. Sediment barriers
        iv. Biological or structural cover of exposed soil
        v. Vegetated buffers along waterways
        vi. Sediment ponds and basins to protect sites adjacent to a proposed development
        vii. Special permits for development
        viii. Mitigation of damages
3. Subdivision regulations
    a. These regulations require new suburban subdivisions to maintain certain infrastructure criteria, they can therefore be used to require development using practices that protect water resources and avoid adverse impacts on sensitive lands, water quality, water supplies, and watersheds.
    b. Site design standards should:
        i. Minimize the amount of impervious surfaces used
        ii. Promote best management practices for streets, curbs, gutters, and other drainage structures.
        iii. Require on-site stormwater management facilities.
4. Building codes
    a. Usually building codes are required by state law to meet certain requirements, but additional codes can also adopted to protect water resources.
    b. Permit limitations can restrict the number of new constructions within a certain area during a time period.
    c. Impervious surfaces can be limited by including controls on the amount of area that can be covered on a site. These limitations restrict the area allowed to be covered by roads, roofs, parking areas, and sidewalks. This allows stormwater runoff to be controlled more effectively.
    d. Mandate the use of permeable materials on exposed surfaces to increase the capture, infiltration, and treatment of stormwater runoff.
5. Development approval standards

a. Policies are more effective if they are integrated into all aspects of land use development regulation and approval.
b. This includes
c. Local governments can incorporate water quality, conservation, or runoff prevention standards into existing codes through rezoning, use permits, variances, subdivision plats, and site plans.

6. Buffer zones
    a. Create setbacks along edges of water resources where the impact of development is particularly likely and harmful.
    b. In a buffer zone development is severely restricted or prohibited.
    c. This area allows an area where pollution can be filter over-ground flows of pollutants from land to surface waters.
    d. Buffers may also minimize flooding, protect wildlife habitat, and provide recreation areas.
    e. The most effective buffers and setbacks are undisturbed and naturally vegetated strips of land that are 50 to 400 feet wide.
    f. Implementation may be by ordinances that include:
        i. Clear buffer boundaries on local planning maps.
        ii. Rules regarding maintenance of the buffer including permissible, required and impermissible vegetation and prohibiting disturbing soil in the buffer.
        iii. Tables describing buffer width adjustment by percent slope of the bank and type of stream.
        iv. Provisions clearly defining allowable and restricted uses. This may require that only structures related to use of the waterway, such as docks. Other provisions may allow development in tiered levels based on how close the development is to the waterway.
    g. Some communities allow development within a buffer only with a permit requiring mitigation of damages.
    h. Public education is important so the public will be up-to-date with appropriate land uses near water sources.
    i. Where a buffer zone is and how wide it should be depends on several factors:
        i. Steepness of surrounding land
        ii. Quantity and velocity of runoff that will enter the buffer
        iii. Vegetation present on site
        iv. Seasonal water levels
        v. Floodplains and wetlands nature and extent
        vi. Soil characteristics including infiltration and capacity
        vii. Development density adjacent to the water source
        viii. Value of the wildlife being protected.
    j. Overlay zones or distance from stream banks can be used to define the buffer.
7. Watershed or water resource overlay zones
    a. Additional restrictions within an overlay zone can be used to protect sensitive or critical areas.

b. A community can identify the area which is then mapped on the zoning map. Specific requirements are then crated that apply to the area.
c. Steps to creating an overlay zone:
    i. Establish a boundary. Topographic maps can be useful since they show the geographical area likely to affect a waterbody. Additionally, hydrological studies should be conducted to ensure the overlay zone is large enough to prevent all significant damage from the entire area draining into the waterbody.
    ii. Creating standards for use in the zone to reduce development impacts. Standards often include limitation on the area of impervious surface allowed, setback requirements from water bodies protected by the overlay zone, restrictions on hazardous material usage, septic system regulation, erosion control standards, restrictions on density, requiring cluster development.
    iii. Creating administrative standards and review procedures for developments. Some projects will be easy to review, others will require site specific review. Geotechnical and hydrological anlysis may be required to determine a projects probable impact on water quality and to determine methods for protecting water for a project. The application of standards, however, may also be incorporated into existing land use review standards.
    iv. Creating enforcement mechanisms in the overlay zone ordinance to make sure landowners and developers comply with its terms.

8. <u>Groundwater, Aquifer, Wellhead, and Sinkhole Protections</u>
    a. Underground water sources are vulnerable from many different sources including infiltration, direct migration, interaquifer exchange, and recharge from surface water.
    b. Since many people depend on drinking water from underground sources it is particularly important to protect these resources.
    c. Methods to protect these resources include:
        i. Prohibiting activities or land uses that endanger ground waters such as hazardous or toxic substance storage
        ii. Measures to control stormwater runoff
        iii. Creation of overlay zones to protect areas of groundwater recharge from particular types of land uses such as those using hazardous substances or a high ratio of impervious surfaces
        iv. Protection of specific locations affecting groundwater, such as wellheads or sinkholes.
9. <u>Wetlands regulations</u>
    a. Healthy wetlands are important to protecting the integrity of water bodies since they provide a filtering function and otherwise have an impact on the healthy operation of a watershed.
    b. Ordinances that affect stormwater management, low impact development standards, riparian buffer zones, and watershed overlay zones protect wetlands and also other parts of a watershed. However, local governing bodies may wish to adopt standards specific to wetlands.

c. Wetland specific regulations protect wetlands with measures which may include design review, review of grading and building permits, limitations on certain activities such as operation of motorized vehicles, filling, dumping, grazing, limitations on pesticide use, and prohibition of soil disturbances. They may require stormwater management plans or floodplain management plans to protect wetlands from runoff and nonsource pollution.

10. Floodplain protection ordinances
    a. Floodplains can be designated for special protections through overlay zones or standards used in the review of all development proposals.
    b. Communities often restrict development in floodplains to prevent loss of life and property during floods, to meet eligibility requirements for the National flood Insurance Program, and to protect the environmental features of the area.
    c. These ordinances should address
        i. Runoff, drainage and pollution
        ii. Functions of particular floodplain landscapes such as wet meadows, bottomlands hardwood forests, and riparian scrub wetlands.
11. Steep slope protections
    a. Slops affect drainage of runoff into waterways, and therefore these protections are often included in wetland and watercourse ordinances. They may also be free-standing ordinances or associated with overlays to protect ridge lines or hilly habitat areas.
    b. Protections should prevent erosion and landslides, decrease overall impervious cover, maintain or restore vegetation that holds soil in place, and prohibit structures and construction practices that alter the natural terrain.
    c. Provisions to protect steep slops limit building on steep slopes, require setbacks from wetlands and watercourses, and include requirements for vegetation or other protections to prevent development impacts on steep slopes.
    d. There is some danger of creating too much complexity with overlays descried earlier, especially in hilly areas. As an alternative performance standards may be used to apply to hills with greater than a certain percent slope.
12. Open space zoning, cluster development, and conservation subdivisions
    a. Wet growth regulation results in more land devoted to open space than conventional design standards.
    b. Additional open space is achieved by:
        i. Encouraging dedication of land to open space and conservation by reducing minimum lot size, setback requirements, and lot frontage distances.
        ii. Requiring a percentage of land on large development projects to be left as open space or limiting the percentage of impervious surface allowed in a development.

iii. Allowing clustered developments so common areas are devoted to open space and natural areas.
iv. Requiring cluster development for lands with sensitive natural features that should be protected

c. Conservation easements or dedications are often used to ensure space is used for recreation areas, natural conservation lands, wildlife habitat, aesthetic enjoyment, or stormwater management facilities.
d. One approach is to grant approval on the condition of dedication of open space in the amount required by the occupants of a development, requiring an amount of open space to be set aside for each person or household. If a developer does not set aside land a fee may instead be assessed. The money is then used to purchase land in another part of the community.

13. Agricultural lands conservation zoning
    a. Prime farmland should be zoned for agricultural use. This not only protects the farmland, but also results in some protection for water resources.
14. Tree preservation ordinances
    a. Codes and ordinances can be used to protect trees and to require tree planning and maintenance on site.
    b. These requirements may prevent removal of trees from development sites unless they are replaced.
    c. Tree credits may be banked and transferred.
    d. Trees of special importance may be registered for protection.
15. Forest conservation ordinances
    a. Forests play an important role in watershed protection, but are increasingly being put at risk for removal through development
    b. These ordinances:
        i. prohibit or severely restrict development forest lands, or
        ii. may require developers to create plans to protect all or parts of forests intact, or
        iii. create incentives for reforestation
16. Native landscaping ordinances
    a. Local ordinances may restrict the removal of existing natural vegetation or provide incentives to preserve vegetation in its natural state. Ordinances may also require or provide incentive for the use of native plants and trees in landscaping or the removal of non-native invasive species.
    b. Local vegetation tends to be better for water resources since it is more draught resistant generally and supports healthy ecological functioning since they are well-suited to their location.
    c. Local governments should at least review local weed and nuisance ordinances to ensure they do not prevent the use of native wildflowers, prairie plants, or warm season grasses.
17. Water conservation ordinances
    a. Through either generally applicable standards or project-by-project review landowners and developers can be required to use water-efficient designs.

b. Codes should be reviewed to remove constraints that prevent use of water-efficient designs such as rain barrels and cisterns or native landscaping.
c. Certain water usages may also be prohibited in codes.

18. Concurrency requirements
    a. Concurrency requirements allow development to proceed only if public infrastructure has adequate capacity to support the additional development. This prevents adding additional water resource demand that cannot be accommodated.
19. Real estate transfer regulations
    a. These regulations prevent the transfer of real estate unless certain water-quality or environmental conditions are inspected and approved. For example, residential onsite water and sewage disposal systems may have to be in working condition for a property to be transferred.
20. Low-impact development zoning
    a. In some communities low impact development is incorporated as a specific set of standards into their land development codes and ordinances (see Low Impact Development Module).
21. Development agreements and planned unit developments
    a. Development agreements, agreements between developers and local governments, stipulate how parties believe a project should be developed.
    b. To achieve agreement permit conditions are negotiated in exchange for the developer providing conditions that benefit the community, such as water resource protection.
    c. Planned unit developments allow large tracts of land to be developed in a way inconsistent with the underlying zoning requirements. This flexibility is useful because the developer may be able to achieve better site design than would be allowed by zoning requirements. Communities may negotiate for open space, green infrastructure, land conservation, and low-impact development methods.
22. Impact fees
    a. Impact fees require a developer to pay for the environmental impact a development will cause.
    b. Impact fees may be used to mitigate the impacts a development will have on water quality.
    c. Impact fees an encourage infill and discourage sprawl.
23. Transferrable development rights
    a. Communities can use transferable development rights to designate some areas for no development and other areas for additional development.
    b. A developer must purchase development rights from an area that is not permitted to develop. In exchange for selling development rights permanent restrictions are placed on the seller's property.
    c. Sensitive areas are protected, and at the same time additional densities are often allowed with the purchase of rights. Transferable development rights are most effective in urban areas.
24. Incentive zoning

a. Incentive zoning allows added desired elements to developers in exchange for protecting water resources or protecting open space.
b. The first step is to determine what incentives will encourage developers to alter their projects. This can be done through consultation with builders, developers, and real estate professionals.
c. Next planning regulations, such as zoning ordinances and comprehensive plans should be amended to include the incentive zoning area.
d. The incentives offered and the benefits to be provided by the developer should be spelled out in the zoning ordinance.
e. Incentive zoning works best where demand for increased density is the highest (Arnold, Norton and Wallen 2009).

Resources

1. The EPA has published an excellent resource, the Model Ordinances to Protect Local Resources, compiling ordinances effecting control of nonpoint source pollution (runoff pollution). These ordinances come from various localities and address planning goals such as aquatic buffer zones, erosion and sediment control, open space development, storm water control, illicit discharges, and source water protection. This is available at: www.epa.gov/owow/nps/ordinance
2. For a wide variety of resources, including key tools, resources, datasets, and more, go to EPA's Watershed Central: http://water.epa.gov/type/watersheds/datait/watershedcentral/index.cfm

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