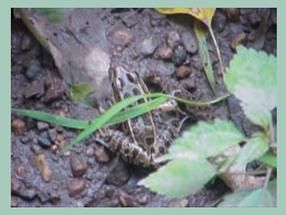

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DEQ Michigan's Nonpoint Source Program

Developing a Watershed Management Plan in the Lower Grand River Watershed

An Introductory Guide

GVMC

Grand Valley Metro Council

Developing a Watershed Management Plan in the Lower Grand River Watershed

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Acknowledgments

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DEQ Michigan's Nonpoint Source Program

Institute of Water Research
Michigan State University

MICHIGAN STATE UNIVERSITY EXTENSION

This pilot version of this guidebook was designed for ongoing use by other watershed or subwatershed associations within the Lower Grand River Watershed (LGRW). Subsequent versions are intended to be released as other watersheds and subwatersheds within the LGRW use and provide feedback for improving the Watershed Management Plan and its various recommendations, maps, guidelines, and other tools.

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Riparian: Relating to the shore area of a lake or the bank of a river or stream.

Riparian corridor: Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants requiring saturated soils during all or part of the year.

Runoff: That portion of the precipitation or irrigation water that travels over the land surface and ends up in surface streams or water bodies.

Sediment: Soil, sand, and minerals that can take the form of bedload, suspended, or dissolved material.

Soil erosion: The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by land-clearing practices related to farming, residential or industrial development, road building, and timber cutting.

Spatially referenced data: Data that is assigned specific geographic locations.

Stakeholder: Any organization, governmental entity, or individual that has a stake in or may be affected by a given approach to environmental regulation, pollution prevention, or energy conservation.

Storm water: Runoff from a storm, snow melt runoff, and surface runoff and drainage.

Superfund site: Uncontrolled or abandoned places where hazardous waste is located, possibly affecting local ecosystems or people.

Surface water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, wetlands impoundment, and seas).

Suspended solids: Sediment particles in the water column that are carried with the flow of water.

Topographic maps: Land maps that display elevation along with natural and man-made features.

Topography: The physical features of a surface area, including relative elevations and the position of natural and man-made features.

Tributary: A river or stream that flows into a larger river or stream.

Vegetative controls: Control measures or practices that usually involve the use of cropping systems, permanent grass, or other vegetative cover to reduce erosion and control.

Water quality: The biological, chemical, and physical conditions of a waterbody, often measured by its ability to support life.

Watershed: The geographic region within which water drains into a particular river, stream, or body of water. Watershed boundaries are defined by the ridges separating watersheds.

Wetland: An area that is regularly saturated by surface or groundwater and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

Wetland Mitigation Banking: Can facilitate compliance with permit requirements by providing a mechanism for the establishment of new wetland areas, or "banks," in advance of anticipated losses. Wetlands established in a mitigation bank provide "credits," which can be sold to permit applicants, or used by the bank sponsor to meet permit conditions.

Contents

Introduction 1

Chapter 1 Identifying and Networking with Local Agencies and Citizens 3

Chapter 2 Getting to Know Your Watershed 7

Chapter 3 Defining a Critical Area 12

Chapter 4 Surveying the Watershed to Inventory Your Critical Area 14

Chapter 5 Prioritizing Pollutants, Sources, and Causes 16

Chapter 6 Determining Goals and Objectives for Your Watershed 18

Chapter 7 Identifying Best Management Practices Needed 19

Chapter 8 Identifying and Analyzing Existing Projects, Programs, and Ordinances 21

Chapter 9 Informing and Involving the Public 23

Chapter 10 Developing an Evaluation Process 25

Chapter 11 Assembling Your Watershed Plan 27

Appendix Glossary of Terms 29

Bibliography 31

Glossary of Terms

Best management practices (BMPs): Structural, vegetative and managerial practices implemented to control nonpoint source pollution.

Confluence: Point at which two or more watercourses intersect.

Critical area: That part of the watershed that is contributing a majority of the pollutants and is having the most significant impacts on the waterbody.

Designated uses: Recognized uses of water established by state and federal water quality programs.

E. coli: Bacterium used as an indicator of the presence of waste from humans and other warm-blooded animals.

GIS: Geographic Information System: A system that analyzes and models data in a spatial context and displays digitally created map layers.

GPS: Global Positioning System: A system capable of providing worldwide navigation and positioning by pinpointing locations.

Groundwater: The subsurface water supply in the saturated zone below the water table.

Headwaters: The origin and upper reaches of a river or stream.

Hydrologically distinct: Defined by drainage basins or watersheds rather than by political boundaries.

Impervious: A surface through which little or no water will move. Impervious areas include paved parking lots and rooftops.

Infiltration: The penetration of water through the ground surface into subsurface soil, or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Lower Grand River Watershed Project: A federally funded grant awarded to the Grand Valley Metropolitan Council from July 2002 through September 2004 to develop a Watershed Management Plan for the Lower Grand River Watershed. The Lower Grand Watershed Management Plan was developed through the Lower Grand River Watershed project and identifies the major water quality impairments in the Watershed. This WMP presents a process for others to use in creating their WMPs.

Nonpoint source pollution: Pollution caused when rain, snowmelt, or wind carries pollutants off the land and into the water bodies.

Nutrients: Mostly nitrogen and phosphorus, which are essential for all life forms. High nutrient concentrations interfere with recreation and aesthetic enjoyment of water resources by causing reduced water clarity, unpleasant swimming conditions, objectionable odors, and blooms of toxic and nontoxic organisms.

Point source: The release of an effluent from a pipe or discrete conveyance into a waterbody or a watercourse leading to a body of water.

Pollutant: Any substance of such character and in such quantities that when it reaches a body of water, soil, or air, it contributes to the degradation or impairment of its usefulness or renders it offensive.

Although not confirmed as a pollution source of *E. coli* bacteria and nutrients in the waterbody, failing septic systems are of concern to the public health department. The number of improperly operating septic systems is not known. However, there are three areas totaling 23 acres within the critical area where it is suspected that septic systems fail.

Assembling the Plan

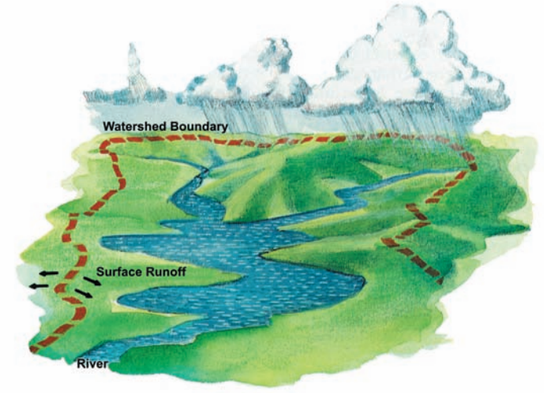
In addition to the products that have been developed throughout the previous chapters, a WMP should present a complete picture of the watershed. As you assemble your plan, keep in mind that a person with limited knowledge of the watershed should be able to read the plan and understand the needs and proposed solutions for effectively managing and restoring all designated uses in the watershed.

The ultimate outcome of your plan is an action-oriented approach to addressing water quality in the watershed. Use your plan to seek funding sources for implementation. Remember that your plan is not static and may change as implementation proceeds. Work with your steering committee to review the WMP periodically to ensure that tasks are being implemented and that the plan is updated.

Your water quality summary should include a narrative for each designated use that is impaired or threatened, describing the relationships among the designated use, pollutants, sources, and causes. Your summary should also quantify the sources based on the inventory and priority they received.

Introduction

This guidebook was written to help local units of government, watershed organizations, and citizens understand the process for developing a Watershed Management Plan (WMP). It is a goal of the **Lower Grand River Watershed Project** to inspire and facilitate other watershed projects. The large scale of the Lower Grand River Watershed Project has made it possible to develop a vision for the entire basin so that subwatershed projects can work together to meet a common goal.



A watershed is an area of land that drains to a common body of water.

The Lower Grand River Watershed ("the Watershed") covers ten counties across West Michigan. Within the Watershed's boundaries are the Rogue, Flat, and Thornapple rivers along with numerous smaller tributaries that are part of Michigan's longest river system. Creating a plan on how to manage the water resources contained in such a large area would not be an easy task. The resulting document would likely be many volumes and take decades to produce. Therefore, a different approach to managing the Watershed's resources has been taken.

There are many tributaries in the Watershed that can be defined as unique subwatersheds. Since each of these subwatersheds is geographically smaller, each will have fewer groups of stakeholders, definable water quality problems, and more local interest. It is at this scale that citizens can develop a WMP.

The purpose of a WMP is to provide an action-oriented strategy enabling local governments and other stakeholders to meet water quality standards. The process for developing a WMP is not established by the Michigan Department of Environmental Quality (MDEQ). However, to be eligible for grant funding from this agency, organizations must include certain elements in every WMP. This guidebook explains the steps for developing a WMP to meet MDEQ requirements. The steps included are based on a planning process used successfully by MDEQ grant recipients since 1995. Watershed planning is an iterative process, so the order in which the steps are completed will vary. Use this guidebook as a general guide and adapt it to fit your needs.

Available Tools

The Grand River is appropriately named. The Grand River is more than just the longest river in Michigan. It also holds vast natural resources for outdoor recreation, a rich history, and diverse concerns for communities and water quality. No plan can adequately provide a solution for managing the entire basin. However, at the basin-wide scale a vision for the entire Grand River can be established. This will require additional planning and strategy development at the subwatershed scale.

While implementing a WMP at the subwatershed level results in the most efficient strategy for watershed restoration, it is often difficult to mobilize the necessary resources to initiate local planning efforts. The Lower Grand River Watershed Project has a series of interactive planning tools to help watershed managers at the subwatershed scale. Watershed managers are encouraged to use this guidebook and its interactive planning tools to develop a subwatershed management plan. Using these tools will result in subwatershed management plans for the Lower Grand River Watershed that share similar characteristics, strategies, and vision.

Using the watershed management plan and the Guidebook

The Lower Grand River Watershed Management Plan is designed to offer background about the entire watershed. Using this plan and guidebook will help create strategies needed to implement watershed management activities in a subwatershed. Refering to the Lower Grand River WMP will help plan goals and objectives for a subwatershed that fit the vision for the entire river basin. This process will ensure that all subwatershed management projects that occur within the Lower Grand River Watershed will be working to uphold similar goals for water quality. Before beginning a project, contact the Water Bureau, Grand Rapids District Office of the Michigan Department of Environmental Quality (MDEQ).

Watershed Assessment Matrix (WAM)

The Lower Grand River Watershed has been divided into 136 unique subwatersheds. This division is based on hydrologic units developed by the United States Geological

Survey (USGS). These subwatersheds are each about 20 square miles, an excellent size for implementing subwatershed management plans.

The WAM is a collection of the available data and resources for each subwatershed. Users of the WAM will find information about the availability of water quality data, land use types, existing planning strategies, and groups of stakeholders for each subwatershed. The information contained in the WAM is linked to other interactive planning tools so that users can customize their use to the subwatershed of interest. The WAM provides all the information you would need to start writing a water resource-related grant or developing a subwatershed management plan. When combined with the Watershed Interactive Map (WIM), described below, the WAM gives users an accurate picture of conditions in each subwatershed. The WAM can be accessed at www.gvsu.edu/wri/isc/lowgrand/wit/plan.htm.

Watershed Interactive Mapping (WIM)

Another obstacle for developing WMPs in the past was the difficulty of creating professional looking maps using current geographic data. Today geographic information systems (GIS) software can be used to download information about roads, streams, land use, soils, and government boundaries from the Internet.

This up-to-date information can then be used to create accurate maps showing the relationships among map layers. By overlapping these layers, a GIS map can show areas where farming is occurring in highly erodible soils, where nonpoint source pollution would likely result, or where residential development is placed in areas with poor septic suitability.

A GIS software program is essential for developing a WMP that meets today's expectations for accuracy and detail. However, these software systems and the computer hardware needed to run them are cost prohibitive for small watershed groups. This hurdle has been overcome by the development of an online GIS mapping tool called Watershed Interactive Mapping (WIM).

The WIM tool provides users with all the GIS information available for each subwatershed. This information can be displayed on any computer with an Internet connection. Users of the WIM can access data from the WAM to create inquiries about the availability of other resources and to obtain characteristics about each subwatershed. The WIM can be accessed at www.gvsu.edu/wri/isc/lowgrand/wit/plan.htm.

Watershed Action Plan (WAP)

In most cases, local governments and other stakeholders achieve the goal of meeting water quality by using best management practices (BMPs). BMPs can be structural, such as detention basins; vegetative, such as rain gardens; or managerial, such as zoning ordinances. Selecting the appropriate BMP to meet water quality needs can be difficult because BMPs are often site specific and information about BMP effectiveness is not always available.

The WAP is an electronic tool that helps watershed managers prioritize water resource use, pollutants, and pollution sources to select the most appropriate system of BMPs. The WAP provides links to information about designated uses, hydrology, BMP characteristics, and land preservation techniques. While using the WAP, you may want to refer other tools for additional information to help you make decisions. Switching between tools is easy since prompts throughout the decision-making process will lead you through using the WAP and associated planning tools. The WAP can be accessed at www.gvsu.edu/wri/isc/lowgrand/wit/plan/htm.

Watershed Interactive Tool (WIT)

The Watershed Interactive Tool is a Web-based tool for local decision makers, educators, students, and residents of the Lower Grand River Watershed. This tool incorporates information about watershed management, natural history, interactive mapping, general watershed concepts, lesson plans for watershed education, government resources, and local water issues. The WIT also provides information to local units of government and nonprofit entities on how to write their own nonpoint source management plan. The WIT can be accessed at www.gvsu.edu/wri/isc/lowgrand/wit/index/htm.

Whenever possible, this guidebook offers suggestions on how to use interactive tools in the planning process.
Look for the green boxes with the tool logo  throughout this document for helpful hints on what tools to use to get. There are also examples of other watershed projects in the Lower Grand River Watershed that may help in the planning process. These examples are found in the blue boxes with the  watershed logo.

Chapter Objectives

- Add any missing tasks
- Refine the water quality summary
- Assemble the watershed plan

Chapter Product

❑ The watershed management plan document, including the final water quality summary

Introduction

In this chapter you will complete your plan by integrating the chapter products developed throughout the planning process and adding a few more tasks. You will also finalize your water quality summary.

What information is needed to complete your WMP?

By now you should have a table of tasks, responsible parties, milestones, timeline, and estimated costs for all objectives for all of your goals. You may want to combine your tables from chapters 7 through 10 into one table.

To complete your table, add the following as appropriate for your watershed:

- Tasks for verifying any remaining suspected pollutants, sources, and causes (see Chapter 4)
- Tasks for achieving desired use goals
- Tasks related to project coordination and administration

What is included in the final water quality summary?

Using the information gathered in the previous chapters, you should modify and finalize the initial water quality summary written in Chapter 2. The final summary provides an accurate picture of the watershed and a clear link between the goals and conditions in the watershed. It includes the designated and desired uses, and detailed information about the pollutants, sources, and causes, and the goals of the watershed plan.

Example: Water Quality Summary (Final)

The example watershed has three designated uses that are impaired: (1) partial body contact recreation, (2) aquatic life/wildlife, and (3) warmwater fishery. The designated use public water supply is threatened.

Project Goals

Restore partial body contact recreation use by: (1) excluding 75 percent of the livestock from uncontrolled access, (2) instituting a residential nutrient lawn care program that properly manages fertilizer application and reduces the total amount of fertilizer used by 25 percent.

Additional goals based on the remaining impaired or threatened designated uses should also be stated.

Recreation

The designated use of partial body contact recreation is impaired due to undesirable algae and *E. coli* levels. The sources of nutrients include: (1) livestock in the stream, (2) residential fertilizer, and possibly (3) failing septic systems. The sources of *E. coli* bacteria include: (1) livestock in the stream, and possibly (2) failing septic systems.

There are 42 livestock operations in the watershed, but only 17 are located within the critical area. Of those, 12 livestock operations allow uncontrolled access to the waterbody. These are significant sources of both *E. coli* bacteria and nutrients.

There are 1,200 acres of residential lawn area within the critical area that receive intensive lawn management. Approximately 625,000 pounds of 25-5-5 (N-P-K) fertilizer or equivalent is applied annually to these lawns. Frequently, fertilizer is misapplied and/or overapplied so that runoff carries nutrients to the waterbody. These nutrients contribute to increased enrichment of the water.

How do you package this evaluation information?

To have a DEQ-approvable watershed plan, you must have a description of the process that will be used to evaluate the effectiveness of implementing your plan. You may do this in the form of a narrative that describes the evaluation plan – or to better ensure that evaluation occurs, you can add it to the table of objectives, tasks, responsible party, milestones, timeline, and estimated costs.

New EPA Minimum Elements
Developing a set of criteria

A set of criteria is needed to determine whether loading reductions are being achieved over time and whether substantial progress is being made towards attaining water quality standards – and, if not, the criteria for determining whether the watershed plan needs to be revised. The criteria for loading reductions *do not* have to be based on analytical water quality monitoring results. Rather, indicators of overall water quality from other programs can be used. The criteria should be based on the milestones and water quality changes. Examples include 1) increased time between dredging a river mouth as an indication of reduced sediment rates, 2) fewer beach closings as an indication of reduced *E. coli* levels, 3) student monitoring results, and 4) improved fishery as demonstrated by creel surveys.

Evaluation Methods Used by Michigan Watershed Projects

Methods	MI Example(s)*	Measures	Pros and Cons	Mode
Survey	Huron River Watershed, Little Rabbit River Watershed, Allegan County	Opinions, attitudes, beliefs, behaviors	Moderate cost, relative ease of implementation	Mail, telephone, or group setting (meeting)
Focus group	Davis Creek Watershed, Kalamazoo County	Perceptions, feelings, opinions, thoughts	Moderate cost, fast way to get public opinions	Small groups of 7–10, represent community
Interviews	North Branch Chippewa River, Isabella County	Opinions, beliefs, attitudes	Hear individual opinions; some may be more open to a one-on-one than in a group setting, more costly in time and resources	One-on-one meeting
Photographic	Bear Creek, Macomb and Oakland counties; Boardman River, Grand Traverse County; Au Sable River	Before and after results	Easy to do, moderate costs	Visual evidence with photos
Calculations or models	Higgins Lake	Physical outcomes (e.g., erosion rates)	Moderate costs, relative ease of implementation	Manual calculations, computer models
Monitoring	York Creek, Kent County	Environmental impacts	Measures change but is more costly and longer term, requires expertise and extensive planning, monitoring may not show results for five to seven years after project completion	Physical sampling and lab analysis using accepted protocols
Water sampling	Donnell Lake, Cass County; Sycamore Creek, Ingham County; Willow Creek, Ingham County	Dissolved oxygen, pH, metals, nutrients		
Biological or aquatic life	Pine Creek, Dickinson County; Nottawa Creek, Calhoun County	Insects, habitat, fish		

New EPA Minimum Elements
Developing a monitoring plan

A monitoring component is needed to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established to determine whether loading reductions are being achieved over time. The monitoring component should include required project-specific needs (the criteria being used to determine whether loading reductions are achieved over time), and local monitoring efforts, and it should be tied to the State water quality monitoring efforts (i.e., environmental, social, administrative, and water quality elements). Examples include 1) social surveys (and follow up) for homeowners, officials, students, and farmers, 2) number of grants received and money committed, 3) water quality and ecological trend results (both ambient monitoring and indica

Chapter 1: Identifying and Networking with Local Agencies and Citizens

Chapter Objectives

- Identify water quality concerns
- Identify other groups or individuals with similar concerns
- Form a steering committee
- Identify a lead organization
- Discuss all existing and perceived concerns
- Define the geographic scope of the watershed
- Modify committee membership based on the geographic scope of the watershed
- Begin to develop a resource library

Chapter Products

- ❑ A watershed steering committee, lead organization, and other committees
- ❑ A description of the watershed and a map with the watershed boundaries
- ❑ A resource library

How do you begin a watershed project?

If you are interested in starting a watershed management project to protect water quality, your first step is to identify your water quality concerns and find individuals or organizations who have similar concerns. Begin by contacting the people and organizations that you know. If they have an interest in water quality, they may be potential partners who can assist you with the watershed planning process.

Once you have contacted the people you know, consider other groups that may be interested in addressing water quality. Anyone who may have a stake in the watershed plan should be encouraged to share their concerns and offer suggestions for possible solutions. By involving **stakeholders** in the initial stages of

project development, you will be helping to ensure long-term success. Consider contacting the potential stakeholders listed in the box below to determine whether they have water quality concerns. They may also be aware of other individuals who might be interested in helping with the project. Then hold a meeting of all interested stakeholders to discuss concerns.

Potential Stakeholders

County/Regional Representatives
- Conservation District
- Grand Valley Metropolitan Council
- County Health Department
- Drain Commissioner
- Michigan State University Extension
- Planning Commission
- Road Commission
- Watershed Councils
- Resource Conservation & Development (RC&D) Councils
- County Board of Commissioners
- County Administrations
- County Farm Bureaus

Local Government (Municipality/Township) Personnel
- Managers/Supervisors
- Engineers
- Public Works Staff
- Parks and Recreation Staff
- Planners

State and Federal Agencies (Local Representatives)
- Michigan Department of Environmental Quality (DEQ) Water Bureau Nonpoint Source Program Staff
- Other DEQ Divisions
- Michigan Department of Natural Resources
- Michigan Department of Agriculture
- Michigan Department of Transportation
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- USDA Natural Resources Conservation Service

Business Representatives
- Developers/Home Builders Association
- Industries and Businesses
- Local Agribusiness
- Recreational Groups and Associations

Citizen Groups
- Churches
- Civic Organizations
- Homeowner/Neighborhood Associations
- Landowners
- Watershed Groups and Organizations
- Riparian Property Owners

Media
- Newspapers
- TV and Radio

Nonprofit Organizations

Foundations

Universities, Colleges, and Schools

Environmental and Conservations Groups

Who should serve on the watershed steering committee?

Steering committee membership, roles, and responsibilities vary depending on water quality conditions and the interest of individuals. Invite interested stakeholders to serve on the steering committee. Usually, one representative per stakeholder organization or agency is included. The steering committee should at a minimum include the individuals in the watershed who have some authority to implement change, since their participation and commitment are likely to be critical to the successful implementation of the watershed plan. You should also include people who will be affected by the change.

There is no predetermined size for the steering committee. You might begin the planning process with 20 to 30 stakeholders and end up with an active steering committee of seven to ten people. Alternately, your initial stakeholder group may be very small, increasing in size as groups and individuals are encouraged to participate.

Projects often begin with a large number of interested people in the early stages of the watershed planning process. More interest at the onset increases the chance that the individuals and agencies necessary to complete the project are already present. Initial public interest is also useful for future information and education activities.

At the first steering committee meeting, review the list of concerns developed during the stakeholders' meeting and add any additional concerns. All suggestions should be recorded.

Once the list is complete, use it to evaluate the steering committee membership. Given the existing and perceived concerns about the watershed, are the steering committee members those who can make decisions and influence change? If not, contact the missing stakeholders and invite them to participate. Keep in mind that as concerns are identified and the plan is developed, the membership of the committee may change.

Who should lead the steering committee?

Once the steering committee is in place, the next step is to identify a lead organization. This may be your organization or agency, or another organization represented on the committee. The leader's role is to ensure that the watershed planning and implementation process continues to move forward. The most appropriate organization to lead the effort is the one that can represent the entire project area, and that has the staff and resources necessary to carry out the plan.

The most appropriate lead organization also depends on the priority concerns within the watershed. For example, if land use in the project area is predominantly agricultural, it may be appropriate for the local conservation district to provide leadership. If the primary concern is urban **storm water**, a drain commissioner's or township office might be an appropriate lead organization.

How should the steering committee operate?

To ensure that meetings run smoothly, it is important to identify some basic roles and responsibilities for the steering committee. For example, someone should serve as secretary to document the important decisions made at the meetings and distribute them to the group. If the group prefers to use an easel or chalkboard during meetings, you may need a note-taker for that purpose.

Some steering committees operate informally, while others use formal partnership agreements. You will have to decide on the most appropriate structure for your group. The committee also needs to decide how they will make decisions—by majority vote, by consensus, or through another agreed-upon process.

Rogue River Watershed

The Rogue River Watershed Project formed two committees: the Watershed Advisory Council and a Technical Committee. The Watershed Advisory Council was made up of representatives from agencies and organizations that have authority to make decisions and influence change. The Technical Committee consisted of representatives from local government and agencies with professional experience in implementing management practices. Later, a subcommittee formed under the Watershed Advisory Council to focus on watershed stewardship. By having a number of committees, the project team could delegate responsibilities to the committee members with the experience most suited for the task. Remember to maintain communication among committees to minimize duplication of work.

Chapter 10: Developing an Evaluation Process

Chapter Objectives

- Understand why evaluation is important
- Understand methods for evaluation
- Select an evaluation method or methods for your watershed

Chapter Product

❑ An evaluation process based on the goals, objectives, and tasks of the watershed plan

Introduction

Evaluation is an important part of watershed planning. It can tell you whether or not your efforts are successful and provide a feedback loop for improving project implementation.

Why should you conduct an evaluation?

A well-planned evaluation process will provide measures of the effectiveness of implementing the WMP. If you are able to show results, you will gain more support from the community and increase the likelihood of project sustainability. Evaluation can show:

- Changes in knowledge or awareness of water quality issues
- Changes in attitudes or behavior
- Which best management practices were adopted and which were not
- Changes in the condition of the watershed
- Improvements in water quality

What methods are available?

There are several evaluation methods to consider, each with pros and cons. Some methods are more complex or costly to use, while others require special expertise to be effectively implemented. Evaluation methods include:

- Physical water quality monitoring, such as temperature and streamflow
- Chemical water quality monitoring, such as metals, nutrients
- Biological life measurements, such as insects, habitat, fish
- Photographic or visual evidence, such as before-and-after photos
- Compilation of the number and location of BMPs implemented
- Pollutant loading reduction measurements
- Stakeholder surveys, such as baseline and follow-up surveys, to evaluate changes in knowledge or behavior
- Focus groups, to determine effectiveness of project activities

How do you select your evaluation methods?

Select evaluation methods as you are developing your plan. The appropriate methods depend on the objectives and tasks you are evaluating. For each objective or task selected, ask the following questions:

- How can effectiveness be measured?
- If it can't be measured directly, are there other indicators that can be measured?

For each task, answer the questions above, and then review the evaluation methods used by Michigan watershed projects to select the best method. For example, if you are evaluating the effectiveness of certain BMPs installed in the watershed, then methods for calculating, modeling, or monitoring reductions in pollutant load may be appropriate. If you are evaluating changes in attitudes and behaviors to determine the effectiveness of your education program, then before-and-after implementation surveys, interviews, and focus groups may be the preferred methods. Because watershed plans contain a mix of activities, you will probably need more than one evaluation method.

When do you conduct the evaluation(s)?

Once you know what you are evaluating and what methods will be used, the next step is to determine a timeline for each of the evaluation methods you identified. Generally, there are two times to evaluate. One is during the implementation of project activities. The purpose of this evaluation is to provide feedback on project activities so that changes can be made, if needed, to increase their effectiveness. The other time to evaluate is after the project activities have been completed. The purpose of this evaluation is to provide some measures of project effectiveness. For each evaluation method, determine an appropriate timeline.

What do you need to conduct the evaluation and who should do it?

The final step in developing the evaluation process is identifying the specific information needed to conduct the evaluation. For example, if you wish to do any before-and-after comparisons, you must have baseline information with which to compare the final results. If you wish to provide feedback during the project, you should ask about the barriers that are being encountered and whether tasks are effectively being implemented. Determine the information you need for each of your evaluation methods.

What messages will be developed to encourage your target audiences to change behaviors?

The objectives of your strategy will involve raising awareness; educating people on watershed problems and solutions; and motivating people to participate in activities to protect, improve, or restore your watershed. To achieve these objectives, your I&E program will need to communicate effectively with the wide range of audiences that make up your watershed's community. Specific themes should be developed to raise awareness of watershed issues. These messages should be repeated frequently to make an impact on the audiences.

How do you deliver the messages to the target audience?

Delivery mechanisms for each target audience should be chosen based on how each group typically accesses information, and who or what they consider to be reliable sources of information. Several delivery mechanisms are identified in the I&E Guidebook.

You can use the following list to begin selecting delivery mechanisms that will effectively reach your target audiences.

- Project Logo
- Brochure
- Fact Sheets
- "Did You Know" Questions or Factoids
- Web Sites
- Watershed Interactive Tool (WIT)
- Media
- Local Newspapers
- Public Access Channels
- Area Newsletters
- Newsletters/News Inserts
- Billboards
- Slide Show
- Watershed Presentations
- Give-a-Ways
- Watershed Fair
- Watershed Calendar
- Volunteer Monitoring Programs

How do you know if your messages are being heard?

Evaluation provides a feedback mechanism for continuous improvement of the I&E program. Evaluation tools must be built into the program at the beginning to ensure that accurate feedback is generated. Indicators of success should be developed throughout the planning and implementation process to help determine whether the objectives have been achieved. The indicators selected must include several parameters, not just the number of brochures mailed out or how many people attended a meeting. To successfully determine if the objectives were met, a pre/post survey, focus groups, interviews, and questionnaires can be useful. Effective evaluation of I&E products and activities provides an opportunity to change your strategy, if needed. The I&E Guidebook provides potential evaluation methods, a worksheet to evaluate I&E products, and materials for tracking tasks, products, and activities.

Watershed Interactive Tool (WIT)

The WIT, a Web-based interactive tool, can be used to locate information for your I&E program. The WIT provides information on the LGRW project, natural history of the LGRW, general watershed concepts, lesson plans for watershed education, government resources, information on local water issues, and much more. These resources can be used to raise awareness and educate target audiences.

What is the role of project committees?

Soon after the development of your steering committee, you can develop additional committees to support the project. Urban and rural committees can be developed to help the project focus on the distinct land use characteristics and issues in your watershed. These committees can provide assistance in identifying systems of best management practices (BMPs) and characterizing the water quality concerns in urban and rural areas. A technical committee can serve as an advisory council to the other subcommittees, providing technical information and reviewing systems of BMPs recommended by the rural and urban committees. An information and education committee can be responsible for soliciting participation for the watershed planning process, implementing public outreach activities, and designing a strategy for public outreach and education.

A sustainability committee can create a strategy to sustain the project into the implementation phase and beyond. This approach could include the development of a vision and mission statement, identification of future funding sources, and a strategy for creating a watershed organization.

How do you determine your geographic scope?

Once a steering committee has formed and has identified stakeholder concerns, it will need to determine the geographic focus of the watershed. The size of the watershed project can depend on many factors, like types of land use, stakeholder concerns, and watershed characteristics. For example, stakeholders may have become concerned that their favorite

trout stream was being choked with sediments. After looking at land use in the watershed, they may find that the problems are coming from on one tributary of this stream system. If the entire watershed covers many miles and government jurisdictions, it may be beneficial to focus attention on just the tributary causing the sediment problems.

The Lower Grand River Watershed Project is very large, but it was intended to serve as a catalyst for smaller subwatershed projects. The MDEQ reports that most watershed projects range in size from two to several hundred square miles. The scale of your project can vary; it should be large enough to encompass the entire problem, yet small enough to manage with your resources and expertise.

An appropriate watershed boundary is a boundary that is hydrologically distinct. Your watershed might be:

- An entire river system, including all lakes and tributaries draining into the river.
- A river tributary from its headwaters to its confluence with the main branch of the river.
- A segment of river from its headwaters to a dam, or confluence of a tributary.
- A lake watershed, including all contributing tributaries.

Watershed Interactive Mapping

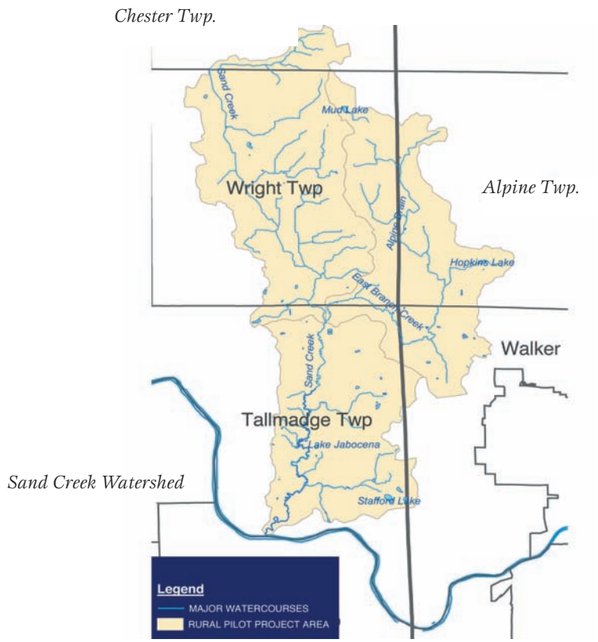
A good map is a very useful tool in developing a WMP. The watershed map will show governmental boundaries, surface water features, roads, and the watershed boundary itself. However, creating a watershed map can be difficult since maps that are readily available do not have watershed boundaries. The Watershed Interactive Mapping tool will meet your geographic information needs. Not only can you create a map of the watershed boundary, but you can also generate maps of land use, soil types, and wetland areas, and you can tell how many acres your watershed will include. To access the mapping tool, go to the following website: www.gvsu.edu/wri/isc/lowgrand/plan.htm. If you need help getting started, a great tutorial is available on this site.

A report to the U.S. Environmental Protection Agency (EPA) in 1996 revealed that barriers to successful watershed planning exist depending on the scale of the project. Large watershed projects often have difficulty coordinating local governments and setting water quality goals for the diverse problems that face large geographic areas. Conversely, small watershed projects often lack the scope to address regional problems and sometimes create worsened conditions in other areas. The report recommends a solution to this paradox by planning on both scales. Large-scale or basin-wide planning is needed to establish regional goals and objectives, and small units are needed for the implementation phase (Adler, 1996).

Watershed Map

A watershed map should clearly show the watershed boundaries and the location of all surface waters (lakes, rivers, streams, and wetlands). The development of the map is an appropriate task for the technical committee. Topographic maps can be used to delineate the watershed, or you may use the online mapping software, Watershed Interactive Mapping (WIM), created for the Lower Grand River Watershed Project.

The other option, if your committee has the necessary technology and expertise, is to produce the maps using a **Geographic Information System (GIS)**, by referencing information from the Michigan Center for Geographic Information (CGI) and other available data. For more information about Michigan's GIS services, go to the State of Michigan Web site (www.michigan.gov), click on the "State Web Sites" link in the title bar, then click on the link to the Center for Geographic Information.



What do you do with the information you collect?

Use the information you collect throughout the planning process to develop a resource library, and encourage steering and technical committee members to contribute information to it. A central location for the information allows access to everyone involved in the project. The best location for the library may be the lead organization's office. This information should also be deposited in the Watershed Assessment Matrix to give all stakeholders in the Lower Grand River Watershed access to your resources.

Information that you might want in the resource library includes:

- All data used to develop the watershed description
- Population and economic trends
- Information about other ongoing environmental and conservation projects in the watershed
- Information from other watershed projects
- Local land use plans, water quality regulations, and ordinances

Chapter 9: Informing and Involving the Public

Chapter Objectives

- Identify target audiences
- Develop messages for the target audiences
- Select delivery mechanisms for disseminating the messages
- Use this information to develop an information/education strategy for your watershed

Chapter Product

❑ An information and education strategy for your watershed that involves the public and stakeholders

What is an information and education strategy and how will it help?

An information and education (I&E) strategy is a tool used to inform the public and motivate them to take action. It is a coordinated strategy tailored to the specific water quality concerns and people within your watershed.

An I&E strategy is needed because the majority of behavioral changes that will be needed to address the sources and causes of pollution in the watershed will be voluntary, rather than required by law. And before individuals will consider changing their behavior, they need to understand the watershed concerns and how their individual activities can play a role in protecting the quality of their water. A well designed and implemented I&E strategy will improve public participaton in your watershed project, because it will provide information to the individuals who are most likely to have an impact on water quality and motivate them to make necessary changes.

Lower Grand River Watershed Project

An I&E strategy was developed for the LGRW to help motivate stakeholders, residents, and decision makers to take the actions necessary to protect water quality and improve environmental conditions in the watershed. The I&E strategy serves as a working document that outlines the major steps and actions needed to successfully maintain and improve water quality and environmental conditions. There are two major sections of the strategy. The first section outlines the I&E strategy used during the planning phase, while the second section recommends an I&E strategy for implementation for the LGRW. The I&E strategy for the LGRW can be found in Chapter 4 of the LGRW Management Plan.

How do you develop an I&E strategy in your watershed?

Through the LGRW Project, an I&E Guidebook was developed to assist communities in developing their own I&E strategy based on the goals and vision of the LGRW Project. The I&E Guidebook outlines the major steps and actions needed for a community to successfully develop an effective I&E strategy, specifically for subwatersheds in the LGRW.

The strategy identifies potential I&E activities to address potential watershed pollutants, target audiences, a proposed timeline, cost estimates, and methods of evaluation. Contact information for various potential project partners and target audiences is provided. The guidebook also includes worksheets and checklists, and identifies pertinent references and programs to help your I&E efforts. A copy of the I&E guidebook can be found as an appendix to the LGRW Management Plan.

How do you select your target audiences?

Based on the pollutants, sources, and causes identified in your management plan and active stakeholders participating in your project, target audiences can be identified. A key target audience is a group whose support is needed to achieve watershed quality goals.

Some groups can be very broad, while others will be very specific. Basic demographic information can be gathered from public sources such as the United States Census, but very specific details need to be uncovered through interviews and focus groups. The I&E Guidebook provides additional information on how to identify, characterize, and prioritize target audiences.

What do you do with the information collected?

The purpose of researching the projects, programs, and ordinances in your watershed is to determine what is already being done and what can be improved upon to protect water quality and meet the goals of your watershed plan. Once you have identified gaps or opportunities for new activities, define tasks that will be included in your WMP.

For example, if one of your goals is to protect the warmwater fishery, your research may have shown that a local ordinance requires that new homes be set back 25 feet from the river. A subsequent task in your WMP might be: "Work with the township to increase the setback to a minimum of 100 feet."

Programs for Wetlands

Wetlands created to mitigate the loss of wetlands through the regulatory process can be created on a case by case basis, or they may be banked. Banked wetlands are constructed or restored in advance of losses through the State's regulatory program and then sold or used as needed. Mitigation banking is a relatively new concept but one that is becoming more and more popular. Mitigation banking has the potential to greatly improve the quality of constructed wetlands in Michigan. Wetland mitigation banking may provide an economically viable way of including wetlands within a WMP. For more information on wetland mitigation, go to the MDEQ website (www.michigan.gov/deq), and click on "water," then "Wetlands Protection," then "Wetland Mitigation Banking."

Chapter Objectives

- Identify designated and desired uses for your watershed
- Identify pollutants in your watershed
- Identify sources of pollutants in your watershed
- Identify causes of pollutants
- Develop goals based on designated and desired users
- Develop an initial water quality summary

Chapter Product

❑ A water quality summary of designated and desired uses, known and suspected pollutants, sources and causes, and overall goals

Introduction

Once your steering and project committees have been organized, the next step is to work from the list of water quality concerns and learn about your watershed. This chapter will help you understand the water quality in your watershed and help you determine goals for your watershed that focus on quality of water. You will also develop a water quality summary that will serve as the foundation of your WMP.

What are designated uses and how will they help you identify water quality concerns?

The primary criterion for water quality is whether the waterbody meets designated uses. **Designated uses** are recognized uses of water established by state and federal water quality programs. In Michigan, the goal is to have all waters of the state meet all designated uses.

All surface waters of the state of Michigan are designated and protected for all of the following uses:

1. Agriculture
2. Industrial water supply
3. Public water supply at the point of intake
4. Navigation
5. Warmwater fishery*
6. Other indigenous aquatic life and wildlife
7. Partial body contact recreation
8. Total body contact recreation between May 1 and October 31

*Certain water bodies are also protected as a coldwater fishery
. Citation: R323.1100 of Part 4, Part 31 of PA 451, 1994, revised 4/2/99

To evaluate all designated uses, your steering and project committees should gather as much information as they can about the watershed. For example, if a Department of Natural Resources Fisheries Division survey reports that sediment from stream bank erosion is filling in spawning areas and decreasing fish productivity, then the *warmwater fishery* designated use may be impaired. For all water quality concerns in your watershed—including both verified and perceived concerns—the steering and/or technical committee should identify the designated uses that are impaired.

Who can help you determine whether the waterbody is meeting its designated uses?

Sand Creek Watershed Concerns	*Impaired Designated Uses*
Eroding road-stream crossings and flooding	Aquatic life/wildlife
Livestock in streams	Partial body contact
Poor fishing	Coldwater fishery

The DEQ Water Division Nonpoint Source Program staff can provide water quality data about various watersheds. The assistance they provide can be supplemented with other contacts in the community based on the pollutants you identify. For example, if the newspaper has reported elevated ***E. coli*** levels, you might contact your local health department to verify that those levels exceeded water quality standards (i.e., to verify that the designated use, *total and/or partial body contact recreation*, is impaired).

Will your water meet designated uses in the future?

In some cases, activities and resulting pollutants in the watershed may prove to be a threat to water quality. Threatened water bodies are defined as those that currently meet water quality standards but may not in the future. For example, if a major residential or commercial development will be occurring in the future, **soil erosion** from the construction site may threaten the *coldwater fishery*. In this case, sediment from development activities should be identified as a potential threat.

The Importance of Wetlands

Wetlands are unique and varied ecosystems that constitute a transitional zone between uplands and open water habitats. Wetlands are among the most biologically productive and valuable ecosystems on earth. Wetlands play critical roles in maintaining and improving water quality and the overall health of our lakes and streams. Wetlands also provide recreational opportunities by serving as habitat for a wide variety of fish and wildlife species.

The widespread degradation or loss of wetlands can contribute to a variety of water quality and quantity problems, in addition to the loss of valuable fish and wildlife habitat. Increased flooding and loss of storm water storage, decreased base flow in streams, and an overall decline in water quality have all been associated with the widespread loss of wetlands.

What are the desired uses for your watershed, and how are they determined?

In addition to water quality concerns, desired uses within the watershed should also be identified. A desired use is simply how you might want to use your watershed or how you might want it to look. For example, although a nature trail is not a designated use, the community may desire one in the watershed. You may also want to protect all **riparian corridors** in your watershed and encourage development outside the riparian corridors. Additionally, you might want to identify and permanently protect natural areas and endangered aquatic species habitat, therefore creating a different "look" for your watershed. Desired uses are important because they encourage community support for overall project activities. The Sand Creek Watershed Partners developed a list of desired uses, shown below.

Sand Creek Watershed Desired Uses

Desired Use	*Goal*
Preserve green space	Identify ways to protect and preserve green space
Maintain and protect unimpeded routes for migratory fish	Identify and discourage activities that would impede migratory routes for fish (e.g, reconstruction of Root Dam)
Preserve agricultural land	Develop zoning and adopt ordinance to permanently preserve agricultural lands
Protect and increase the number of wildlife species	Identify critical habitat for wildlife species and ways to protect these areas
Protect wildlife/riparian corridor	Develop zoning and adopt ordinance to establish permanent easements
Enhance existing recreational trails	Enhance Musketawa Trail and trails in Aman Park
Control invasive species that would decrease the integrity of the stream	Raise awareness about invasive/exotic species and encourage planting native vegetation
Maintain and improve public access areas	Identify improperly maintained public access areas and ways to improve them

How do you identify known or suspected pollutants?

The next step in developing your watershed plan is to identify the pollutants that are threatening or impairing the designated uses. A designated use is threatened or impaired because of the presence of one or more pollutants in the water. For example, if the designated use *warmwater fishery* is threatened due to urbanization, then one pollutant of concern may be sediment, since development activities may increase erosion and sediment **runoff**.

The list of pollutants that you develop at this stage is an initial "best guess" based on your familiarity with the watershed and available information. You will verify the presence of the pollutants later. To develop the initial list of pollutants, the steering or technical committee might contact organizations, universities, or local health depart-

Chapter 8: Identifying and Analyzing Projects, Programs, and Ordinances

Chapter Objectives

- Identify the local programs, projects, and ordinances that currently impact water quality
- Evaluate them to see if they are consistent with the goals of your watershed plan
- Identify opportunities to coordinate with or improve upon existing programs

Chapter Product

❑ A summary of existing local projects, programs, and ordinances, and any modifications needed to meet the watershed goals

Introduction

In this chapter, you will assess the local programs that impact water quality within your watershed. The goal is to build upon and coordinate with existing projects and programs. You will also assess whether local ordinances are adequately protecting water quality.

Where do you begin?

With input from your steering committee and the work that has been completed in the previous chapters, you are probably familiar with many of the projects, programs, and ordinances that address water quality in your watershed. For example, you might know that an annual stream cleanup is held along a stretch of the river, or that a storm water ordinance exists in the township that encompasses your critical area. Now, you will obtain more specific information about these projects, programs, and ordinances.

You should begin with the projects, programs, or ordinances with which you are familiar. Ask yourself the following questions:

- How does the project or program relate to the goals of the watershed project?
- Is the project, program, or ordinance effectively protecting water quality? If not, how can it be improved?
- What partnerships exist and how well are they working?
- Do opportunities exist for launching new activities in cooperation with an existing project, program, or ordinance?

Note how the agencies and organizations in the watershed operate, as well as their legal and jurisdictional authority. For example, you may need to ask the local road commission staff about their maintenance schedule and how they set priorities for upcoming work. Begin by summarizing the roles and limitations of each of your stakeholder groups. For example, you may need to research the authority and limitations of the drain commissioner or planning board. This step is important because you do not want to make a recommendation in your WMP that no one has the authority to carry out.

You should also familiarize yourself with any land use ordinances or restrictions within the watershed, such as wetland or storm water ordinances, setback requirements for new development projects, or any other ordinances that relate to water quality or land use. This can be a very time-consuming task. However, since land use controls are a critical component of WMPs, this is an important step in the process.

Lower Grand River Watershed Project

In Chapter 3 of the Lower Grand River WMP, there is an overview of the projects, programs, and ordinances that are related to water quality. Compiling this overview allowed the steering committee to celebrate all that was accomplished and identify gaps or areas needing improvement. You should review Chapter 3 of the Lower Grand River WMP to determine whether your goals for your watershed could be achieved by cooperation or involvement with any of the programs that are identified.

The Lower Grand River WMP assessed existing opportunities and gaps at a regional scale. It is important that you review local ordinances and programs related to water quality in your community. You may consider conducting a policy review analysis. This process can be facilitated by using one or more of the documents listed below:

• *Filling the Gaps: Environmental Protection Options for Local Governments* by the Michigan Department of Environmental Quality
• *Opportunities for Water Resource Protection in Local Plans, Ordinances, and Programs* by the Southeast Michigan Council of Governments
• *Better Site Design: A Handbook for Changing Development Rules in Your Community* by the Center for Watershed Protection

New EPA Minimum Elements

Estimating technical and financial assistance

Develop an estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement plan. "Authorities" are defined as specific states or local legislations which allow, prohibit, or require an activity. BMP cost can be found online.

New EPA Minimum Elements

Developing a schedule to implement management measures

Once the tasks have been identified, designate an individual or organization to be responsible for ensuring their completion. Sand Creek Watershed Partners created a table to organize task completion. Complete your table by developing milestones that will help you meet each of the tasks. Milestones should be tied to the progress of the plan to determine if it is moving in the right direction. A timeline and cost estimates for implementing the tasks should also be established. Specific dates are not required for the timeline, but if terms such as "short term" are used, they should be defined.

Sand Creek Watershed Implementation Recommendations

Proposed Recommendations	Pollutant Addressed	Estimated Unit Cost	Potential Partners	Implementation Schedule
Build manure storage structures	Nutrients, Pathogens	$36-$198/1,000 gallons	NRCS, Landowners	Short term, 0-5 years
Build watercourse crossing (for tractor crossings)	Sediment	$382/linear foot - box culvert $1,125/linear foot - bridge	NRCS, Landowners	Short term, 0-5 years
Work with landowners to remove inoperable/dismantled vehicles in "junk yards"	Hydrocarbons	$300 for removal 30 hours/site	Gov't Units	Long term, 5-10 years
Install porous pavement	Sediment, Hydrology, Thermal Pollution	$2/square foot - porous concrete $0.5-$1/square foot - porous asphalt	County Road Commission; Gov't Units, Landowners	Long term, 5-10 years

ments that are likely to have monitoring reports and research studies.

As information is collected, the steering and technical committees should begin creating a Watershed Pollutants chart that shows the known and/or suspected pollutants contributing to the impaired or threatened designated use. Remember, some suspected pollutants are based on local knowledge and perceptions.

Buck Creek Watershed Project

In the Buck Creek Watershed, an MDEQ Biological Survey stated that aquatic life/wildlife and fisheries were being impaired by loss of habitat. The technical committee learned that the loss of habitat was due to sediment covering cobble and gravel in the streambed. Therefore, sediment was added to the list (see following table) as a known pollutant.

The technical committee also suspected road salts were impairing aquatic life/wildlife. Since there is no water quality monitoring for salts, the technical committee added road salts to the lists as a suspected pollutant.

Buck Creek Watershed Known and Suspected Pollutants

Impaired Use	*Pollutants*
Warmwater and coldwater fisheries	Sediment (k), nutrients (k), temperature (s)
Indigenous aquatic life and other wildlife	Sediment (k), road salt (s)
Partial and total body contact recreation	Pathogens (k)

k=known, s=suspected

How do you identify sources of pollutants?

To reduce the pollutants impairing the designated uses in your watershed, you need to determine where the pollutants originate. Your list of sources will initially include both known and suspected sources of pollutants. This list will be a snapshot view, based on personal observation, input from your steering and technical committees, surveys, and other available information.

Begin by looking at the list of known and suspected pollutants. For each pollutant, list all known and suspected sources.

Depending on the amount of available information, you may have few or no known sources of pollutants, but many suspected sources. Keep in mind that most suspected sources will either be confirmed or eliminated during the inventory of your watershed, as discussed in Chapter 4.

How do you identify the causes of each source of pollution?

For each known or suspected source, you need to identify the cause, or the condition that is creating the source of the pollutant. For example, if sediment (the pollutant) is resulting from stream bank erosion (the source), the cause of the stream bank erosion may be unrestricted livestock access, human access, or flow fluctuation. *This step is important because by identifying the cause of the pollutants' sources, you will be able to design the most successful control measures.*

Sand Creek Watershed Project

To determine the potential cause of pollution, the Sand Creek Watershed Partners used a flowchart process to review a list of pollutants and sources. This information was obtained through watershed inventories conducted in previous years. Local residents were asked to contribute their knowledge of water conditions. Their combined knowledge helped to review potential causes of each source of pollution. The project team knew that sediment was impairing their coldwater fishery. By working with a local university and the MDEQ, they were able to identify the source of this sediment as unstable hydrology. A preliminary study performed by MDEQ scientists found that the cause of the streambank erosion was probably increased stream flow coming from drained agricultural areas, urban expansion of impervious surfaces, and a dam failure in the Sand Creek Watershed.

Buck Creek Watershed Pollutant Sources

Pollutants	*Sources*
Pathogens (k)	Septic Systems Livestock Storm water runoff Sanitary sewers Animals
Sediment (k)	Streambank erosion Agricultural erosion Storm water runoff Construction sites
Nutrients (k)	Septic systems Sanitary sewers Livestock Storm water runoff
Unstable hydrology (k)	Impervious surfaces Loss of flood storage
Temperature (k)	Storm water runoff Solar heating
Habitat fragmentation (k)	Invasive species Development
Chemicals (s)	Storm water runoff Dumping Spills

k=known, s=suspected

What is in a water quality summary?

Your watershed plan should also include a water quality summary. The water quality summary is a short and clearly written synopsis of water quality in the watershed. It includes the designated and desired uses addressed in the plan, the known and suspected pollutants, known and suspected sources of the pollutants, their known and suspected causes, and the goals for the watershed. Such a summary can be used to educate citizens, stakeholders, and local officials. An example initial water quality summary is given below.

At this point you should develop your initial water quality summary. After you have completed your inventory and analyzed the data in the upcoming chapters, you will modify and finalize the water quality summary (Chapter 11). The final summary will provide an accurate picture of your watershed and a clear link between the goals and conditions in the watershed.

Example: Water Quality Summary (Initial)

The example watershed has three designated uses that are impaired: (1) partial body contact recreation, (2) aquatic life/wildlife, and (3) warmwater fishery. The designated use public water supply is threatened.

Project Goals

The first project goal is to restore partial body contact recreation use by reducing *E. coli* bacteria and nutrient loadings. The second goal is to…
Other goals based on the remaining impaired or threatened designated uses should also be stated.

Recreation

The designated use of partial body contact recreation is impaired due to undesirable algal blooms and *E. coli* levels. The only known source of these pollutants is livestock in the stream. Suspected sources include failing septic systems and the misapplication and/or over-application of fertilizer in residential areas.

Uncontrolled livestock access to streams results in *E. coli* and nutrient deposition directly into the water. When septic systems do not properly treat waste, nitrates can be transported from the septic field area to the waterbody, where they contribute to increased plant growth and dissolved oxygen depletion. The misapplication and/or over-application of fertilizers can result in nutrients being transported from the land to the waterbody, where algal blooms are formed.

Your water quality summary should include a narrative for each designated use that is impaired or threatened, describing the relationship of the designated use to the pollutant(s), the pollutant to source(s), and the sources to causes.

Chapter 7: Identifying Best Management Practices Needed

Chapter Objectives

- Identify the best management practices (BMPs) for each source or cause of pollution in your watershed
- Combine BMPs into systems

Chapter Product

❑ A table showing the systems of BMPs needed for each source or cause of pollution, and estimated costs

Introduction

At this point, you have a list of objectives for achieving each of your watershed goals. This chapter will help you identify the **best management practices** needed to address the priority sources and causes of pollutants in your critical area.

A BMP is a land management practice that a landowner implements to control sources or causes of pollution. There are three types of BMPs that treat, prevent, or reduce water pollution.

- **Structural BMPs:** "brick and mortar" practices that require construction activities to install, such as storm water basins, grade stabilization structures, and rock rip-rap
- **Vegetative BMPs:** pracices that use plants, including grasses, trees, and shrubs, to stabilize eroding areas
- **Managerial BMPs:** practices that involve changing the operating procedures at a site

BMPs are typically applied as systems of practices because one practice rarely solves all water quality problems at a site, and the same practice will not work for all the sources and causes of a pollutant. All three types of BMPs may be needed to address a source of pollutants. For example, in the case of a storm water basin (structural BMP), if the side slopes were not stabilized with vegetation (vegetative BMP) the basin would likely erode, blocking the outlet and impairing the effectiveness of the basin.

York Creek Watershed Project

The planners for the York Creek Watershed Project categorized the implementation strategies into three categories: technical assistance programs, information and education programs, and BMPs. This categorization is important to keep in mind when selecting BMPs. In some cases, a structural or managerial BMP may not completely address a water quality problem. Completing the system of BMPs may actually require public education activities. In the case of the York Creek Watershed Project, these systems of BMPs were determined by both the end users and the technical committee. By involving the York Creek Watershed's communities, they were able to identify systems of BMPs that were supported by those who would be installing and maintaining BMPs, and implementing educational and managerial programs.

BMPs for Wetlands

In the development of a WMP, wetlands can be incorporated by taking measures to restore lost wetlands and protect existing wetlands. Local planners may find the protection and restoration of wetland resources to be a far more cost effective approach to water management than the use of highly engineered structures, producing the added benefits of wildlife habitat and open space in the community. Generally, restoring historically lost wetlands will help to improve water quality, while preserving existing wetlands will help to maintain current water quality.

Watershed Action Plan

The Watershed Action Plan (WAP) can be used to identify BMPs for your area. The WAP also provides technical information for each BMP it lists.

New EPA Minimum Elements

Achieving load reductions

The following are required when proposing measures for load reductions: 1) a description of the BMPs, information and education activities, and land use policies needed to achieve the estimated load reductions and 2) an identification (using a map or a description) of critical areas needing the measures identified above. Examples include:

- X acres of wetlands will be restored (or protected) below the 585 foot topological contour,
- a downspout disconnection program will be implemented in all neighborhoods built prior to 1960, and
- management support will be provided targeting producers adopting nutrient management.

Chapter 6: Determining Goals and Objectives for Your Watershed

Chapter Objective

- Develop objectives for each of your watershed goals

Chapter Product

❑ A table showing objectives for each of your watershed goals

Introduction

Having completed the steps in Chapters 1 through 5, you should have the necessary information to determine detailed objectives and tasks to meet your watershed goals.

How do you develop goals for the watershed?

The goals that you develop for your watershed should aim to restore and protect the designated uses. Goals outline the anticipated future state of the watershed. They are usually broad and may change based on the data gathered during the inventory of your watershed.

For each impaired and threatened designated use, work with your steering committee to develop goals for the watershed. You may also want to include goals tied to the desired uses. Goals related to desired uses may help you gain additional support for your watershed project. See the example from the Sand Creek Watershed in the following table. Once you have outlined your goals for the watershed, you should determine objectives for each of your goals.

Where do you begin?

An objective outlines how you will reach a goal. In this planning process, an objective is how you will reduce pollution from a source to protect or restore a designated use. For each goal, think of specific ways to achieve the desired end.

Sand Creek Watershed Project Goals and Objectives

Goal: Restore the fishery by reducing sediment, nutrients, and thermal pollution.

Objectives:

Reduce sediment by:
_ Stabilizing stream flow by reducing impervious surfaces
_ Protecting riparian areas with stream buffer ordinances
_ Reducing erosion from construction sites
_ Encouraging cover crops and no-till practices

Reduce nutrients by:
_ Encouraging composting and curbside collection of yard waste
_ Installing livestock exclusion fencing and filter strips
_ Protecting riparian areas with stream buffer ordinances
_ Encouraging proper installation and maintenance of septic systems

Reduce thermal pollution by:
_ Monitoring thermal variations in highly impervious areas
_ Identifying areas for further investigation
_ Encouraging use of storm water infiltration
_ Protecting riparian areas with stream buffer ordinances

How do you determine the tasks for reaching each objective?

Tasks are the steps needed to reach an objective. Implementing most objectives requires a combination of four types of activities, each with associated tasks. These include:

- Implementing best management practices
- Reviewing and modifying existing projects, programs, and ordinances
- Designing and implementing education and information activities
- Evaluating the effectiveness of planned activities

The next four chapters provide specific guidance for these types of activities.

New EPA Minimum Elements

Estimating load reductions and setting associated goals

Goals relating to estimates of the load reductions should be developed. This can be done using the "Pollutants Controlled Manual" and technical resources on the Web (see www.bmpdatabase.org). Percent reductions can be used only in conjunction with a current or known load. Examples of estimates of load reduction goals include: "Purchase of Development Rights (PDR) on X acres would prevent Y additional input during development and Y input annually" and "Y miles of grassed swales would reduce sediments to Z% of the yearly loadings from the subwatershed."

You should now have all of the following for your watershed:

- A list of impaired and threatened designated uses
- A list of desired uses
- A list of known and suspected pollutants for each impaired and threatened designated use
- A list of known and suspected sources for each known and suspected pollutant
- A list of known and suspected causes for each known and suspected source
- Goals based on protecting and restoring designated uses
- Goals based on desired uses
- An initial water quality summary

New EPA Minimum Elements

Estimating the extent of pollutant sources

After you have identified and confirmed pollutant sources that need to be controlled based on your inventory, you will need to provide estimates of the extent to which they are present in the watershed. Information can be based on a watershed inventory, data extrapolated from a previous inventory, aerial photos, GIS data, or other sources. The Watershed Interactive Mapping (WIM) tool can provide you with GIS data on land use, population density, and hydrology. Examples include:

1) X number of dairy cattle feedlots need upgrading and there are X number of cattle per facility,
2) Y acres of parking lots need improved runoff management,
3) Z linear miles of eroded streambank need remediation.

Chapter 3: Defining a Critical Area

Chapter Objective

• Identify critical area(s) for your watershed

Chapter Product

❑ Designation of a critical area that geographically narrows the scope of your watershed project by focusing attention on the parts of the watershed that contribute the greatest pollution to the waterbody

Introduction

At this point in the watershed planning process, your steering and project committees have considered or identified all of the potential pollutants and sources within the watershed that may be affecting designated uses. Your next step is to identify a critical area within your watershed.

What is a critical area?

A **critical area** is the geographic portion of the watershed that is contributing a majority of the pollutants and is having a significant impact on the waterbody. The concept behind identifying a critical area is to reduce the geographic scope of your watershed project and focus your attention on the part of the watershed that is contributing pollutants.

Why is it necessary to identify a critical area?

Focusing on the critical area will help you prioritize the concerns and subsequent actions within the watershed. Identifying a critical area will also save time in conducting your inventory, result in the greatest reduction in pollutants, expedite the restoration process, and save money by focusing limited financial and technical resources on the areas

directly contributing the pollutants. During the implementation phase, financial incentives will be targeted to the critical area to obtain the greatest water quality improvements for the money invested.

How are critical areas determined?

To identify critical areas, you should consider the pollutants in your watershed and how they might be reaching the water. Identify the pollutant sources, determine where they likely originate, and assess their movement from the source to the water. You should also consider areas that may be vulnerable to groundwater contaminants, such as areas with sandy soils (where pollutants can infiltrate the soils and reach groundwater) or abandoned wells.

Watershed Interactive Map

One tool to help you define critical areas is the Watershed Interactive Map (WIM). The WIM uses map data from state and federal agencies to show locations of streams, streets, and wetlands. There is also information about land use and soils. One way to use this information to define a critical area is to use the query tool to identify areas of interest on your map. For instance, use the query tool to locate highly erodible soils, and then to find agricultural land use. The intersection of these two layers would be a great spot to define as a critical area. Another tool in the WIM is a buffer tool. You could use this tool to create a quarter-mile buffer around the edge of surface water. This would define the area adjacent to lakes and streams that are the most sensitive to storm water runoff. Keep in mind that the information contained in the Watershed Assessment Matrix (WAM) is also included in the WIM. You can query the information in your subwatershed to locate areas that have Superfund sites, trout streams, and wellhead protection areas. These types of conditions will influence your critical area.

Watershed Action Plan

If you have not done so, now is the time for you to begin using the Watershed Action Plan (WAP) to organize your pollutant sources and causes.

• First, open the WAP and click on the button in your subwatershed on the map that appears.

• Next, you will be taken to a watershed cover sheet. Review this information with your steering committee to remind everyone of the watershed characteristics.

• Click the next button and you will be taken to the best management practice (BMP) selection page. At this time, you are not ready to select BMPs; however, you are ready to begin prioritizing your pollutant sources and causes.

• Begin the prioritization process by clicking the "On" button in the first row.

• Click on the arrow next to the white box under Designated Use. This will open a dropdown menu.

• Now click on the designated use. Continue this process for pollutant source, pollutants, and causes. If you do not see the item you need, you can click another category. If you need more rows for data, click the "add more rows" button to add an additional five rows to your spreadsheet.

• Once you have entered all the information for each designated use that is impaired or threatened, click the "Next" button at the bottom of the page; this will take you to the prioritization page.

The prioritization process can be based on a variety of factors, such as the number of sites affected by a particular pollutant or the control method considered most effective to reduce a pollutant. Whatever process is selected must be documented and acceptable to the steering committee.

The WAP will take the information you entered on the previous page and bring it into the prioritization tool.

• Begin by clicking "Clear" to erase any previous rankings.

• Enter the priority ranking of each pollutant in the subwatershed. If the pollutant impairing a designated use has more than one source, the pollutant is repeated, and must be ranked with the same priority.

• When completed, click the "Rank" button to place the pollutants in prioritized order. Complete the ranking of the sources within each pollutant. If a source has more than one cause, the source is repeated, and must be ranked with the same priority.

• When completed, click the "Rank" button to place the sources in prioritized order. Complete the same process for the causes of the sources.

• After the causes have been ranked in prioritized order, you may view a printable summary of the Watershed Action Plan by clicking the "Print Summary" button.

Chapter 5: Prioritizing Pollutants, Sources, and Causes

Chapter Objectives

- Prioritize pollutants for your watershed based on the designated uses
- Prioritize sources and causes of the pollutants

Chapter Product

❑ A prioritized list of pollutants, sources, and causes for your watershed

Introduction

Based on your inventory of the critical area, you should have a thorough understanding of the pollutants, sources, and their causes. The next step is to prioritize them to help you decide which should be addressed first in your watershed management plan. By prioritizing, you may be able to achieve the greatest pollutant reduction while treating the fewest sources, resulting in the greatest water quality benefit for your money.

To sort through all the information you have collected, gather your steering committee and inventory group to review the inventory findings. It may be advantageous to re-list on an easel or board all of the designated and desired uses, pollutants, sources, and causes. With this information, your steering and/or technical committee can begin to prioritize the lists. Often the steering committee, relying on its knowledge about concerns and priorities of watershed residents, decides which designated uses are most important.

Buck Creek and Bear Creek Watershed

Buck Creek Watershed Project

In the Buck Creek Watershed, the technical committee used a process that first prioritized the designated uses. The committee could not place a specific rank for each designated use, so they ranked several designated uses as high priority, some as moderate, and others as low. This helped the technical committee prioritize the pollutants, sources, and causes, rather than spending time ranking each designated use numerically. The pollutants were then ranked by determining which had the biggest impacts on the high-priority designated uses. Sources and causes were ranked by estimating the suspected contribution each had on pollutant loads and the likelihood that improvements could be made. Since little water quality data existed in this watershed, this ranking was based on the committee's best professional judgment.

Bear Creek Watershed Project

In the Bear Creek Watershed in Kent County, sediment and *E. coli* bacteria were identified as the two major pollutants. The watershed planners used four criteria and a numerical ranking scheme to prioritize sources. The sources were first grouped by category, so that road crossings were ranked against road crossings and agricultural sites against agricultural sites. A priority list of all sites was developed by comparing across categories.

Which prioritization process should you use?

There is no single best method for prioritizing designated uses, pollutants, sources, and causes. Consider the methods discussed in this chapter. After you complete this step, you may find additional information—such as the willingness of a landowner to participate—that might require you to revisit and reprioritize your designated uses, pollutants, sources, and/or causes.

York Creek Watershed Project

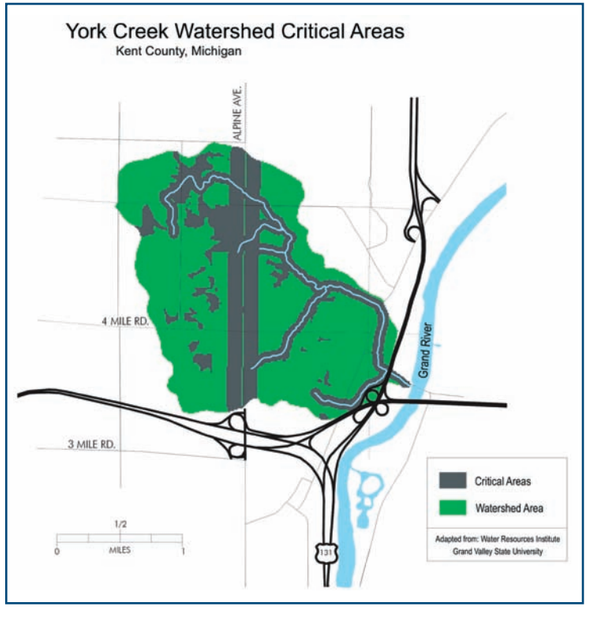
In the York Creek Watershed, planners identified eroding streambanks as a source of pollutants. They initially identified the critical area as simply the corridor along the stream. Other known pollutants included increased hydrologic flows due to development and increased storm water runoff. Because development was primarily occurring along a particular street, York Creek's critical area was expanded to include that street. In addition, the York Creek Watershed is hilly, and the planners identified several areas with highly erodible soils, which they added to the critical area. York Creek's critical area, then, was a blend of a stream corridor, a development corridor, and patches of erodible land outside the corridors.

A critical area might also consist of one or more subwatersheds. Water quality data may show that within the watershed, only one or two upstream areas contribute the vast majority of pollutants to the waterbody. Occasionally, it makes sense to identify the entire watershed as the critical area.

The Functions of Wetlands

Wetlands provide numerous ecological functions that are extremely valuable to society in a variety of ways. While it may be difficult to quantify, the loss of wetlands have had many negative impacts. The functions provided by wetlands include flood storage and prevention, groundwater recharge, sediment capture and storage, pollution treatment, erosion control, and wildlife habitat.

Effective and comprehensive watershed planning should include an evaluation of wetland resources and the functions they provide. Typically, the first step in evaluating wetland conditions within a watershed is to compile information on the amount and location of historic and present-day wetlands. Data layers readily available through geographic information systems (GIS) can be used to compile this information and produce a wetland resources map for the watershed.



Chapter 4: Surveying the Watershed to Inventory Your Critical Area

Chapter Objectives

- Conduct an inventory of your watershed
- Use the data collected to modify the lists of known and suspected pollutants, sources, and causes

Chapter Products

- ❑ A list of sources and causes for each pollutant
- ❑ The location of sources for each pollutant
- ❑ A brief summary of the method(s) used to conduct your inventory

Introduction

After you identify the critical area, the next step is to complete an inventory of the critical area to refine your list of pollutants, sources, and causes. The focus of your inventory will be to either eliminate suspected pollutants, sources, and causes from the list, or add them to the list of known pollutants, sources, and causes. You will also be verifying the "knowns." Since the entire watershed may not necessarily contribute pollutants, you may not need to inventory the entire watershed.

For example, one part of your watershed may have highly erodible soils, but if the soil does not reach the waterbody, it would not be considered a water quality pollutant. Another portion of the watershed may be part of a natural area protected with permanent easements. If neither of these areas contribute pollutants to your waterbody, they can be eliminated from your physical inventory.

How can you inventory the critical area?

There are several methods available for inventorying a critical area, ranging from an in-depth inspection of your watershed to computer modeling.

Coldwater River Watershed Project

In the Coldwater River Watershed, the Watershed Council hired a consultant to perform a physical inventory of the watershed. The inventory included evaluations of road-stream crossings and a survey of the mainstream channels via canoe. At the road stream crossings there was evidence of sedimentation and erosion. If the watershed inventory would have stopped there, the Council would not have discovered many more sites of streambank erosion between the road-stream crossings. The inventory that was conducted by boat found many erosion sites in agricultural areas where the river had been channelized. This information helped the Watershed Council identify potential sources of sediment that were impairing the coldwater fishery.

Visual Methods

As you walk, drive, and/or canoe the watershed, look for signs to help you verify pollutants, sources, and causes. Some signs will be readily apparent, while others will be more difficult to identify. Note that if you only conduct the inventory by car, you may miss information on the status of the watercourse between road-stream crossings.

Before beginning your visual inventory, review aerial photographs, topographic maps, soil maps, and your watershed map, and determine how to proceed. Some watershed planners hire a certified pilot to fly over their watershed, both to obtain a clearer view of the watershed and the patterns on the land and to take aerial photographs. If several groups of people are assisting with the inventory, you will need to decide what data to collect and how you will standardize the data collection process. Most watershed groups have used an inventory sheet that includes information such as:

- Land use (for example, is the land being used for agricultural row crops or is it an urban area developed adjacent to the streambank?)
- The condition of streambank vegetation
- Amount of tree canopy (i.e., shade)
- The slope of the bank
- The stability of the streambank (for example, signs of erosion such as gullies)
- In-stream water quality indicators such as nuisance algal growth
- Stream bed composition
- The condition of road-stream crossings
- Storm water or drainage pipes discharging into the stream

You should decide who will collect the data, who will be responsible for making sure the data is consistently collected, and who will enter the data into your database (if you have one). You should also determine what to do with the data collected. You may find it helpful to set up a database to enter, store, and analyze the data. If you don't have computer capabilities, you might want to set up colored file folders for different subwatersheds or different reaches of river.

The advantages of a visual inventory are that it gives the watershed planner the most accurate picture of what is occurring in the watershed, and it familiarizes local stakeholders, decision makers, citizens, and agency personnel with their watershed. It also provides the opportunity to introduce the watershed project to riparian landowners. Two disadvantages are that it is time-consuming and data-intensive.

Using Photographs

Some watershed planners have incorporated photographs into their inventories. These serve as a visual reference for the site and provide a good "before" shot to compare with a photo taken after control measures are installed.

Photographs clearly illustrate problems that need to be corrected. They also:

- Generate interest in the watershed
- Show where improvements occurred
- Are inexpensive for the benefit they provide
- May help improve a proposal for grant funds

For before-and-after photographs, you need to document where you stood to take your "before" picture to find the same location for your "after" picture. You also need to label and properly store the images.

Modeling Methods and GIS

Computer models simulate real-world conditions. They are used to fill in missing data or information that cannot be readily obtained from direct measurements. Some models can evaluate the effects of different design scenarios, while others can run complex simulations based on observed data to help identify causes of a particular impact. Computer models can also be used to predict alternate scenarios.

It is important to remember that computer models are data dependent and will only be reliable if reliable data is used. Adequate data is often lacking or costly to obtain. Models are powerful tools to use in watershed analysis but must be verified with field observations.

Another computer tool, a geographic information system (GIS), is excellent for creating watershed maps and **spatially referenced data** layers that can be visually placed on top of each other. For example, a GIS can create a map of a watershed that combines soil, elevation, and land use data. If that map doesn't provide the watershed planner with enough information, other data layers, such as roads and county boundaries, can easily be added to the map.

A GIS is useful for storing and displaying information collected during the inventory. For example, after the necessary data layers have been added to the map, symbols marking the location of all severely eroding road-stream crossings, all severely eroding streambanks, and sites with livestock in the stream can be added. Check the Watershed Interactive Mapping (WIM) tool for available data layers in your watershed.

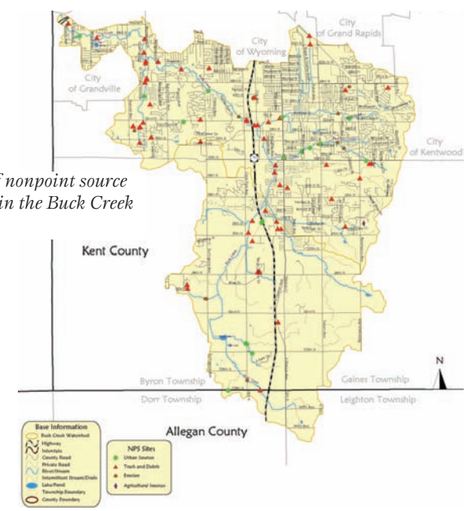
York Creek Watershed

In the York Creek Watershed, a GIS provided local planners with the tools needed to evaluate site plans. The GIS included soils, elevation, land use, roads, water bodies, and parcel information. The planner could click on the parcel, view the soil conditions, and compare the proposed construction site plan with the information in the database. The York Creek GIS also included information from the inventory, including photographs from eroding road-stream crossings.

The disadvantage of GIS is that the program requires a high level of expertise to set up, operate, and maintain. The equipment to run GIS can be expensive and the data may be difficult to acquire. Remember that the data generated from both GIS and models are only as good as the data entered. Field verification is always necessary.

What do you do with the information collected?

Once the inventory data is collected, update your list of known and suspected pollutants. You may want to insert a new column next to the "knowns" to include files or documents that verify the knowns. If you still have items in the "suspected" column, make note of them and refer back to them when writing the detailed objectives for your watershed goals.



Location of nonpoint source pollutants in the Buck Creek Watershed