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# Introduction to Watershed Planning

Welcome to the Introduction to Watershed Planning module. The goal of this module is to introduce a flexible framework for watershed planning and point out key factors that help make planning successful.

Local planning processes generally address problems or may seek to protect or improve quality of life. Watershed planning is no different. Some watershed planning groups convene to address chronic problems like degrading fisheries, while others seek to address acute problems like contaminated mine drainage or heavy erosion along streambanks. Other planning efforts may bring together citizen groups, local agencies and states to work together on plans for community and environmental improvements. The degree of success achieved in watershed planning often depends on having people that can devote substantial time to the effort.

This learning module is for you if

- You are (or would like to be) part of a local watershed planning process.
- You would like to protect or improve the quality of life in your area.
- You have questions about regulations, funding, or where to find help.

## Introduction

Much of this material is based on the *Handbook for Developing Watershed Plans to Restore and protect our Waters* (EPA 2008) (http://water.epa.gov/polwaste/nps/handbook_index.cfm#contents) and the Watershed Plan Builder (http://java.epa.gov/wsplanner/). This Handbook is intended to help communities; watershed organizations; and state, local, tribal and federal environmental agencies develop and implement watershed plans to meet water quality standards and protect water resources. It will be particularly useful to persons working with impaired or threatened waters.

The goals of this module are as follows:

- Introduce a flexible framework for watershed planning.
- Point out key factors that help make successful plans.
- Familiarize you with:

  **Six Steps to Watershed Planning**
  These are the general steps you would take to improve management of a watershed for any number of purposes (Figure 1). Your goals could be flood protection, restoring wetlands and other critical habitats, or managing stormwater. This module and the Handbook it


**Figure 1**

summarizes were intended to help watershed managers address water pollution problems; so there will be many references to water pollutants, water quality standards, and a variety of state and local land use issues affecting water quality. For any project involving managing water resources, it is difficult to achieve success without help and expertise; that is why "Build Partnerships" is the first step. In fact, partners will be important in each step in this process and necessary to accomplish your goals.

**EPA's 9 Minimum Elements of Successful Watershed Plans**

While the emphasis of the Handbook and this module are on the six steps of watershed planning, EPA's section 319 Nonpoint Source Clean Water Act grant guidelines refer to "9 minimum elements" of successful watershed projects that are required for watershed-based plans that are developed and implemented with section 319 funds (Figure 2). An additional goal of the Handbook (and this module) is to show both how the nine elements presented in the Clean Water Act section 319 guidelines serve as building blocks to develop watershed plans and where these elements fit within the six steps of the watershed planning process. More information on the relationship between the six steps of watershed planning and the 9 elements of a watershed plan are provided in section 4.


**Figure 2**

## Why is Watershed Planning Important?

No matter where we live or work, we are in a watershed teeming with unique, inter-related natural processes. These natural forces help shape the watershed landscape, its water quality, and—in turn—our lives. Each watershed has unique living and nonliving components that interact, with one element responding to the action or change of another. Knowing your watershed means coming to learn the natural processes working within the watershed boundaries (Figure 3).

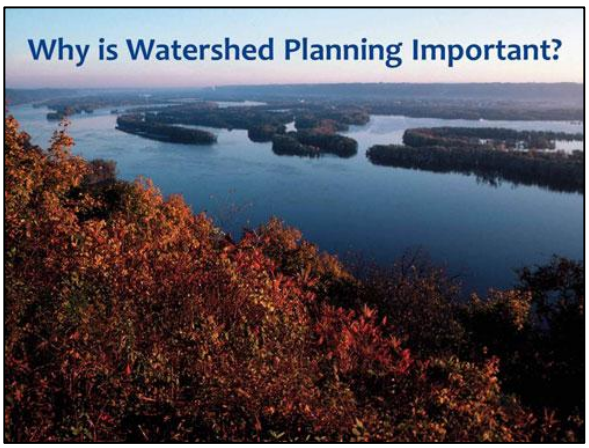


**Figure 3**

Careful watershed planning does more than just protect the water and the plants and animals that actually live in the water. It can help protect the physical, chemical, and biological components of your watershed, or restore those that have already been degraded. A watershed provides an integrating context for solving a multitude of

waste and water problems. Watershed plans can be used to help attain or maintain water quality standards to protect the flora and fauna that make up carefully balanced ecosystems, and to restore ecosystems whose balance has been disturbed or destroyed.

> Water quality standards are the foundation of the water quality based control program mandated by the Clean Water Act. Water quality standards define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from degrading.

Because watersheds are defined by natural hydrology, they represent the most logical basis for managing water resources. The resource becomes the focal point, and managers are able to gain a more complete understanding of overall conditions in an area and the stressors that affect those conditions. Watershed planning provides a context for integration, by using practical, tangible management units that people understand, focusing and coordinating efforts, and finding common ground and meeting multiple needs. Additionally, this process yields better management by generating ecologically based, innovative, cost-effective solutions, forging stronger working relationships, and supporting consistent, continuous management of the resource.

## Basis for this Module

In this module you will learn about the framework needed to conduct a successful watershed planning effort. The basis for this framework is built around the six steps of watershed planning that are discussed in detail in the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (http://water.epa.gov/polwaste/nps/handbook_index.cfm). The Handbook provides information on the processes and tools to quantify existing pollutant loads, develop estimates of load reductions needed to meet water quality criteria, and identify the practices that need to be implemented to achieve those reductions. This module provides a basic overview of the concepts presented in the Handbook.

An additional goal of the Handbook (and this module) is to show how the 9 elements in the Clean Water Act section 319 grant guidelines are used to develop watershed plans and to show where they fit within the six steps of the watershed planning process. The nine elements are the components of the watershed planning process that EPA feels are critical to preparing effective watershed plans to address nonpoint source pollution (Figure 4).

If your water resource management goals deal with point sources of pollution (those with discharge pipes and permits), drinking water protection, protecting critical habitats, or other issues, there might be other key elements in addition to these described above.

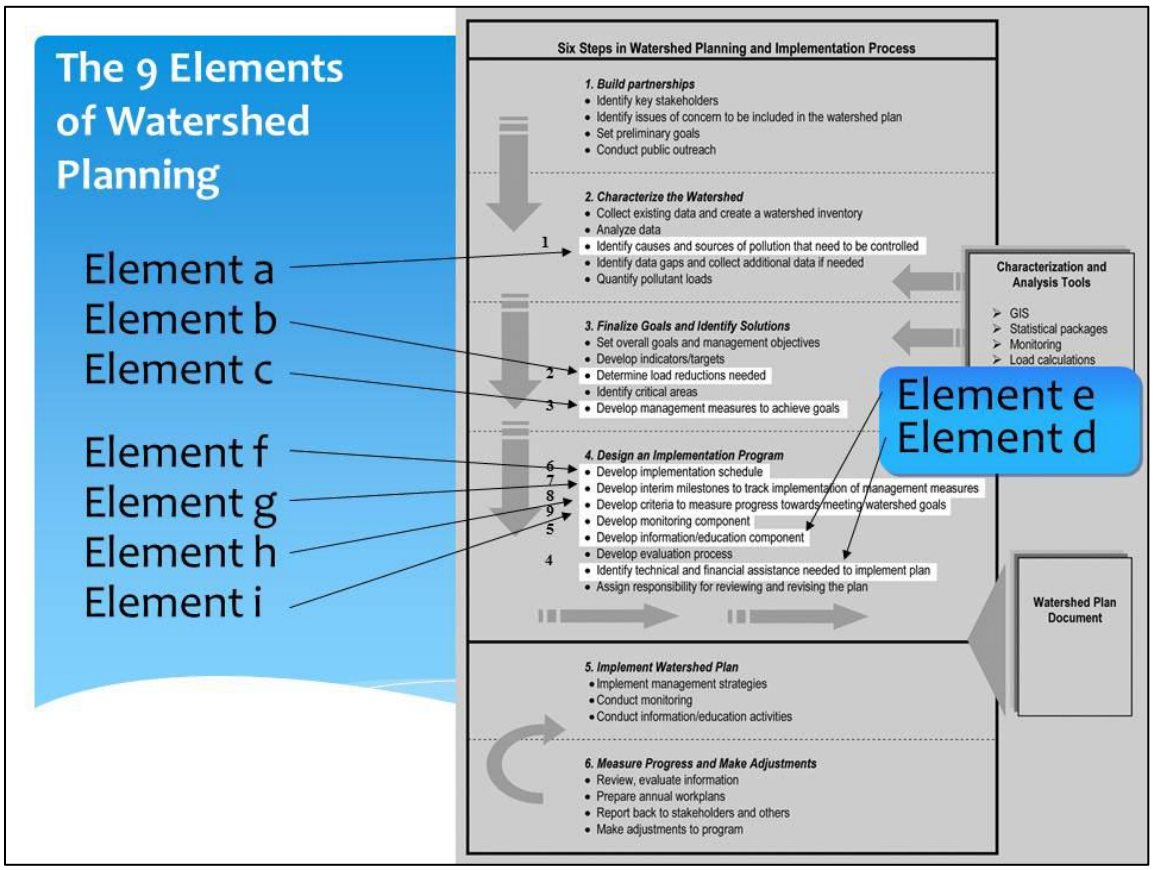


**Figure 4**

## Watershed Planning Is an Interactive Process

The process of creating and implementing a watershed plan is dynamic and iterative by nature (Figure 5). Because the variables involved in developing the plan are always changing, your plan will change with them. You might collect data and find answers you didn't expect to find. You'll revisit your goals, assess the situation, and make changes as necessary. Once you implement your plan, the feedback collected during your evaluation will give you the information you need to update your plan and continue to document water quality improvements and make progress toward attaining water quality standards. Do not be discouraged if all your intended results are not met in the first or second cycle of your planning

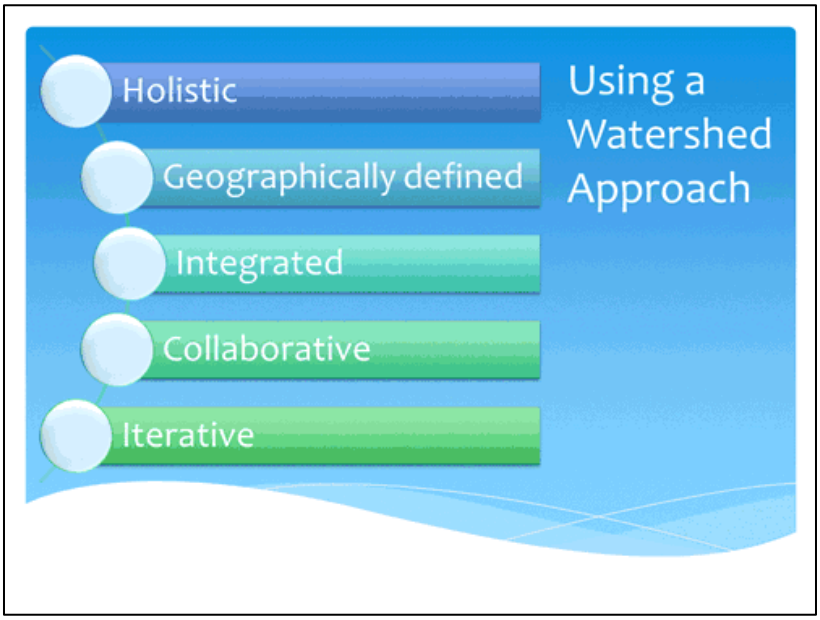


**Figure 5**

process. Remember that even small progress is success as long as it is paired with ongoing commitment and diligence!

Watershed plans should ideally address all water quality impairments and the sources and causes of those impairments. Your watershed plan should address the sources and causes of immediate threats, but also any pollutants or threats (e.g., loss of natural vegetation, changes in water flow, or increases in impervious areas) of pollutants that might affect the long-term health of the watershed

## The Six Steps of Watershed Planning

## Step 1: Build Partnerships

The first step toward building a successful watershed plan is building the right team. Building partnerships (Figure 6) and meeting the challenges to make them work successfully will be the foundation of your success. The very nature of working at a watershed level means you should work with at least one partner to improve watershed conditions. In addition, watershed planning is often too complex and too expensive for one person or organization to tackle alone. Weaving partners into the process can strengthen the end result by bringing in new ideas and input and by increasing public understanding of the problems and, more important, public commitment to the solutions. Partnerships also help to identify and coordinate existing and planned efforts. For example, a watershed organization might be interested in developing a volunteer monitoring program but is unaware that the local parks department is working on a similar program. Researching and identifying partners can help to avoid reinventing the wheel or wasting time and money.

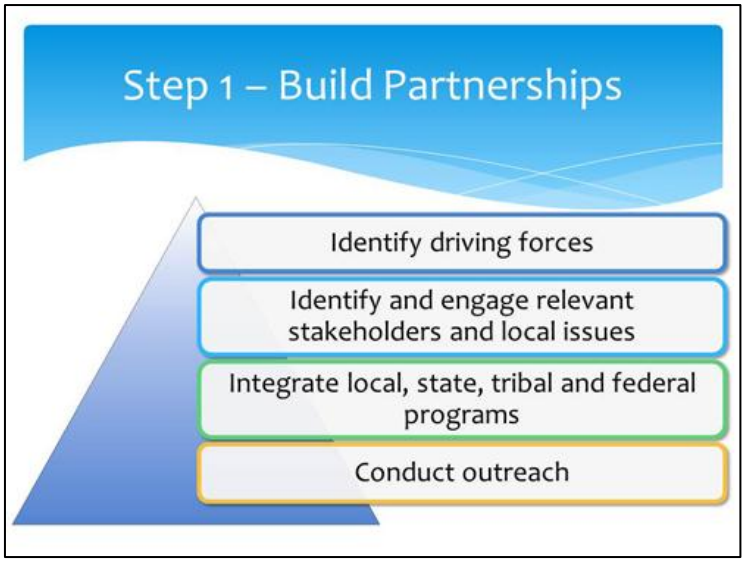


**Figure 6**

Remember that watershed planning partnerships or groups are not all the same. Some address chronic problems (e.g., degrading fisheries) while others seek to address acute problems (e.g., contaminated mine drainage or heavy soil erosion). Still others are formed to build plans for broader community and environmental improvements or to prevent future problems. The degree of success achieved in watershed planning often depends on having people that can devote substantial time to the effort. Often these watershed issues are related, and therefore partnerships might need to draw from all issue groups to succeed.

### Identifying Driving Forces

Watershed plans can be initiated for various reasons and by various organizations. For example, a local agency might want to develop a watershed plan to comply with new federal and state water quality regulations. Or perhaps a watershed organization wants to develop a watershed plan to help coordinate future land use planning efforts to protect sensitive environmental areas in the community. It is important to identify the driving forces that are motivating you to develop a watershed plan (Figure 7). These driving forces will set the foundation for developing your plan's goals and objectives. The typical watershed planning drivers usually fall into one of the following three categories.

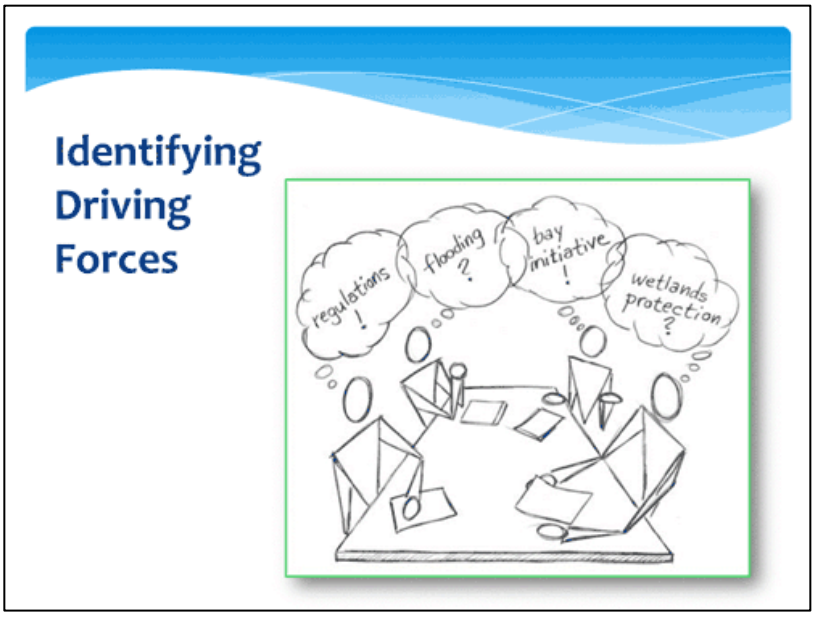


**Figure 7**

*Regulatory Issues*

Water resource or other regulations sometimes require a planning or management document that contains some of or all of the elements required in a watershed plan. Communities pursuing efficient, effective approaches to planning often initiate a comprehensive watershed planning effort to streamline multiple planning tasks, such as meeting Clean Water Act section 303(d) requirements for development of total maximum daily loads (TMDLs), CWA section 319 grant requirements, or federal and state source water assessment and protection program regulations.

*Government Initiatives*

Dozens of federal, state, and local initiatives target geographic areas like the Chesapeake Bay or the Great Lakes, or attempt to focus on one aspect of a management program, such as the following:

- EPA-supported, geographically targeted programs (e.g., Chesapeake Bay programs, Great Lakes).
- U.S. Department of Agriculture (USDA) initiatives (e.g., Farm Bill programs, Forest Service planning).
- Other federal water resource initiatives (e.g., those sponsored by the Bureau of Land Management, the Bureau of Reclamation, and the National Oceanic and Atmospheric Administration).
- Stream or river restoration planning (e.g., by cities, counties, states).
- River authority and other state-enabled (or required) watershed planning initiatives.
- State initiatives such as Pennsylvania's Growing Greener program or Michigan's Clean Michigan Initiative.

*Community-Driven Issues*
Often the decision to develop a watershed plan comes from within the community. People have a desire to protect what they have or to restore water resources for future generations. Some compelling issues include flood prevention, development pressures, or a desire to protect drinking water sources.

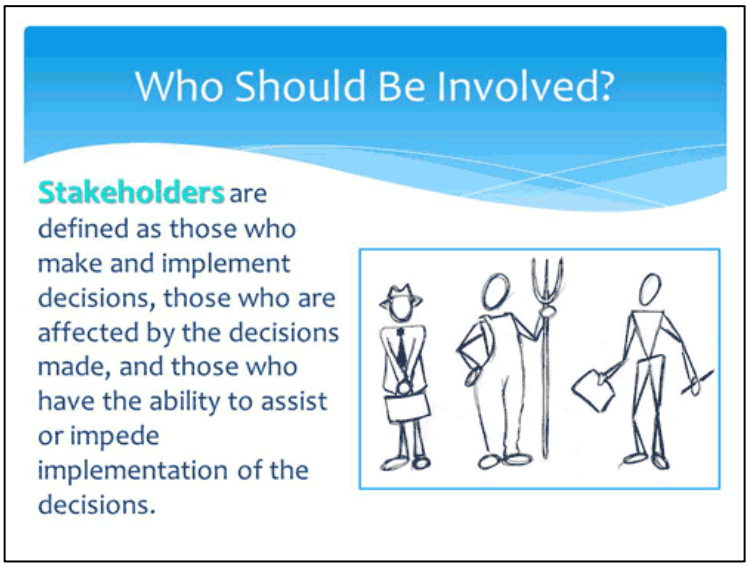


**Figure 8**

### Identify and Engage Relevant Stakeholders and Local Issues

Successful development and implementation of the watershed plan will depend primarily on the commitment and involvement of community members. Therefore, it is critical to build partnerships with key interested parties at the outset of the watershed planning effort. People and organizations that have a stake in the outcome of the watershed plan are called stakeholders (Figure 8). Stakeholders that participate in the decision-making process are more willing to share in the responsibility to implement those decisions. Stakeholders are important to the process for several reasons, including ensuring that all concerns are factored into the plan that is developed (Figure 9).

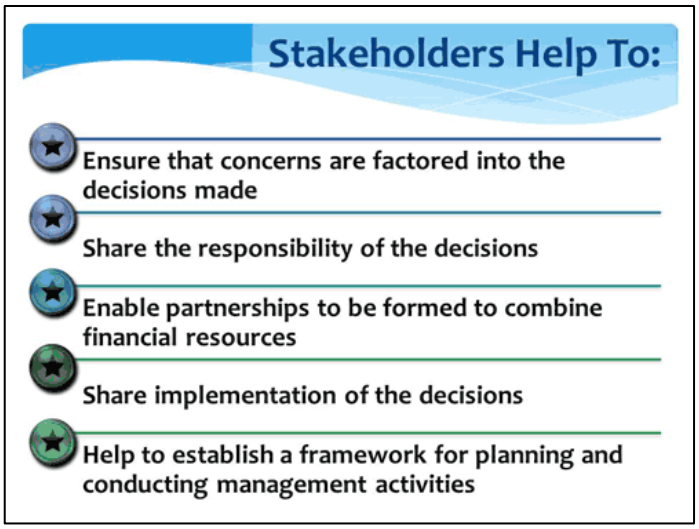


**Figure 9**

It is essential that all categories of potential stakeholders are identified and included, not just those who volunteer to participate. Key stakeholders also include those who can contribute resources and assistance to the watershed planning effort and those who are working on similar programs that can be integrated into a larger effort. Keep in mind that stakeholders are more likely to get involved if you can show them a clear benefit to their participation.

Success depends on involving a good mix of people and organizations to put together and implement the plan. You will need to find people to play a number of roles including the following:

- Technical
- Education
- Community and Learning
- Leadership
- Communication
- Public Policy

One way to identify key stakeholders is to chart them. The worksheet shown below in Figure 10 will help you strategically target your outreach to potential partners.

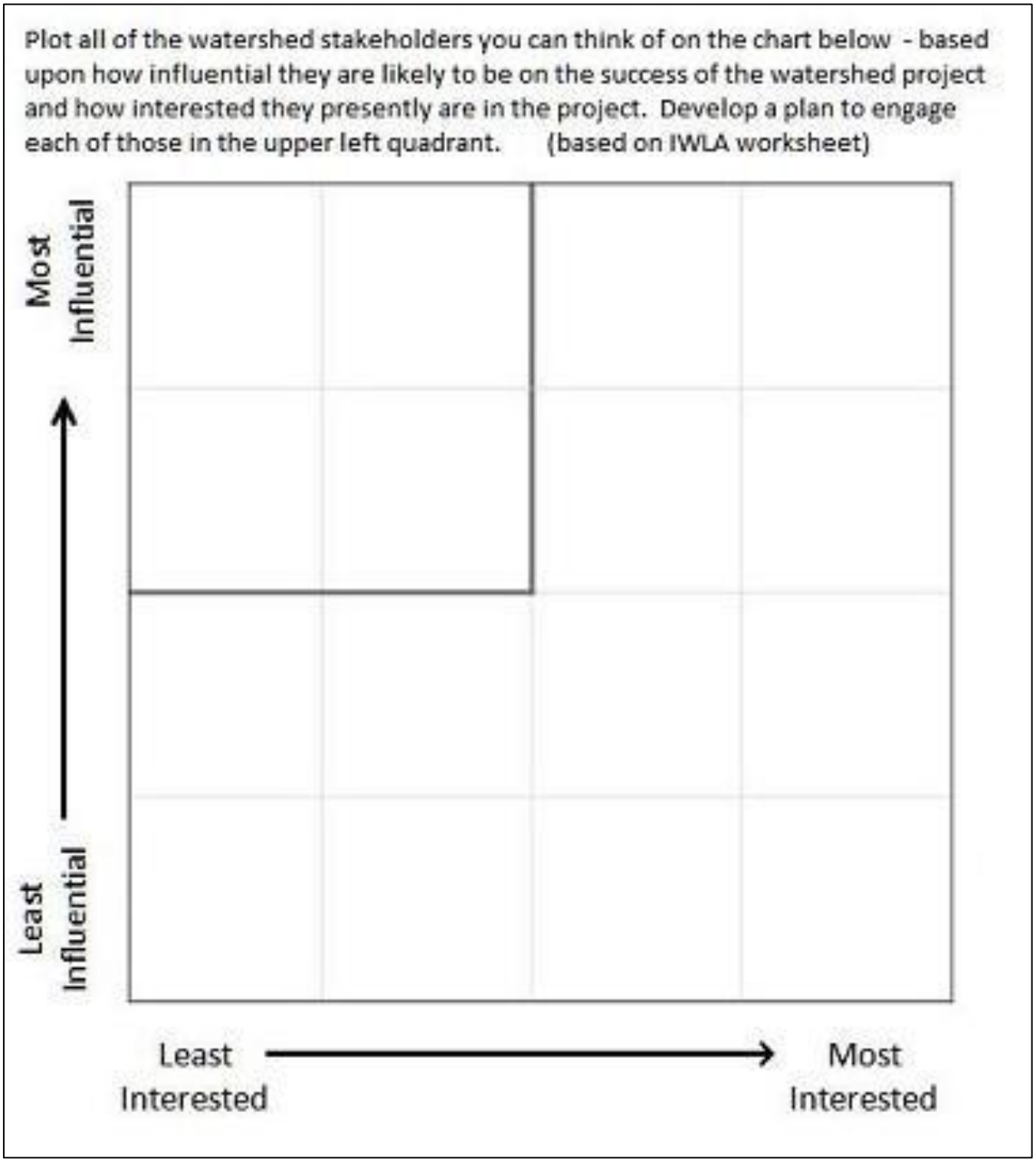


**Figure 10**

A diverse group has a better chance of fulfilling these roles by bringing different talents, interests, concerns, and values to the table. Some people who live outside the watershed (e.g., recreational boaters, anglers) might even have an important role to play because they benefit from or affect water or other natural resources within the watershed. It's important to realize that no matter who becomes involved in your effort, a successful partnership takes time to develop, and you can expect some highs and some lows along the way.

**Strategies for Success**

Building a successful partnership takes skill, time and patience (Figure 11). Here are some specific strategies that will help your watershed group's chances of succeeding.


**Figure 11**

- Identify and involve the *right* people; those who are affected by and interested in watershed protection.
- Select leadership from within and allow these leaders to emerge from among the members of the partnership.
- Build a common purpose by developing a concise purpose statement that defines general goals and responsibilities of the partnership.
- Focus on the future in setting clear and attainable goals.
- Make best use of talents by building the partnership around members' interests and strengths.
- Encourage communication and participation, which will promote a spirit of trust and cooperation.
- Set up a flexible organization, allowing your group to determine how the partnership should function.
- Know your capacities, skills, and financial resources; carefully consider the resources that are available to the group both from within the group and outside the group.
- Cultivate trust and develop a process for working together that feels comfortable — a process in which leadership and talents can flourish in an atmosphere of trust and productivity.

Success depends on involving a good mix of people and organizations who have a stake in the watershed.

**Information on Why Partnerships Succeed or Fail**

*Why Partnerships Succeed?*

Partnerships are successful for a number of reasons. Your challenge is to determine what motivates people and make sure these motivations are addressed. As described in the Conservation Technology Information Center's publication, *Building Local Partnerships*, key reasons partnerships succeed include the following:

- Members enjoy working with others.
- Partnership provides opportunities to meet new challenges.

- Potential for professional and personal growth.
- Sense of accomplishment.
- External factors motivate involvement (e.g., public expectations, organizational mandate, job description).
- Members see a chance to address new challenges or expand their skills.
- Members want to demonstrate broader abilities to their home organizations.
- Community interest and support for the group runs high.
- Additionally, informal social interaction can provide the glue that holds a partnership together. Encourage these types of interactions and build on the motivations.

*Why Partnerships Fail?*

Most people agree with the notion of partnership, at least in principle. However, partnerships can be unsuccessful for a variety of reasons, including the following:

- Past failures.
- Lack of commitment and financial support.
- Worry about lost independence.
- Lack of credit for own contributions.
- Personality conflicts.
- Power struggles or turf battles.
- Disagreement on realistic roles and responsibilities.
- Differences in cultural and personal values.
- Low or controversial community interest and support for the group.
- Rigid attitudes about the problems or possible solutions.
- Misunderstandings and incomplete communication.

#### Overcoming Potential Obstacles

Some of the potential obstacles to success can be overcome by getting started *on the right foot* (Figure 12). Some helpful hints include:

- **Pay particular attention to the early meetings and activities**
  First impressions mean a lot. People are often skeptical at the first meeting and might be suspicious of other partners. Incorporate ice breaker activities into your first meeting to encourage conversation and alleviate any tension.

- **Set ground rules**
  The group will probably need to set some specific ground rules related to meeting participation, discussion, confidentiality, constructive feedback and expected contributions.

- **Start with a few short-term tasks that have a good chance for success**
  Be sure that early projects are realistic and will be seen as winners in the eyes

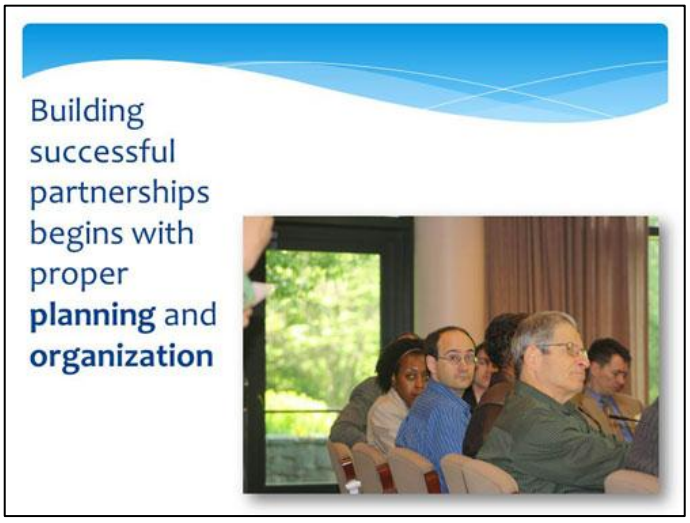


**Figure 12**

of the partners.

- **Challenge the group regularly with fresh facts and information**
  New information (that you will be gathering as a partnership) will help to better understand your situation and improve your effectiveness.

- **Spend time together**
  It will take time to get the partnership working effectively. Spend time (outside of meetings if possible) to get to know each other.

- **Use the power of positive feedback, recognition and reward**
  People respond to positive incentives in the partnership setting just as they do as individuals.

### Getting Stakeholders Involved

Once you've identified the categories of stakeholders that need to be involved in your watershed planning effort, you then need to determine the roles and responsibilities of the stakeholders. How will decisions be made? Will they be responsible for developing work products or just reviewing plans?

Next you might need to organize larger groups of stakeholders into some kind of structure to facilitate participation. Options for structuring your group range from informal, ad hoc groups to highly organized groups with multiple committees. The method you choose will likely depend on the makeup of the stakeholders willing to participate, the time and financial resources available, and your capabilities with respect to facilitating the plan development effort.

You also need to identify the skills and resources that each member brings to the table. A wide range of technical and people skills are needed for most planning initiatives. Stakeholders might have access to datasets, funding sources, volunteers, specialized technical expertise, and communication vehicles.

As stakeholders begin to show an interest, you'll likely note that the type and degree of effort that individuals or organizations are willing to put forth will vary. Some stakeholders will want to be directly involved in the detailed technical planning process, whereas others will simply want to be periodically updated on progress and asked for feedback. Still others won't want to plan at all, but instead will want to know what they can do now to take actions that will make a difference.


**Figure 13**

The last step to get stakeholders involved is conducting outreach activities (Figure 13). Outreach activities are key to building

support for the watershed planning effort and helping to implement the plan. Outreach activities are needed at the very beginning of the watershed planning effort to make potential partners and stakeholders aware of the issues, recruit them to participate, and educate them on the watershed planning process. Once your group is established, you might want to form an outreach committee to design outreach materials and to plan future outreach efforts in the community and within each stakeholder's peer group.

### Collaborating with Existing Programs


**Figure 14**

Watershed plans will most likely involve a combination of at least some local, state, tribal and federal partners (Figure 14). Therefore, it is important to identify any potential programs and activities that might be relevant to your watershed planning effort and to determine if you want to try to partner with them (e.g., existing monitoring programs in your watershed, point sources, Total Maximum Daily Loads (TMDLs) completed in the watershed, Clean Water Act 319 Nonpoint Source grants, Farm Bill programs, etc.). Also, if you are working in a watershed with hazardous waste issues, refer to EPA's *Integrating Waste and Water Programs to Restore Watersheds: A Guide for Federal and State Project Managers* (www.epa.gov/superfund/resources/integrating.htm).

Many of these programs can offer assistance with planning, data collection, implementing controls, or even assist with developing regulations. In addition, some states have developed multi-agency partnerships for the support of monitoring and management practice implementation, which local groups can access. Including partners from these organizations in the watershed management process can help to ensure that any available datasets are identified and that any potential funding opportunities are noted.

## Step 2: Characterize Your Watershed

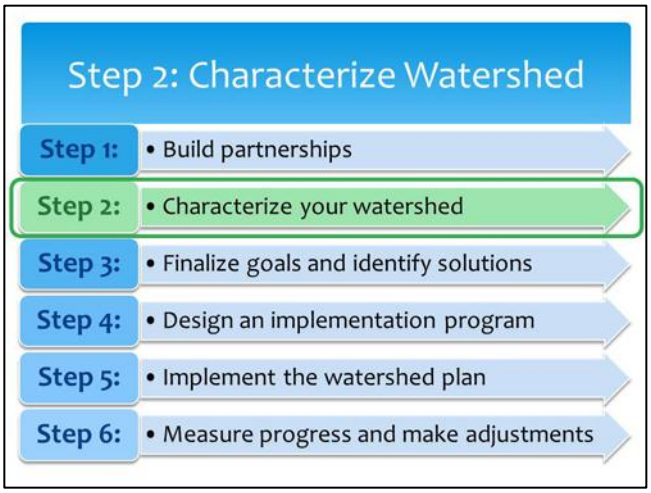


**Figure 15**

Once you've established your partnerships, the next step in your watershed planning effort will be to characterize the watershed so that you can get a better understanding of the impacts in the watershed, the causes and sources of the impacts, and to quantify pollutant loads (Figures 15 and 16). After you characterize the watershed you will then have the foundation needed to identify and select management strategies to bring about improvements.

### Define the Scope of Your Planning Effort

To ensure that your watershed planning effort remains focused, effective and efficient, defining the scope of

the effort is critical (Figure 17). The term scope is used to describe the boundaries of a program or project, which can be defined in terms of space (the area included in the watershed plan) or other parameters. It is important to define the scope of your watershed planning effort as not only the geographic area to be addressed but also the number of issues of concern and the types (and breadth) of the goals you want to attain.

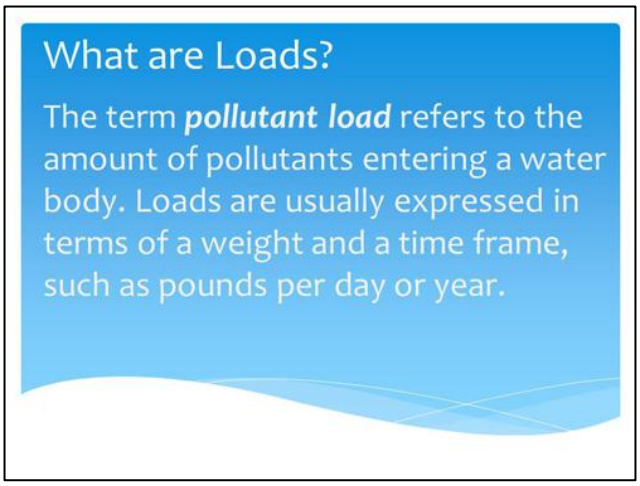


**Figure 16**

After you've defined the scope, one of the first activities you will need to undertake when characterizing the watershed is to talk with stakeholders to identify their issues of concern. These issues will help to shape the goals of the plan and to determine what types of data are needed. As a project manager you might think you already know the problems, such as not meeting designated uses for swimming and fishing. The issues of concern are different in that these are the issues that are important to the community. For example, stakeholders frequently list trash in the streams as an issue. Other groups might be interested in protecting stream buffers, wetlands and other critical resources.

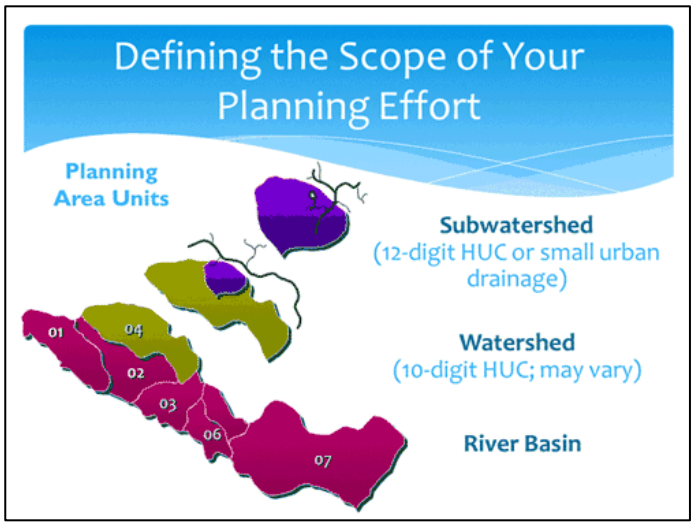


**Figure 17**

**Gathering Existing Data**

Unfortunately, we don't have a natural system barometer to hang outside our window that gives us a direct measure of existing conditions. Instead, we must choose multiple indicators (chemical, biological and physical) that can help us indirectly gauge overall system integrity.

In general, five broad categories of data are used to adequately characterize the watershed:

- Physical and natural features—watershed boundaries, hydrology, topography, soils, climate, habitat, wildlife.
- Land use and population characteristics—land use and land cover, existing management practices, demographics.
- Water body and watershed conditions—water quality standards, 305 (b) report, 303(d) list, TMDL reports, source water assessments.
- Pollutant sources—point sources, nonpoint sources.
- Water body monitoring data—water quality and flow, biology, geomorphology.

When collecting data, be sure to collect data on both the potential natural pollutant sources and potential human sources (Figures 18 and 19). Both pollutant source types can influence pollutant loading.

### Finding the Right Data

Your data collection effort should begin with your stakeholders. Stakeholders might know of a wide variety of existing data directly related to the issues you will be focusing on as you develop your plan. For example, if the stakeholders identified development pressures as a concern, perhaps someone from your town's planning department is an involved stakeholder. They will likely be able to help you collect information on land use patterns, building permits, and current zoning practices. If they have identified the protection of wetlands as a goal, you should identify the wetlands in the watershed and any current protection strategies in place.

Although stakeholders can provide some data, much of the data you need for characterizing your watershed might have already been partially compiled and summarized in existing reports, including the following:

- 305(b) report (as part of the Integrated Report)—summarizes designated use support status for waters in the state.
- 303(d) lists (as part of the Integrated Report)—identify waters not meeting water quality standards.
- EPA's Assessment Database (ADB)—includes data used in 305(b) and 303(d) assessments.
- ATTAINS—this is an EPA maintained database that includes locations of 303(d)-listed waterbodies and provides downloadable geographic information system (GIS) coverages. (www.epa.gov/waters/ir/)
- TMDL reports.
- Source water assessments.
- CWA section 319 Watershed Plans.
- Clean Lake Plans (CWA section 314).

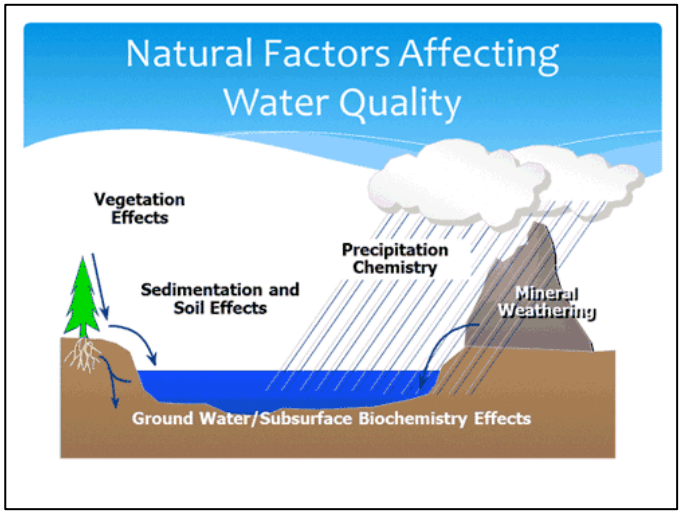


**Figure 18**

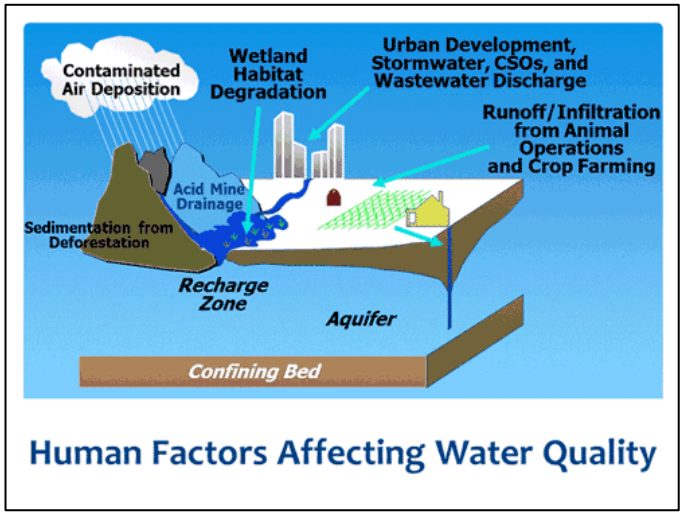


**Figure 19**

Although some of these plans might be outdated and represent historical conditions, they can provide a valuable starting point for gathering data and characterizing historical and current conditions in your watershed. Below are examples of additional sources of existing data:

- Federal agencies—USGS (http://www.usgs.gov/), USFWS

(http://www.fws.gov/), USFS (http://www.fs.fed.us/), BLM (http://www.blm.gov/), USACE (http://www.usace.army.mil/Home.aspx)
- State agencies—Water, fish and game, forest, agriculture
- Local agencies—Water/wastewater, health, planning and zoning, etc.
- Colleges & universities—Special studies, class projects
- Watershed groups—Volunteer monitoring programs, local knowledge

Use today's technology to your advantage. Many federal agencies keep expansive datasets that are publicly available and could be very useful in your planning efforts. Check the following online sources or databases:

- Envirofacts: www.epa.gov/enviro/
- STORET: www.epa.gov/storet
- WQX: www.epa.gov/storet/wqx/
- MyWATERS Mapper: http://watersgeo.epa.gov/mwm/ (See Figure 20)
- ENVIROMapper: www.epa.gov/emefdata/em4ef.home
- GRTS: http://epa.gov/owow/NPS/grts/
- ICIS: www.epa.gov/compliance/data/systems/icis/
- ECOTOX: www.epa.gov/ecotox
- BASINS: http://water.epa.gov/scitech/datait/models/basins/index.cfm
- Cleanups in My Community: www.epa.gov/cimc
- Watershed Plan Builder: http://java.epa.gov/wsplanner/
- Superfund Site Information: www.epa.gov/superfund/sites/cursites
- Water Quality Portal: www.waterqualitydata.us
- NWIS: http://waterdata.usgs.gov/nwis
- Water Quality Portal: www.waterqualitydata.us/
- International Stormwater BMP Database: www.bmpdatabase.org
- GeoData.gov: http://geo.data.gov/geoportal/

You can read more about where to find the data you need for your watershed planning effort in Chapter 5 of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (http://water.epa.gov/polwaste/nps/handbook_index.cfm).

### Creating a Data Inventory

As you are collecting all existing data, create an inventory (Figure 21) to determine what you have and identify where additional data is needed (data gaps). If you do have data gaps, look to your stakeholders and public resources for assistance with data collection needs. Some


**Figure 13**

MyWATERS Mapper (http://watersgeo.epa.gov/mwm/) offers simple map tools to display geographic information. It also provides access to data stored in several EPA water program databases with information on water quality standards, impaired waters, point sources, and other watershed issues.

**Figure 20**

members of your group might already be collecting the types of data you need. If you don't have immediate access to such resources, look to public resources such as your local and state government, other watershed groups, universities and volunteer monitoring groups.

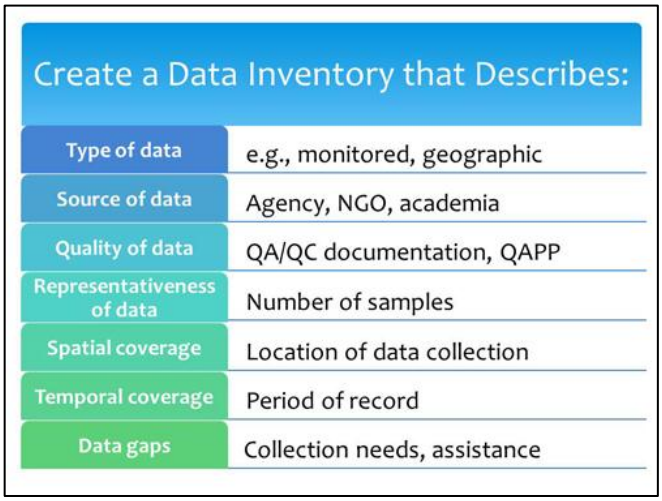


**Figure 21**

The most likely types of data to be gathered are tabular data (e.g., monitoring data), reports and anecdotal information, and GIS data. For each of the datasets, you should document the important characteristics to identify and summarize the data. It is often useful to create the lists in a spreadsheet, such as Microsoft Excel, or a database, such as Microsoft Access. Spreadsheets are easy to use, but you can't search or query the data as you can in a database. Creating the data inventory in a spreadsheet, or even in a word processing program (e.g., Microsoft Word), is adequate. However, if you have a large amount of data and would like to be able to query the data, for example, by keyword or content type, you should use a database program for the inventory.

**Identifying Data Gaps**

One of the most difficult challenges in watershed planning is knowing when you have enough data to identify relationships between impairments and their sources and causes (Figure 22). There will always be more data to collect, but you need to keep the process moving forward and determine whether you can reasonably characterize watershed conditions with the data you have. The first step to identify gaps in your data is to review your data ask the following questions:

1. *Do I have the right types of data to identify causes and sources?*
2. *What is the quality of the data?*

The answers to these questions will tell you whether you need to collect additional data before proceeding with data analysis. Although you will develop a monitoring component as part of your watershed implementation plan, it's often necessary to collect additional data during the planning phase to complete the characterization step. The additional data will help you to identify management measures linked to the sources and causes of pollutants. You might conduct windshield surveys of erosion control problems at construction sites, conduct interviews with residents about local flooding, or conduct targeted sampling efforts.

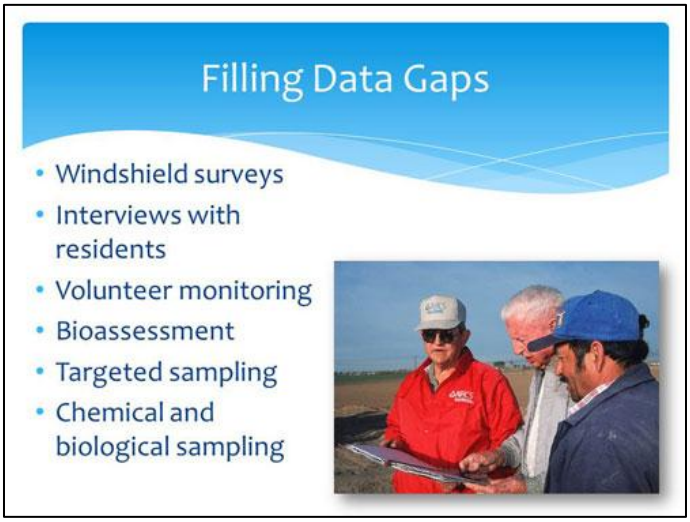


**Figure 22**

Be careful to first determine whether the data are essential to the understanding of the problem. For example, although it might become obvious during the inventory process that chemical data are lacking, this lack of data should be considered a gap only if chemical data are essential to identifying the possible sources of the impacts and impairments of concern. If the necessary datasets are available, you should then compare the quality of the information with the data quality indicators and performance characteristics. If the data quality is unknown or unacceptable (that is, it doesn't meet the needs of the stakeholders for watershed assessment), you should not use the existing dataset. Using data of unknown quality will degrade the defensibility of management decisions for the watershed and could, in the long run, increase costs because of the increased likelihood of making incorrect decisions.

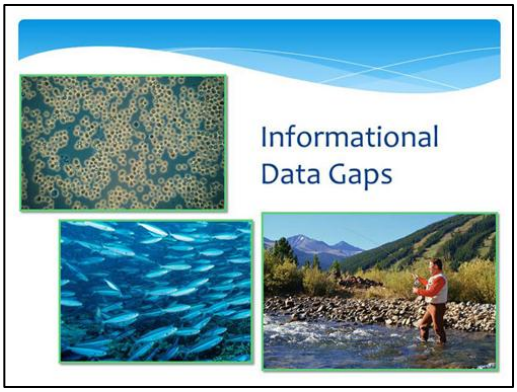

**Figure 23**

Remember that collecting existing and new data, identifying data gaps, and analyzing data is an iterative process. Although obvious data gaps can be identified during the data inventory process, more specific data needs are often discovered only during data analysis and subsequent activities, such as source assessment or modeling. Several different types of data gaps might require that you collect additional information. What constitutes a gap is often determined by the information needed to adequately identify and characterize causes and sources of pollutants in the watershed. There are three major types of data gaps—informational, temporal, and spatial (Figures 23, 24 and 25).

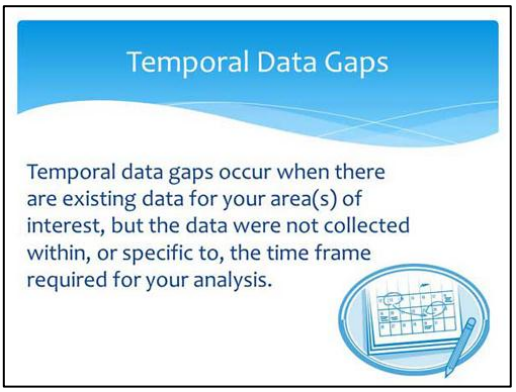

**Figure 24**

At this point, you've collected existing data for your watershed, assessed its quality and relevance, and identified gaps. If you can identify and quantify the water quality problems in the watershed, quantify pollutant loads, link the water quality impairments to specific sources and source areas, and you know enough to select and target management measures, you can move on to the next step and analyze the data.

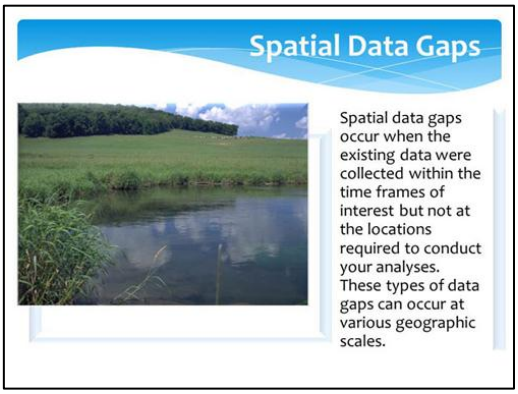

**Figure 25**

### Data Analysis

Once you have filled your data gaps and compiled the most complete data set available, it's time to analyze what you have. Data analysis is the process by which raw data collected in a monitoring program are turned into information to help meet project objectives. Because data analysis techniques are used to support a variety of goals and involve multiple types of data, a combination of techniques is usually used. Less-detailed analyses, such as evaluating summary statistics, might be conducted for certain pollutants, whereas more

detailed analyses might be conducted for others, depending on the goals of the plan and the pollutants of concern. Data analysis is typically an iterative process that is adapted as results are interpreted and additional information is gathered (Figure 26).

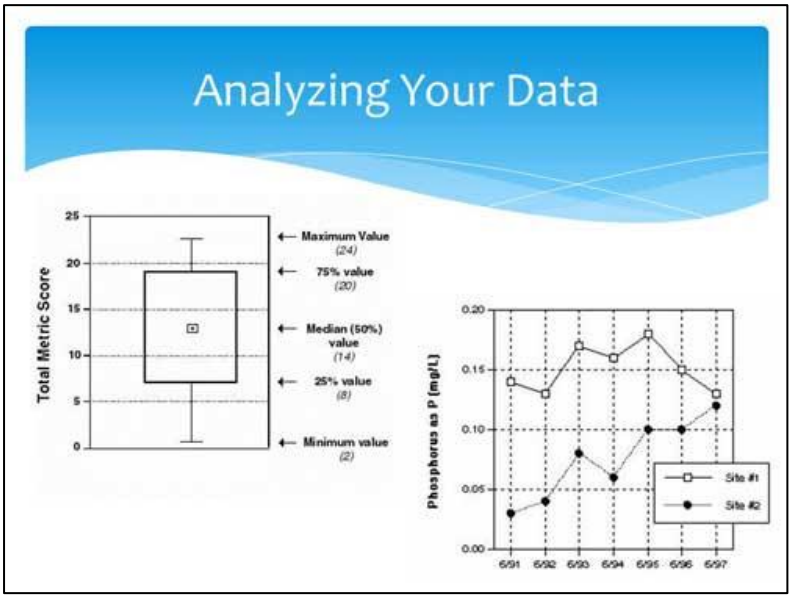


**Figure 26**

Although 305(b) and 303(d) reports provide the necessary information to identify the types of water quality problems occurring in your watershed, it is likely that you will have to analyze available monitoring data yourself to fully characterize and understand the problems. This analysis typically involves comparing available monitoring data to water quality standards but in a way that goes beyond the assessment already completed by the state for section 303(d) and 305(b) assessments. When identifying impaired waterbodies for the 303(d) list, states usually compare available monitoring data to applicable water quality criteria and, on the basis of their listing guidelines and criteria (e.g., percentage of samples above the criteria), determine which waters don't meet the criteria. In evaluating impairments in your watershed, you don't want to simply duplicate the state's efforts. Instead, use the 305(b) and 303(d) information to target your analyses—to identify which waterbodies are impaired or threatened—and begin your analysis there. (You should also include in your analysis those waterbodies identified by stakeholders as degraded but not included in the state assessments.)

A process common to all data analysis is Exploratory Data Analysis (EDA). EDA is an open-ended exploration of a data set, where the analyst summarizes characteristics of the variables and looks for patterns and relationships. Basic tools of EDA include summarizing univariate statistics like mean, median, variance, and standard deviation. Data should be evaluated to determine if they meet requirements for analysis using parametric statistical tools (i.e., normal distribution, independence, and constant variance); the need for data transformation (e.g., log10) should be assessed. Relationships between two variables can be explored by examining scatterplots and calculating correlation coefficients. The overall goal of EDA is to understand the structure and patterns of your data set and to formulate hypotheses that can then be tested by statistical techniques such as t-Test, Analysis of Variance (ANOVA), and regression analysis.

One key element of EDA is graphing. Data plots and graphs are not only critical to identifying patterns in your data, but are also necessary for presenting and reporting on monitoring results. Regardless of what kind of graphs best suit your data—pie charts, histograms, box plots, time series line plots, scatterplots, or regression plots—data should always be plotted.
Together with the input from stakeholders and your local knowledge of the watershed, analyzing your data should lead you to an understanding of where and when problems occur in your

watershed and what could be causing the problems. Ideally the data analysis phase will progress in such a manner that each analysis leads to a greater understanding of the problems, causes, and sources—each analysis identifies another piece of the puzzle. This step satisfies element a of the section 319 guidelines—identification of the causes and sources that need to be controlled.

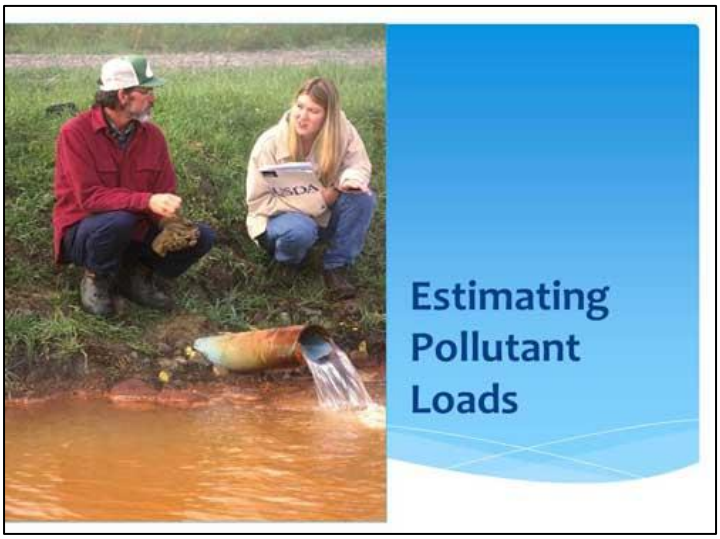

**Figure 27**

### Estimating Pollutant Loads

Early in the watershed characterization process, you identified and gathered available data and information to assess the watershed and created a data inventory. Then you conducted a preliminary data review, identified gaps, and collected additional data if needed. Finally, you analyzed the data to characterize the water body conditions and identify causes and sources. Your next step is to estimate pollutant loads from watershed sources to target future management efforts. This step satisfies element b of the section 319 guidelines (Figure 27).

Without knowing where the pollutants are coming from, you cannot effectively control them and restore and protect your watershed. The loading analysis provides a more specific numeric estimate of loads from the various sources in the watershed. By estimating source loads, you can evaluate the relative magnitude of sources, the location of sources and the timing of source loading. The loading analysis can help you plan restoration strategies, target load reduction efforts and project future loads under new conditions.

Without knowing where pollutants are coming from, you can not effectively control them and restore and protect your watershed. You must estimate pollutant loads from each source to target management efforts.

You can use various approaches to do the loading analysis, and which one is right for you depends on several factors, including water quality parameters, time scale, source types, data needs, and user experience. Some loading analyses are focused on determining how much load is acceptable, whereas others focus on source loads that attribute loading to each category of sources in the watershed. For watershed planning purposes, source load estimates are desirable because the information can be used to support management planning and targeting of restoration resources.

Sometimes loading estimates have already been developed for watersheds. Check whether a previous study is available—a total maximum daily load (TMDL); a USGS, USDA, university, or Clean Lakes study; or other watershed-based program that might have required development of loading estimates. Such studies can often be used to provide loading estimates appropriate for developing the watershed plan.

Two general types of techniques are used for estimating pollutant loads. The first type is a set of techniques that directly estimate loads from monitoring data or literature values. These techniques are best suited to conditions where fairly detailed monitoring and flow gauging are available, and the major interest is in total loads from a watershed. The second type is watershed modeling techniques. These techniques include a wide range of models that can provide loads by sources, help predict future conditions and evaluate multiple management practices.

### Using Monitoring Data or Literature Values to Estimate Pollutant Loads

Commonly used approaches for estimating pollutant loads in watersheds involve using in-stream monitoring data or literature values (e.g., land use loading rates). These simple approaches can vary in detail or scope depending on the needs of the analysis and the available data. In most cases, they provide a coarse estimate of the pollutant loads entering a water body, without great detail on the contributing sources or areas of concern (Figure 28).

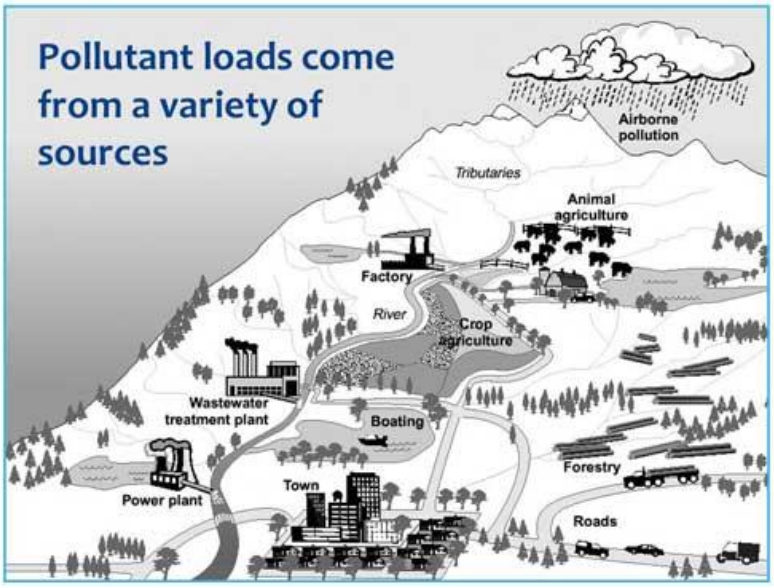


**Figure 28**

Monitoring data can be used to directly estimate the pollutant loading entering a water body. Because the monitoring data represent in-stream conditions, the resulting estimate represents the total loading from a watershed upstream of the monitoring point. This type of estimate does not attribute loads to particular sources or areas. This generalized loading can help to evaluate downstream impacts, can be used to calculate a per acre loading, and can be used for comparing local loadings with those of other areas. This loading estimate is also based on historical conditions because it is directly estimated from monitoring data. It cannot be used to directly predict how loadings might change in the future.

Empirical relationships documented in scientific literature are another option for estimating pollutant loads. Empirical relationships are those based on observed data, and they are represented by an empirical equation. An example of an empirical relationship relating watershed characteristics to pollutant loading is the Simple Method (Schueler, T. 1987. *Controlling urban runoff: a practical manual for planning and designing urban BMPs*. Metropolitan Washington Council of Governments. Washington, DC). The Simple Method is a lumped-parameter empirical model used to estimate stormwater pollutant loadings under conditions of limited data availability. Because it is a lumped approach, it assumes the physical characteristics for land units within a subwatershed are homogeneous, thereby simplifying the physical representation of the subwatershed. The approach calculates pollutant loading using drainage area, pollutant concentrations, a runoff coefficient and precipitation data. In the Simple Method, the amount of rainfall runoff is assumed to be a function of the imperviousness of the contributing drainage area. More densely developed areas have more impervious surfaces, such

as rooftops and pavement, causing more stormwater to run off rather than being absorbed into the soil. The Simple Method includes default and suggested values for the equation parameters, or values can be watershed-specific based on monitoring data or local information.

EPA provides various technical guidance documents on their TMDL Technical Support Documents webpage (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/techsupp.cfm). These resources range from short fact sheets to detailed handbooks, including the *Draft Handbook for Developing Watershed TMDLs* (PDF) (www.epa.gov/owow/tmdl/pdf/draft_handbook.pdf). The materials are designed to help watershed planners identify and address specific impairments and discuss the potential environmental, financial, and implementation benefits of developing TMDLs on a watershed scale. This Draft Handbook provides practitioners with a series of screening factors that should help determine, based on pollutant type, water body type, data quality, and other considerations, the site specific suitability of the TMDL watershed approach. Additionally, the Draft Handbook highlights the connections between watershed TMDLs and other water programs, identifying opportunities for integrating watershed TMDLs into other similar water quality management efforts, such as watershed planning, permitting, and water quality trading.

**Watershed Modeling**

Models provide another approach for estimating loads and evaluating various management alternatives. A model is a set of equations that can be used to describe the natural or human-made processes in a watershed system, such as runoff or stream transport. By building these cause-and-effect relationships, models can be used to forecast or estimate future conditions that might occur under various conditions (Figure 29). Models can be highly sophisticated, including many specific processes such as detailed descriptions of infiltration and evapotranspiration. Models can also be very generalized, such as a simple empirical relationship that estimates the amount of runoff based on precipitation. Some models are available as software packages, whereas simple models or equations can be applied with a calculator or spreadsheet. Compared to using monitoring data or literature values, models add more detailed procedures that represent the separate processes of rainfall, erosion, loading, transport and management practices. By separately addressing each process, models can be adapted to local conditions, and the simulation can be made more sensitive to land use activities and management changes.

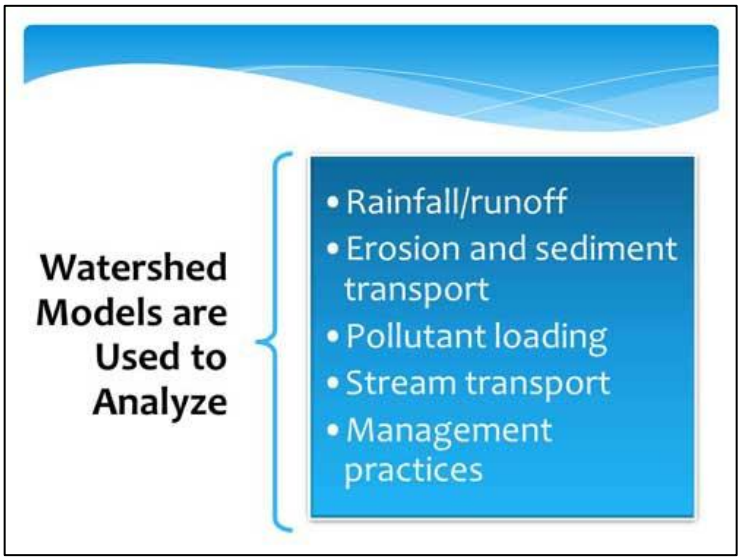

**Figure 29**

For more details on the types of models available and how to select the ones most appropriate for your watershed planning effort, see Chapter 8 of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (http://water.epa.gov/polwaste/nps/handbook_index.cfm) .

You might also want to review the Watershed Modeling Module (http://cfpub.epa.gov/watertrain/moduleFrame.cfm?module_id=26&parent_object_id=1087&object_id=1087) or the Overview of Watershed Monitoring Module (http://cfpub.epa.gov/watertrain/moduleFrame.cfm?module_id=24&parent_object_id=915&object_id=915).

## Step 3: Finalize Goals and Identify Solutions

### Setting Goals and Management Objectives

Now that you have characterized and quantified the problems in the watershed, you're ready to refine the goals and establish more detailed objectives and targets that will guide developing and implementing a management strategy (Figure 30).


**Figure 30**

The process of developing specific objectives and targets (Figure 31) is an evolution of the watershed goals you previously identified with your stakeholders. As you proceed through the watershed plan development process, you will gain more information on the watershed problems, water body conditions, causes of impairment, and pollutant sources. With each step of the process, you can focus and better define your watershed goals, until eventually you have specific objectives with measurable targets.


**Figure 31**

The first step is identifying the broad watershed goals with your stakeholders, answering "What do I want to happen as a result of my watershed plan?" As you do this, you will also identify environmental indicators that can be used to measure progress toward meeting those goals. Once you have identified the sources contributing to watershed problems, you can refine your watershed goals and develop management objectives targeted at specific pollutants or sources. The management objectives identify how you will achieve your goals. It is important to have indicators that can be measured (e.g., load or concentration) to track progress toward meeting those objectives. You should link some of these indicators to pollutant sources based on their cause—and—effect relationship to then identify the load reductions needed to meet the target. For example, in-stream levels of dissolved oxygen can

be linked to nutrient loads, and you can use various methods to determine what reductions in nutrients will result in the dissolved oxygen target.

The next step will be to translate your watershed goals into management objectives that focus on specific processes that can be managed, such as pollutant loading and riparian conditions. For example, if one of your preliminary goals was to reduce flood levels, the specific management objective associated with that goal might be to minimize flooding impacts by improving peak and volume controls on urban sources and retrofitting inadequate road culverts.

When setting goals and management objectives for your watershed plan, be sure they are:

- Achievable
    - Can you realistically reach these goals within your time frame?
- Financially viable
    - Do you have the financial resources to support all of the activities needed to reach your goals? If not, you should develop a funding plan. See EPA's Sustainable Finance Tools website http://water.epa.gov/grants_funding/shedfund/tools.cfm).
- Technically viable
    - Do you have the technical capabilities among the members of your team to complete the activities needed to reach your goals?
    - If not, do you have the financial resources to outsource some of the more complex work?
- And most importantly are you goals....MEASURABLE!!!
    - Have you designed your goals (and supporting activities) in such a way that they are measureable?
    - Do the metrics you have designed provide you with the types of information you need to determine whether your program is successful?

This step satisfies element c of the section 319 guidelines.

#### Setting Indicators and Targets

Once you have established specific management objectives, you'll develop environmental indicators and numeric targets to quantitatively evaluate whether you are meeting your objectives (Figure 32). The indicators are measurable parameters that will be used to link pollutant sources to environmental conditions. Indicators include a measurable **parameter**, a **measure of change** and a **time frame**. Here are some examples:

- The pollutant load has decreased by 10% in 3 years.
- 12% of the community reports an increase in awareness of watershed issues over a 3 month period.


**Figure 32**

- Committed funds have increased by 50% over 4 months.

There are three main types of indicators. Programmatic indicators measure the success of the nuts and bolts of the program or project planning process (see box). Programmatic indicators help determine things like whether sound objectives were developed, time frames set, and staff assigned appropriately.

- Programmatic
  - Number of BMPs installed, plans approved, training workshops held, brochures distributed, volunteer hours logged, etc.
- Environmental
  - Biological: macroinvertebrates, bacteria, riparian cover
  - Physical: Flow, temp, turbidity, habitat, pool/riffle ratios
  - Chemical: DO, pH, nutrients, metals, pesticides
- Social
  - Number of farmers requesting technical assistance
  - Percentage of the surveyed target audience that accurately identified the top two pollutants affecting their watershed 30-days after reading the newspaper insert

Environmental indicators are important because they will help document environmental results such as pollutant load reductions. For a list of environmental indicators and a description of how they are used to identify relationships between pollutant sources and environmental conditions, refer to the indicators table in Figure 33 (see page 4-11 in Handbook for a list of other indicators).

Social indicators measure change in awareness or behavior as a result of programmatic activities. These indicators can only indirectly measure environmental impact. Social indicators can help you draw some conclusions about environmental achievements likely to be made as a result of actions taken by stakeholders and the public in general. For example, if you know that 40 more people signed up for the volunteer monitoring program than last year, you can assume that the program has collected more environmental data, covered more stream segments, or addressed more problems than before. Ideally, you will want to use a combination of all three types of indicators to get the best picture of how things are progressing.

| Issue | Indicator | Example Target Value | Why You Would Use It |
|---|---|---|---|
| Sediment | Pebble counts (% surface fines < 2 mm) | < 20% | Pebble counts provide an indication of the type and distribution of bed material in a stream. Too many fines can interfere with spawning and degrade the habitat for aquatic invertebrates. |
| | Stream channel stability | No significant risk of bank erosion | Channel stability uses a qualitative measurement with associated mathematical values to reflect stream conditions. |
| | Total suspended solids (TSS) | Monthly avg. concentration < 40 mg/L | Solids can adversely affect stream ecosystems by filling pools, clogging gills, and limiting the light penetration and transparency critical to aquatic flora. |
| | Turbidity | < 25 NTU | Turbidity measures the clarity of water and can also be used as an indirect indicator of the concentration of suspended matter. |

**Figure 33**

### Determining Load Reductions Needed

After you have set indicators and targets, the next step is to determine load reductions needed to meet those targets (Figure 34). To estimate the load reductions expected from the practices you will implement, you need to understand the cause-and-effect relationship between pollutant loads and the water body response. Establishing this link allows you to evaluate how much of a load reduction from watershed sources is needed to meet water body targets. The options for establishing such links range from qualitative evaluations to detailed receiving water computer modeling. As with your approach for quantifying pollutant loads, selecting the appropriate approach will depend on several factors, including data availability, pollutants, water body type, source types, time frame and spatial scale. Most important, the approach must be compatible with the method used to quantify loads and must be able to predict the necessary load reductions to meet targets.


**Figure 34**

A number of techniques can be used to estimate load reductions needed such as making qualitative linkages, using a mass balance approach or using receiving water models. Regardless of what approach you use to estimate your allowable loadings or necessary reductions, it's likely that several scenarios or combinations of source reductions will meet your targets.

As is the case with all elements of establishing targets and watershed assessment, you will need to call on technical members of your agency or outside experts to help identify load reductions needed.

### Identify Critical areas and Management Strategies

Using the information you have collected, you can locate critical areas where management measures will likely achieve the greatest pollutant load reductions (Figure 35). In general, management practices are implemented immediately adjacent to the waterbody or upland to address the sources of pollutant loads. Using the locations of the pollutant sources will help you identify possible locations to target. GIS maps with overlays of impaired waters, impervious cover percentages, or other key information can also help target critical areas. Identifying critical areas for reducing


**Figure 35**

pollutant loads also helps to satisfy element c of the section 319 guidelines — describe management measures and targeted critical areas.

### Selecting Management Strategies

Once you have determined loading targets to meet your objectives, you'll need to identify management measures and practices to help meet those targets. Management *measures* are groups of cost-effective management practices. Management *practices* are specific, site-based actions or structures to control pollutant sources (Figure 36).

**Figure 36**

Management measures can be implemented for various purposes, such as protecting water resources, aquatic wildlife habitat, and downstream areas from increased pollution and flood risks. Management measures can also help control the pollutant loads to receiving water resources by:

- Reducing the availability of pollutants (such as reducing fertilizer, manure, and pesticide applications).
- Reducing the pollutants generated (source reduction such as erosion control).
- Slowing transport or delivery of pollutants.
- Capturing pollutants before they reach the water body.

Management measures can also be used to guide the implementation of your watershed management program. They establish performance expectations, and in many cases they specify actions that can be taken to prevent or minimize nonpoint source pollution or other negative impacts associated with uncontrolled and untreated runoff. There are many types of individual management practices, from agricultural stream buffer setbacks to urban runoff control practice retrofits (Figure 37) in developed areas, to homeowner education programs for on-site septic system maintenance. The NRCS National Handbook of Conservation Practices (http://directives.sc.egov.usda.gov/viewerFS.aspx?hid=22299) provides a list of practices applicable to rural and farming areas.


**Figure 37**

Management practices can be used to protect critical areas that might not have been listed among the valued watershed features identified earlier in the planning process. Vegetated areas next to a

stream, lake, floodplain or forest, for instance, might not rank high among stakeholders' lists of valued watershed features, but they filter pollution, serve as important habitat, help control flooding and can be critical sites for protection efforts. A critical area might be determined by major water uses such as water supply locations, recreational areas and fragile wildlife habitats. Your group could identify a number of areas throughout the watershed with vulnerable characteristics (e.g., unstable streambanks or shallow ground water). Your goal in planning management measures for such critical areas is first to recognize what they are and where they occur, and then to maintain their greatest benefits. More information on management measures and practices, including cost/benefit and effectiveness information is available in EPA's series of management measure guidance documents on pollution related to agriculture, forestry, wetlands, hydromodification, urban areas and marinas. The documents can be downloaded at www.water.epa.gov/polwaste/nps/pubs.cfm. In addition, there are several Watershed Academy modules (www.epa.gov/watertrain) and Watershed Academy webcasts (www.epa.gov/watershedwebcasts) on various management practices.

Management practices can be categorized several different ways, such as source controls vs. treatment controls, structural controls vs. nonstructural controls, or point source controls vs. nonpoint source controls. For the purposes of this module, management practices are grouped into structural controls and nonstructural controls. Structural controls are defined as built facilities that typically capture runoff; treat it through chemical, physical, or biological means; and discharge the treated effluent to receiving waters, ground water, or conveyance systems.

Nonstructural practices usually involve changes in activities or behavior and focus on controlling pollutants at their source. Examples include developing and implementing erosion and sediment control plans, organizing public education campaigns and practicing good housekeeping at commercial and industrial businesses. Throughout this process, it is important to work and communicate with landowners, this will assist you in selecting practices that meet local cultural and economic needs.

The preliminary goals you have already set should target specific processes that can be managed, such as pollutant loading and riparian conditions. For example, if you set a goal of restoring aquatic habitat, that goal might be refined to include specific management measures. The new goal would appear this way: restore aquatic habitat in the upper main stem of the White Oak Creek (goal) by reducing agricultural sources of sediment (management measure) by 50 percent (measurable indicator) over a 3-year period (time frame). Specific practices to support this management measure might include things like increasing set-backs of agricultural fields from streams, increasing riparian vegetation, rotating grazing areas to avoid bare soils, terraces, herbaceous wind barriers.

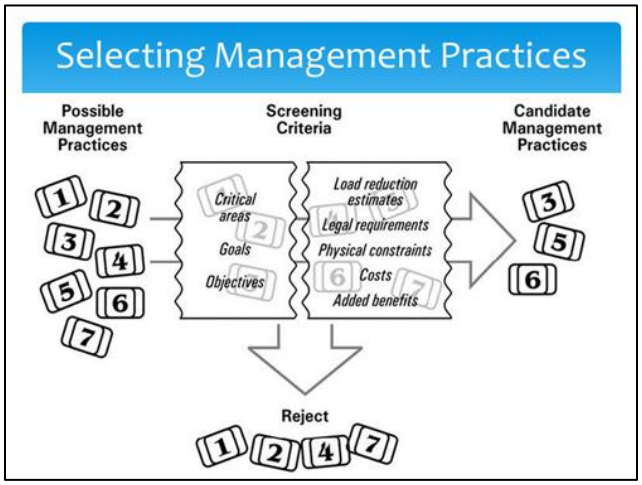


**Figure 38**

Using screening criteria (Figure 38), you'll evaluate potential management strategies (a

single management practice or multiple practices used in combination) to narrow them down to the most promising options. The screening criteria are based on factors such as pollutant reduction efficiencies, legal requirements and physical constraints.

Selecting management strategies also helps to satisfy element c of the section 319 guidelines — describe management measures and targeted critical areas.

In addition to voluntary structural and nonstructural management practices, you should be aware of the practices that are required under regulatory programs and what they will result in over the next 5 to 10 years. Point sources are most often controlled using regulatory approaches however, nonpoint sources can also be regulated to some degree. It's important to consider that regulatory approaches work well only when adequate mechanisms are in place to provide oversight and enforcement.

***Example Regulatory Approaches for Nonpoint Sources***:

- **Local stormwater ordinances and permits** (Figure 39). Local stormwater ordinances require development applicants to control stormwater peak flows, total runoff volume or pollutant loading using stormwater practices such as bioretention cells, stormwater ponds or constructed wetlands. The Center for Watershed Protection's Stormwater Manager's Resource Center (www.stormwatercenter.net/intro_ordinances.htm) provides examples of real-world and model ordinances that can be used to guide future growth while safeguarding local natural resources.
- **Local development ordinances and permits**. Local development and subdivision ordinances require development applicants to meet certain land use (e.g., commercial vs. residential), development intensity, and site design requirements (e.g., impervious surface limits or open space, riparian buffer or setback requirements).
- **Federal or state forest land management plans**. Corporate, federal and state owners of forestlands are often required to develop and implement forest management plans, which usually include management practices for logging, road construction, replanting and other activities. A number of states also have forestry practice regulations that cover logging practices by individuals or private landowners. Watershed planners can review recent or existing forest management plans in the watershed, discuss with managers which plans and practices are working well, and identify areas that could be strengthened.

**Figure 39**

State NPDES permits help regulate discharges from construction sites of certain sizes. Other sites could be managed through local ordinances.

- **Federal or state grazing permits**. Federal or state lands that are leased to individuals often require permits that specify conditions and management practices that must be adhered to for the term of the permit. Watershed planners can also review these permits.
- **State regulatory authority**. Some states also have the authority to regulate nonpoint sources.
- **Agreements for trading**. Agreements for trading between point and nonpoint source loads can help distribute the load reduction burden.

**Example Regulatory Approaches for Point Sources**

Point sources are regulated under the National Pollutant Discharge Elimination System (NPDES) permit program. Authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program covers discharges from industrial facilities, municipal stormwater conveyances, concentrated animal feeding operations (CAFOs), construction sites, publicly owned treatment works (POTWs), combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs).

## Step 4: Design Implementation Program and Assemble and Watershed Plan


**Figure 40**

Designing your implementation program and assembling the watershed plan generates several of the basic components needed for effective watershed plans (Figure 40). Many of these components are also key elements listed in the section 319 grant guidelines for developing watershed-based plans. Those included in the guidelines are noted below in italics.

- An information/education component to support public participation (*element e*).
- A schedule for implementing management measures (*element f*).
- Interim milestones to determine whether management measures are being implemented (*element g*).
- Criteria by which to measure progress toward reducing pollutant loads and meeting watershed goals (*element h*).
- A monitoring component to evaluate the effectiveness of implementation efforts (*element i*).
- An evaluation framework and process.
- An estimate of the technical and financial resources and authorities needed to implement the plan.
- Assignment of responsibilities.

For more information on designing implementation plans, see Chapter 12 of EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (http://water.epa.gov/polwaste/nps/handbook_index.cfm).

**Develop and Information/Education (I/E) Program**

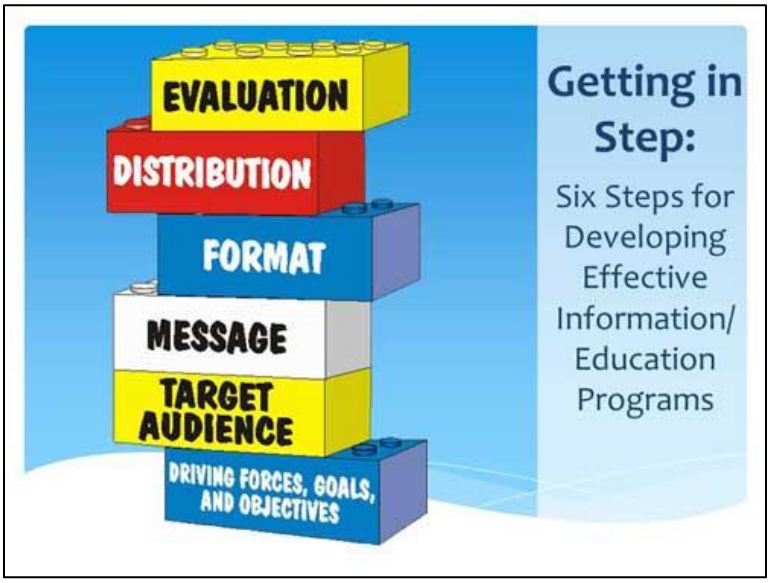


**Figure 41**

Because many water quality problems result from individual actions and the solutions are often voluntary practices, effective public involvement and participation promote the adoption of management practices, help to ensure the sustainability of the watershed management plan, and perhaps most important, encourage changes in behavior that will help to achieve your overall watershed goals. Following are six steps (Figure 41) that will help you develop an effective I/E program. The steps are covered in even greater detail in the module Getting in Step: A Guide for Conducting Watershed Outreach Campaigns (http://cfpub.epa.gov/watertrain/moduleFrame.cfm?module_id=37&parent_object_id=1784&object_id=1784). The module is based on EPA's outreach guide *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns* (http://cfpub.epa.gov/npstbx/getinstep.html) and on more than 100 outreach training workshops sponsored by EPA and others around the country.

In addition to the outreach guide, video, workshops, and training module, the Getting in Step outreach series includes a comprehensive stakeholder guide. *Getting in Step: Engaging Stakeholders in Your Watershed* (http://cfpub.epa.gov/npstbx/files/stakeholderguide.pdf) presents the tools you need to effectively engage stakeholders to restore and maintain healthy environmental conditions through community support and cooperative action. The guide is intended primarily for federal, state, tribal, and local agency personnel involved in watershed management activities.

*Step 1: Define Driving Forces, Goals and Objectives* Start with the driving forces that you outlined in the beginning of the watershed planning effort. Your outreach goals and objectives will reinforce the overall watershed goals and objectives and should be specific, measureable, action-oriented and time-focused. When designing each objective, be sure that you keep in mind the desired outcome (e.g. create awareness, provide information, encourage action).

*Step 2: Identify and Analyze the Target Audience* Take time to carefully identify the group(s) of people you want to reach with your message to meet your objectives. This is your target audience (Figure 42) and it should be broken down into smaller segments using demographics, location, occupation, watershed role and other factors.

*Step 3. Create the Messages for Each Audience* After gathering information on members of the target audience, you're ready to craft a message that will engage them and help achieve your watershed planning objectives. To be effective, the target audience must be able to understand it and it must appeal to people on their own terms. The message should articulate what actions the audience should take. These actions might include letting vegetation grow taller along a stream, pumping septic tanks or conducting soil tests before fertilizing lawns.


**Figure 42**

*Step 4. Package the Message* Determining how best to package or format the message for delivery is a key step and requires a bit of research and networking. The most important thing to keep in mind during this step is "*Where does your target audience get its information?*" The answer to this question will be very different for different audiences.

*Step 5. Distribute the Message* Once the message has been packaged in the desired format, you can proceed with distribution. Common means of distribution are by direct mail, door-to-door, by phone, through targeted businesses, during presentations, as hand-outs at events, through media outlets and by posting your message in public places. Consider which distribution methods are best for your community. Local governments, for example, might choose to add inserts to utility bills, whereas local community groups might prefer door-to-door visits. Be creative in your distribution mechanisms.

*Step 6. Evaluate the I/E Program* Evaluation provides a feedback mechanism for ongoing improvement of your outreach effort. Be sure to develop your evaluation component into your plan from the beginning to improve your chances of getting accurate feedback. Incorporating the design of your evaluation component into the beginning of your I/E program development will force you to:

- Think about what you ultimately want your audience to get out of your program (desired outcomes).
- Closely align your activities with your goals.
- Ensure that your desired outcomes are measurable.

Failing to include this step early on can result in programs with goals and desired outcomes that are not measurable. In such cases, it can be difficult or even impossible to determine the effectiveness of the program.

### Establish an Implementation Schedule


**Figure 43**

The schedule component of a watershed plan involves turning goals and objectives into specific tasks (Figure 43). The schedule should include a timeline of when each phase of the project will be implemented and accomplished as well as the agency/organization responsible for implementing the activity. In addition, your schedule should be broken down into increments that you can reasonably track and review (such as quarters). Use your resources. Locate people who have experience implementing similar tasks while developing your schedule. Be sure to pay special attention to timing issues that need to be coordinated to keep tasks on track!

### Establish Milestones

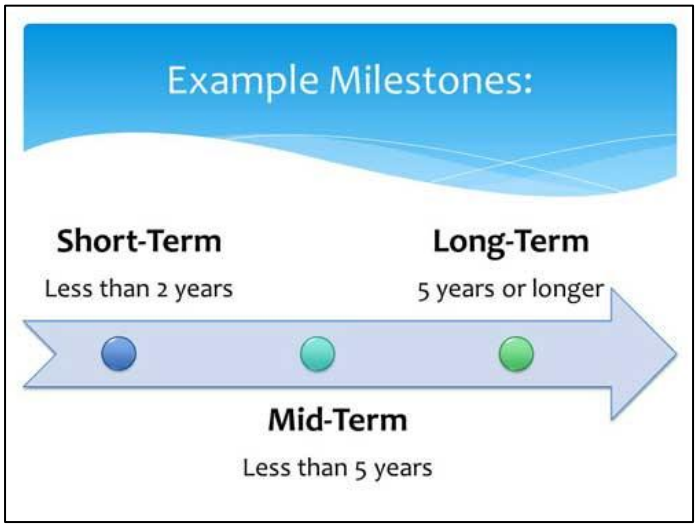


**Figure 44**

To help stay on track you should develop interim milestones. Think about want you want to accomplish and by when. It usually helps to think of milestones in terms of relevant time scales (Figure 44). For example,

- Short-term (1 to 2 years).
- Mid-term (2 to 5 years).
- Long-term (5 to 10 years or longer).

It is also helpful to think of the milestones as subtasks, or what needs to be accomplished over time to fully implement the practice or management measure. When determining time scales and subtasks for actions, place the milestones in the context of the implementation strategy. Given the selected practices and the available funds or time frame for obtaining grants, estimate what can be accomplished by when.

**Example Milestones:**

**Short-Term (< 2 years)**

- Achieve 5 percent reduction in sediment load on 1,000 acres of agricultural land in the Cross Creek subwatershed by implementing rotational grazing practices.
- Eliminate direct sources of organic waste, nutrients, and fecal coliform bacteria to the stream by installing 5,00 feet of fencing to exclude direct access to cattle along Cross Creek.

**Mid-Term (< 5 years)**

- Reduce streambank erosion and sediment loading rate by 15 percent by reestablishing vegetation along 3,600 feet of Cross Creek.

**Long-Term (5 years or longer)**

- Achieve the fecal coliform water quality standard in the upper section of Cross Creek above Highway 64.

#### Developing Criteria to Measure Progress Toward Water Quality or Other Goals

As part of your implementation program, you should set some criteria by which you will determine whether you are achieving load reductions over time and making progress toward meeting your overall watershed goals. These criteria can also support an adaptive management approach by providing mechanisms by which to reevaluate implementation plans if you are not making substantial progress toward meeting your watershed goals (Figure 45).

Example Indicators and Targets to Meet Objectives

| Management Objectives | Indicator and Target Value |
|---|---|
| Reduce phosphorus loads from cropland runoff and fertilizer application | Dissolved oxygen: daily average of 7 mg/L<br>Phosphorus: Daily average of 25 µg/L |
| Minimize flooding impacts by improving peak and volume controls on urban surfaces and retrofitting inadequate road culverts | Peak flow volume and velocity: peak velocity for 1-yr. 24-hr storm of 400 cfs |
| Reduce sediment loads from upland sources; improve riparian vegetation and limit livestock access to stabilize streambanks | Riffle-to-pool ration: 1:1 ratio<br>Percent fine sediment: <10 percent of particles <4 mm |
| Reduce bacteria loads from livestock operations | Fecal coliform bacteria: Geometric mean of 200 cfu/mL |
| Reduce nitrogen loads to limit algal growth | Algal growth: 10 percent coverage<br>Chlorophyll a: <1 µg/L |
| Improve controls to reduce metal loads from runoff | Zinc: Maximum of 120 µg/L<br>Copper: Maximum of 13 µg/L |

**Figure 45**

These criteria can be expressed as indicators and associated interim target values. You can use various indicators to help measure progress. You will want to select indicators that will provide quantitative measurements of progress toward meeting the goals and can be easily communicated to various audiences. It is important to remember that these indicators and associated interim targets will serve as a *trigger*, in that if the criteria indicate that you are not making substantial progress, you should consider changing your implementation approach.

**Developing a Monitoring Component**

As part of developing your watershed plan, you should develop a monitoring component to track and evaluate the effectiveness of your implementation efforts using the criteria developed in the previous section. Monitoring programs can be designed to track progress in meeting load reduction goals and attaining water quality standards, but there are significant challenges to overcome, such as communication problems and selecting monitoring designs, sites, parameters, and sampling frequencies (Figure 46).


**Figure 46**

As part of developing an implementation program for your watershed plan, you should develop a monitoring component to evaluate the effectiveness of the practices you've implemented.

Be sure to relate the monitoring program directly to the management objectives you've already identified and interim goals.

Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring can be done at numerous levels; *the most important criterion is that the monitoring component should be designed in concert with your objectives*. If another agency is already conducting monitoring (e.g., making annual measurements of phosphorus loads or regulating shellfish beds based on bacteria counts), you might be able to use such ongoing monitoring to track your project's progress.

Regardless of the specific objective, keep in mind that measures of progress toward your water quality goals are important. Because of natural variability, one of the challenges in water quality monitoring is to be able to demonstrate a link between the implementation of management measures and water quality improvements. To facilitate being able to make this connection, the following elements should be considered when developing a monitoring program.

1. Directly relate monitoring efforts to the management objectives.
2. Incorporate previous sampling designs.
3. Monitor land use changes in conjunction with water quality monitoring.
4. Use an appropriate experimental design.
5. Conduct monitoring for several years before and after implementation.

6. Build in an evaluation process.

### Identify Technical and Financial Assistance Needed

A critical factor in turning your watershed plan into action is the ability to fund implementation (Figure 47). Funding might be needed for multiple activities such as management practice installation, I/E activities, monitoring, and administrative support. In addition, you should document what types of technical assistance are needed to implement the plan and what resources or authorities will be relied on for implementation, in terms of both initial adoption and long-term operation and maintenance (O&M). For example, if you have identified adoption of local ordinances as a management tool to meet your water quality goals, you should involve the local authorities that are responsible for developing these ordinances. The estimate of financial and technical assistance (which satisfies element d of the section 319 guidelines) should take into account the following:


**Figure 47**

- **Funding sources**
  - Grants, contracts, donations
  - Supplemental environmental projects
- **Sources of technical assistance**
  - Internal and external
  - Design/engineering services
  - Volunteer & other groups
- **Regulatory or other authority**
  - Health department
  - Planning/zoning department
  - WHPP, SWPP, etc.
- **Matching support sources**
  - Outreach & education support
  - Be creative!

- Administration and management services, including salaries, regulatory fees, and supplies, as well as in-kind services efforts, such as the work of volunteers and the donation of facility use.
- I/E efforts.
- The installation, operation, and maintenance of management measures.
- Monitoring, data analysis, and data management activities.

You might want to discuss your monitoring plan with state water quality agency staff who are responsible for monitoring. They can advise you on the interpretation of standards, appropriate standard methods, quality assurance, and the existence of similar or nearby efforts. In addition, larger monitoring efforts might require other technical assistance in the design and reporting phases. Some watershed efforts have monitoring teams to do this, which include state agency participants and university advisors.

For more information on locating resources, leveraging funds and estimated estimating costs, see chapter 12 of the *Handbook for Developing Watershed Plans to Restore and Protect our Waters* (http://water.epa.gov/polwaste/nps/handbook_index.cfm). For a complete list of federal funding opportunities, see the Catalog of Federal Domestic Assistance (http://www.cfda.gov/) . This

website provides access to a database of all federal programs available. Also visit the Catalog of Federal Funding Sources for Watershed Protection (http://www.epa.gov/watershedfunding) to help match your watershed project needs with funding sources and EPA's Sustainable Funding website (http://water.epa.gov/grants_funding/shedfund/tools.cfm).

#### Create an Evaluation Framework

You should review your watershed program for two primary reasons. First, you want to be able to prove, or demonstrate, that by implementing the management measures, you are achieving your water quality and other environmental goals. Second, you want to be able to continually improve your program in terms of efficiency and quality. This adaptive management process should be built into your program before implementation so that you ask the right questions and use the answers to strengthen your program. Collecting information does no good if you don't use the information to improve your watershed program (Figure 48).

In general, you will evaluate three major parts of your watershed implementation program to be able to demonstrate progress and make improvements in your program. You need to structure your evaluation framework to consider all three components and develop indicators that will measure each. The components are *inputs*, *outputs*, and *outcomes*. When filling in these components, you'll work backward, starting with your desired outcomes (goals) and working toward identifying the specific inputs needed to achieve those outcomes.

1. **Inputs**: the process used to implement your program. This includes inputs to your program such as resources of time and technical expertise, organizational structure and management, and stakeholder participation.
   *Sample evaluation questions:*
   - Are the human and monetary resources allocated sufficient to carry out the tasks?
   - Did stakeholders feel they were well represented in the process?

2. **Outputs**: the tasks conducted and the products developed. This includes the implementation activities such as installing management practices, developing brochures, holding workshops, preparing fact sheets, and so forth.
   *Sample evaluation questions:*
   - Are we meeting our implementation schedule?
   - Are we meeting our milestones?
   - Did we meet our milestones sooner than expected?
   - Did we reach the appropriate target audiences with our I/E materials?

3. **Outcomes**: the results or outcomes seen from implementation efforts. This includes increased awareness and behavior changes among the watershed community, and environmental improvements such as water quality, habitat, and physical changes. Outcomes can be further broken down into short-term outcomes and long-term outcomes.
   *Sample evaluation questions:*
   - Did the target audience increase its awareness of watershed issues?
   - Did the behaviors of the target audience change as a result of implementing the watershed plan?

- Are we meeting our interim targets for pollutant load reductions?
- Are pollutant loads being reduced?

Many programs use a logic model to evaluate their programs. A logic model is a visual representation of your program showing the inputs, outputs and outcomes. This type of model is useful because it puts all this information in one place and summarizes a complex program in a simple picture. It also provides a to do list for evaluation, signaling what needs to be evaluated and when. The sample logic model shown here is for a program aimed at restricting cattle from a creek to reduce sediment and nutrient loading.

In addition to the logic model, you can use many others methods and tools to evaluate your watershed program, such as baseline surveys, focus groups, direct measurements, and stakeholder interviews. The important point is to determine what methods you will use before your implement your program. Identifying these methods will help make sure you are collecting information that will directly relate to your program. For example, if you wish to do any before-and-after comparisons, you should have baseline information with which you can compare the final results. The methods will be used to measure the indicators you have selected. For each indicator selected, you will identify the method for measuring the indicator.

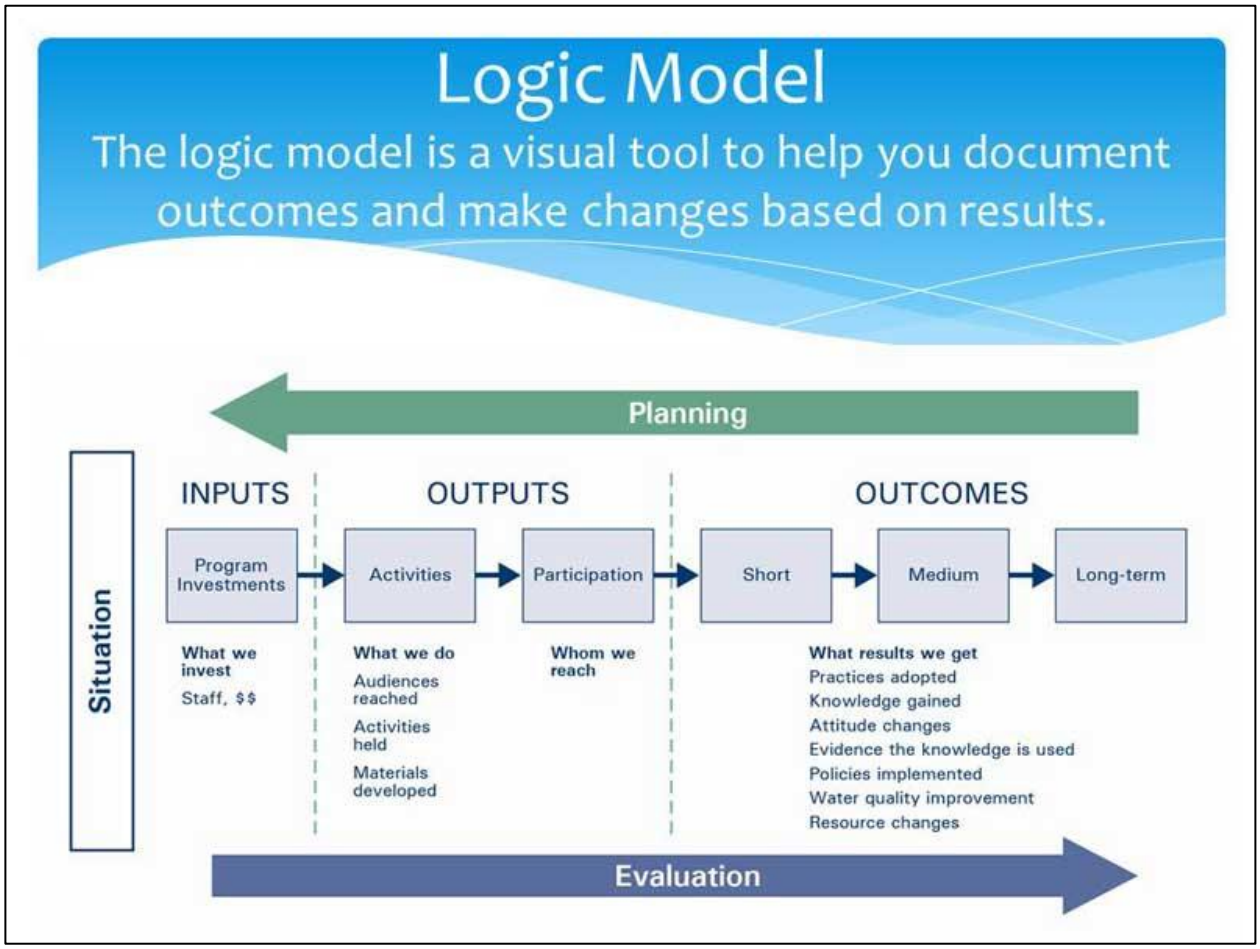


**Figure 48**

Remember that you'll need to evaluate your program before you've started to implement it, during implementation, after activities have been completed, and after the entire project is complete.

### Assembling the Watershed Plan

Once you've completed all the previous steps, it is time to put your plan together and get it out there. Be sure to have several people (at least one person who was not involved with writing the plan) review each section carefully. After you are sure it is complete it is time to put it together and distribute it. You might want to review this general watershed plan outline (Figure 49) to make sure you've got all the pieces you need.

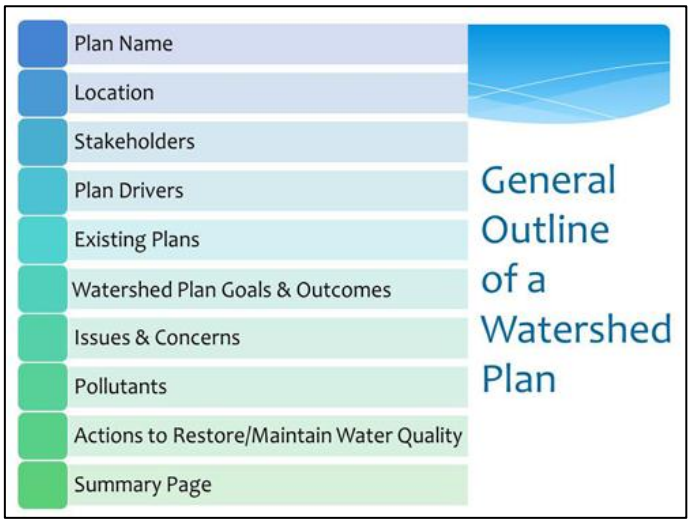


**Figure 49**

As part of your I/E program you might already have developed the beginning of a mailing list. If you cannot afford to produce enough copies of the plan to send out to everyone on your list, consider sending out a notice of availability, reader-friendly summary version executive summary, or a list of frequently asked questions that you can distribute to a wider audience. Make sure you have predetermined locations where the public can view the plan (such as public libraries or government centers) and print the location on the materials you mail out. Other distribution methods could include handouts at community events, articles in local papers or press releases. You should also consider creating a Web page for your organization or possibly posting your plan on another related Web page. Piggyback on the efforts of other organizations to help spread the word about the watershed plan.

## Step 5: Implement the Watershed Plan

Now that you have your plan on paper, you can get started implementing it (Figure 50). The process of implementing your watershed plan will consist of four major phases:

- Creating an organizational structure.
- Implementing activities.
- Preparing work plans.
- Sharing results.

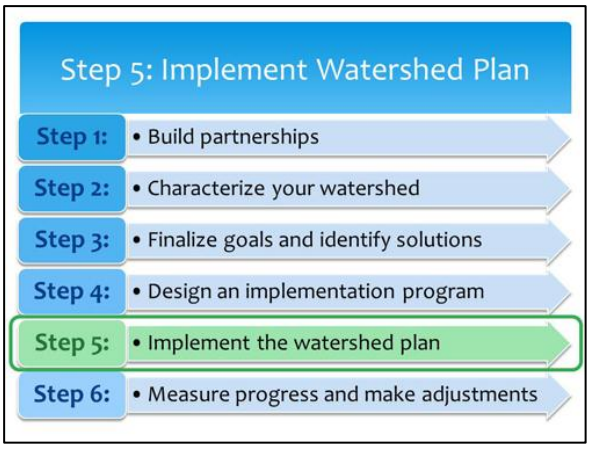


**Figure 50**

When the implementation phase begins, the dynamic of your watershed group, and stakeholders' level of participation, might change. It is important to take time at this point to consider creating a strong

organizational structure.

First you will need to determine how you want to continue to operate. Do not just assume that you will proceed with the same group that helped to develop the plan. Take a hard look at the planning team and ask the team members if they want to continue to be involved in implementing the plan. Consider creating a watershed implementation team made up of key partners, whose responsibilities include making sure tasks are being implemented, reviewing monitoring information, identifying or taking advantage of new funding sources, and sharing results. While reviewing the composition of your team, consider whether you have the members who possess the following types of expertise and skills: project management, technical expertise, group facilitation, data analysis, communication and public relations. Your watershed plan implementation team should include members that can bring these skills to the table.

#### Implement Management Strategies

The management measures selected, schedules and milestones set, financial and technical resources identified, and I/E programs developed provide a road map for implementation. Follow it. Take advantage of the partnerships you formed during plan development to work toward efficiently implementing the plan.


**Figure 51**

Key implementation activities include the following (Figure 51):

- Ensuring technical assistance in the design and installation of management measures.
- Providing training and follow-up support to landowners and other responsible parties in operating and maintaining the management measures.
- Managing the funding mechanisms and tracking expenditures for each action and for the project as a whole.
- Conducting the land treatment and water quality monitoring activities and interpreting and reporting the data.
- Measuring progress against schedules and milestones.
- Communicating status and results to stakeholders and the public.
- Coordinating implementation activities among stakeholders, multiple jurisdictions and in the implementation team.

To keep the implementation team energized, consider periodic field trips and site visits to document implementation activities in addition to the necessary regular team meetings.

### Develop Work Plans

The next step in the implementation process will be to develop work plans (Figure 52). Your watershed plan will serve as the foundation for preparing the work plans, which will outline the implementation activities in 2- or 3-year time frames (depending on the scope of your project). If you think of your watershed plan as a strategic plan for long-term success, work plans are the specific to-do lists to achieve that vision. Work plans can be useful templates for preparing grant applications to fund implementation activities. Depending on the time frame associated with your funding source, your work plan might need to be prepared annually with quarterly reporting. It is also possible to update work plans and make some changes, within the original scope of the work plan, as needed; although you should not completely change the focus of your work plan after receiving funding.


**Figure 52**

### Conduct Monitoring

Ideally, you will have monitoring results from previous years (e.g., if possible it is good to collect pre and post implementation monitoring data to demonstrate project effectiveness). Even if you do not, it is important to begin monitoring promptly. You must begin building your datasets to ensure that future evaluations are as accurate as possible (Figure 53). You will use the monitoring data you gather to compare against the criteria you developed. This data will also help you to determine if you are meeting each of your milestones. While your planning team might not be able to conduct all of your monitoring activities, other resources such as universities, other local watershed groups and volunteer networks can help to fill in data gaps. There are many resources to support your monitoring needs.

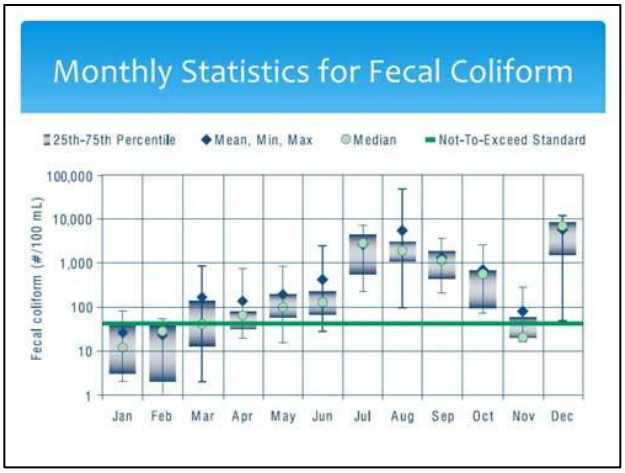


**Figure 53**

### Conduct Outreach Activities

Ongoing communication with the public is an essential component of successful plans. Keeping the community in which you are working both informed and involved will generate support in many forms. The more people who are educated about what's happening in the watershed, the more people who will be likely to want to donate the time, services, money, knowledge, personal connections....all the things that keep programs running and successful, not just in reaching short-term goals, but successful in the long run. To ensure that support for the watershed project continues, consider holding events that target specific segments of the community. Hold a watershed week and hit a different audience each day...turn your work into community fun. The

plan is already important to you and your team, but making it important to the rest of the people who will bear some role in its implementation is what will make the difference (Figure 54).


**Figure 54**

## Step 6: Measure Progress and Make Adjustments

### Review and Evaluate

Once you have started to implement your watershed plan, you need to monitor both water quality and land treatment to ensure smooth implementation and to measure progress toward meeting goals (Figure 55). You need to create decision points at which you'll review information and then decide whether to make changes in your program or stay the course. As part of your evaluation efforts, you will periodically review the activities included in your work plan and the monitoring results to determine whether you are making progress toward achieving your goals. And over time you may need to update your plan.


**Figure 55**

You should review the implementation activities outlined in your work plan, compare results with your interim milestones, provide feedback to stakeholders, and determine whether you want to make any corrections. These reviews should address several key areas:

- The process being used to implement your program. This process includes the administrative and technical procedures used to secure agreements with landowners, develop specifications, engage contractors, and the like.
- Progress on your work plan. Check off items in your annual work plan that have been completed.
- Implementation results. Report on where and when practices have been installed and have become operational.
- Feedback from landowners and other stakeholders. Review information on the stakeholders' experience with the implementation process and with operation and maintenance of the practices.

In all likelihood, the evaluation process will identify new issues and land uses that might be affecting the watershed. This is why watershed management should be seen as a cyclical or iterative process. One should never look for a rigid, step-by-step cookbook recipe for watershed management. One size does not fit all; different regions of the country have watersheds that function in very different ways. Even neighboring watersheds can have major differences in geology, land use, or vegetation that imply the need for very different management strategies. Different communities vary in the benefits they want from their watersheds. Moreover, watersheds change through time. Eastern watersheds cleared of their forests in the first half of the 20th century had specific management needs during regrowth in the second half of the century, but management needs will likely change again in the 21st century. Changes can even occur on more immediate time scales, for example, because of the appearance of a serious forest pest or disease, a change in water use patterns, or the arrival of a new community industry or enterprise. Watershed management is a dynamic and continually readjusting process that is built to accommodate these kinds of changes.

**Share Results**

As part of the I/E program you developed, you should have included opportunities to publicize the plan to increase awareness of the steps being taken during implementation. Continuous communication is essential to building the credibility of and support for the watershed implementation process. This is especially critical if you're using a stakeholder-driven process. Transparency of the process builds trust and confidence in the outcome. Regular communication also helps to strengthen accountability among watershed partners by keeping them actively engaged and might also stimulate more stakeholders to get involved in the effort (Figure 56).


**Figure 56**

Lack of communication can impede participation and reduce the likelihood of successful implementation. Watershed report cards are a great way to get the word out.

Sharing results can also help to ensure more consistent watershed approaches across subwatersheds. Regularly reporting information can also help to keep you accountable to stakeholders who have a vested interest in the success of the project. You should provide information on interim results and report the ways in which the plan is working and how you plan to address the deficiencies. Encourage stakeholders to contribute ideas on how to make improvements.

Progress and implementation results can be shared through various media formats, such as press releases, ads in local newspapers, television or radio public service announcements, or presentations at community meetings such as those of homeowner associations and local civic organizations, PTA meetings, or other gatherings of members of the watershed community. The

group might wish to issue a watershed *report card* or develop a fact sheet, brochure or annual report to highlight its successes. Report cards let the community know whether water quality conditions are improving overall. They also allow people to compare results across specific areas to see if things are improving, whether some aspects seem to be connected and whether a change in direction is needed to bring about greater improvements. This is an effective way to build awareness of the watershed issues and the progress of watershed plan implementation. In addition, when people see progress, they'll continue to work toward making the plan a success!

#### Make Adjustments

- Ask questions.
- Incorporate feedback and adjust you plan.
- Develop discrete opportunities to adjust the plan (i.e., a 6-month review).

## Module Conclusion

For more information see the *Handbook for Developing Watershed Plans to Protect and Restore Our Waters* (http://water.epa.gov/polwaste/nps/handbook_index.cfm) and the *Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters* (http://water.epa.gov/polwaste/nps/upload/watershed_mgmnt_quick_guide.pdf).

If you have completed this module, you now know all the steps involved in developing and implementing a successful watershed outreach campaign and you can get started! Remember that there are no hard-and-fast rules. The tips provided in this module are meant to inspire you and help you get started off on the right foot. The important thing is to make real progress with your goals. If done wisely, outreach will be one of the most effective, satisfying, and enjoyable ways to help reach your goals.

# Self-Test for Watershed Planning Module

Now that you have completed the Introduction to Watershed Planning Module, perhaps you would like to test what you have learned. After you've completed the quiz, check your answers with the ones provided at the bottom of the page.

Ways to contact us:
Use the online submission form (http://water.epa.gov/aboutow/owow/contact.cfm).

You may also write us at:
wacademy@epa.gov

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1. **The Watershed Planning Module is designed for people who:**

   **A.** Are (or would like to be part of a local watershed planning process.
   **B.** Would like to protect or improve the quality of life in your area.
   **C.** Have question about regulations, funding, or where to find help.
   **D.** All of the above

2. **Which step listed below is NOT included in the six steps of Watershed Planning?**

   **A.** Build partnerships
   **B.** Characterize your watershed
   **C.** Finalize goals and identify solutions.
   **D.** Develop clean energy solutions
   **E.** Design an implementation program

3. **How many elements has EPA identified that need to be included in watershed plan that are funded under section 319?**

   **A.** 8
   **B.** 6
   **C.** 9
   **D.** 12

4. **The first step of Watershed Planning, Building Partnerships, involves**

   **A.** Integrate local, state, tribal and federal programs
   **B.** Conduct outreach
   **C.** Identify driving forces
   **D.** Identify and engage relevant stakeholders and local issues
   **E.** All of the above

5. **During watershed planning, stakeholders help to**

   **A.** Ensure that concerns are factored into the decisions made
   **B.** Share the responsibility of the decision
   **C.** Ensure that those who live outside the watershed do not have a say in the process
   **D.** Share implementation of the decision
   **E.** A, B, and D

6. **What are key actions to help planner fill data gaps?**

   **A.** Windshield surveys
   **B.** Interviews with residents
   **C.** Targeted sampling
   **D.** Volunteer monitoring
   **E.** Bioassessments
   **F.** All of the above

7. **All of the following are included in Exploratory Data Analysis (EDA) EXCEPT**

   **A.** Summarizing univariate statistics like mean, median, variance, and standard deviation
   **B.** Analysis using parametric statistical tools (i.e., normal distribution, independence and constant variance)
   **C.** Data transformation (e.g., log10)
   **D.** Creating a data inventory
   **E.** Examining scatterplots and calculating correlation coefficients

8. **The three major components of the Water Quality Standards Program are:**

   **A.** Designated use, existing use, and TMDLs
   **B.** Water quality criteria, antidegradation, and existing uses
   **C.** Antidegradation, designated use, and water quality criteria
   **C.** TMDLs, water quality criteria, and designated use

9. **To keep your implementation team energized through the process, you might consider**

   **A.** Providing monetary incentives
   **B.** Hosting periodic field trips and site visits to document implementation activities
   **C.** Changing team members frequently

10. **Watershed models can be used to analyze**

    **A.** Air Quality
    **B.** Erosion
    **C.** Pollutant loading
    **D.** Population trends
    **E.** B and C
    **F.** B, C, and D

**Correct Answers:** 1. D; 2. D; 3. C; 4. E; 5. E; 6. F; 7. D; 8. B; 9. F; 10. B;