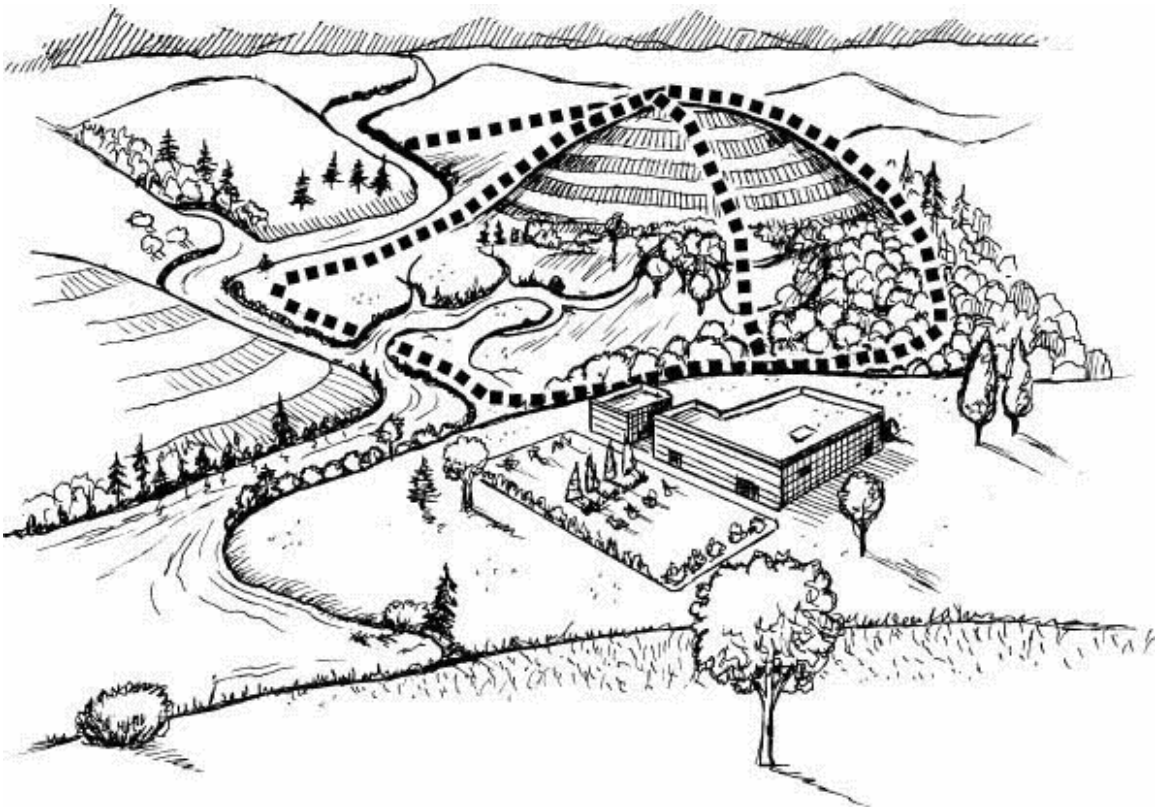
Organizing a Watershed Partnership

The Conservation Information Center (CTIC), a nonprofit partnership dedicated to the advancement of environmentally beneficial information, practices, and technologies, coordinates the Know Your Watershed campaign. The center was established in 1982 under the charter of the National Association of Conservation Districts. For more information call 765-494-9555.



Acknowledgements

The majority of the information contained in this document was obtained from the Know Your Watershed campaign and the Center for Watershed Protection. Both of these nonprofit organizations can be accessed through the Internet at the addresses below. Additional information was obtained through the Keep America Beautiful Organization.

Conservation Information Technology Center: http://www.ctic.purdue.edu/CTIC/CTIC.html
Center for Watershed Protection: http://www.cwp.org/

About this document

Organizing a Watershed Partnership is a document for people who want to begin the process of building a local partnership to help protect their watershed. The document will not solve all of your problems. It is designed to provide general guidelines for going through the process of building voluntary partnerships, developing a watershed management plan, and implementing that plan. Because each watershed is unique, there may be sections that do not apply to your particular situation. A Table of Contents is provided to help you narrow your search for the appropriate information that may apply to your group.

Table of Contents

Getting to Know Your Local Watershed

Why is your watershed important?

A watershed is an area of land that drains into a river, stream, lake or wetland. As rainwater and melting snow run downhill, they carry sediment and other materials into our streams, rivers, lakes, wetlands and groundwater. We all live in a watershed. Watersheds are the places we call home, where we work and where we play. Everyone relies on water and other natural resources to exist. What you and others do on the land impacts the quality and quantity of water and our other natural resources.

Healthy watersheds are vital for a healthy environment and economy. Our watersheds provide water for drinking, irrigation and industry. Many people also enjoy lakes and streams for their beauty and for boating, fishing and swimming. Wildlife also needs healthy watersheds for food and shelter.

Managing the water and other natural resources is an effective and efficient way to sustain the local economy and environmental health. Scientists and leaders now recognize the best way to protect the vital natural resources is to understand and manage them on a watershed basis. Everything that is done in a watershed affects the watershed's system.

Pollutants and water quality

In the past, most water quality problems were traced to the most obvious cause, point-source pollution. This means the problem can be traced to a specific location such as a pipe or disposal site. Technical and regulatory methods have been used to detect and control these problems. Much progress has been made in preventing further water quality problems from point sources.

However, water quality problems from nonpoint-source pollution are more difficult to isolate and control. These sources are often hard to identify and difficult to measure. This type of pollution results from a wide variety of activities over a wide area. Nonpoint-source pollutants are in the water that runs off crop or forest land. Others include failing septic systems, parking lots, construction sites, irrigation systems and drainage systems. It can even result from automobile exhaust getting in the atmosphere and falling back to earth in the rain.

A partnership among all who live, work or play in the watershed can help identify concerns, educate those involved and encourage them to take action. Watershed management plans focus on prevention of pollution. This is easier and cheaper than trying to cleanup a watershed after the fact. Understanding your watershed is the first step in protecting the water and other natural resources.

Understanding your watershed

The watershed where you live is a dynamic and unique place. It is a complex web of natural resources - soil, water, air, plants and animals. Yet, everyday activities can impact these resources, ultimately impacting our well being and economic livelihood.

Features - Your watershed has many features that make it unique.

- **Size**
  One important feature is the size of the watershed. Some (like the Mississippi River basin) are very large and include many smaller river basins or watersheds. These smaller watersheds can be subdivided into even smaller areas. The ideal size for a voluntary partnership to work with is 50,000 acres or less. At this size your group will likely see water quality improvements sooner than in larger areas. Of course, in regions of the United States where ranchers, foresters and others manage large tracts of land, you may be working with a much larger watershed.
- **Boundary**
  Another important feature is the geographic boundary of the watershed. A ridge or high area from which water drains either toward or away from your watershed forms the boundary.
- **Terrain**
  The topography (terrain) is another important feature. How flat or steep the land is, impacts how fast water drains. The faster the drainage, the more potential for flooding and increased soil erosion.
- **Soil type**
  Soil type is also important. For example, sandy soils allow the ground to soak up water faster. This reduces surface runoff, but can affect ground water. Clay soils, on the other hand, are tighter and do not allow as much water infiltration. This can lead to more runoff and soil erosion.
- **Other features**
  Whether your watershed drains into a stream or lake, the area nearest the water greatly affects water quality. This is why filter/buffer strips, wildlife habitat, wetlands and riparian areas are important aspects of your watershed.

Both filter/buffer strips and wetlands utilize nutrients and tie up sediment to help improve water quality. Wetlands also act as natural sponges to absorb peak flows of water and reduce flooding. Many fish and wildlife species rely on wetlands for rearing their young, and for food and shelter. To fully understand your watershed, you'll also need to consider how it is used.

Land uses and trends

All activities within the watershed have an impact on its natural resources. Cities, homes, roads and factories modify the watershed and affect its natural resources. Farming, recreation, mining, construction and forestry can also significantly affect a watershed. One trend you may want to note is whether or not more homes are being built in rural areas. This can lead to conflicts over watershed issues such as livestock odor, pesticide use or septic systems. It can also lead to significant changes in land use, which can affect water quality and property values.

- **Natural resource uses -** You may also find natural resources are used in many different ways in your watershed. Municipalities and local industries can use water. Farms also rely on water for irrigation and livestock. Many people enjoy water for recreational uses like fishing, swimming and boating. So the water quality and quantity are important to the watershed's stakeholders. Air quality, wildlife, soil

quality and the other natural resources can also be important aspects of watershed management.

- **Stakeholder uses -** To fully understand your watershed you'll also need to understand how the people who live use it, work and play there. These are the stakeholders who need to be involved in the planning and implementing process. For this reason, they'll need to be a part of the watershed partnership.
- **Social trends** - Social trends also influence watershed management efforts.
- **Economic trends -** A sound local economy is also important to everyone with a stake in the watershed. That's why it's important to consider the local economy and ways to sustain or improve it through successful watershed management. Ask your group how the natural resources within the watershed can affect the local economy.
- **Employment trends -** These trends can be critical. For instance, are people living in one and working in a different watershed? Are jobs and family incomes dependent on the watershed? Do people understand how various jobs depend on it? Is employment stable? Are jobs transient?
- **Attitude trends -** Most people rely on their beliefs and experiences, rather than on scientific data, to shape their attitudes. This means that when their perceptions don't match reality, people react to their perceptions, not reality.

Beginning Watershed Projects

1. Determine size and boundaries
2. Show terrain
3. Overlay soils
4. Identify and map critical areas
5. Map land uses and identify trends
6. Identify uses of natural resources
7. Determine employment trends
8. Study economic trends
9. List stakeholders
10. Define attitude trends

Watershed Partners

As you look around your community, you'll find people who will want to be involved in a plan to protect your watershed. The section of this document, Building Local Partnerships, describes how partners can contribute and outline strategies for building local watershed partnerships. Successful partnerships start with partners understanding each other's beliefs about current issues. What people believe to be real is real in its consequences. Understanding each other's beliefs will help you resolve conflicts and speed up your efforts.

By using the partnership approach you'll find greater local initiative, responsiveness, and control. Partnerships can build a climate of cooperation and focus on solutions. A plan developed by a local partnership is more effective and efficient than other methods such as, broad sweeping regulations. The result is improved environmental and economic health of your watershed. The list below provides you with a starting point for locating possible watershed partners.

Watershed Partners

- Landowners or Homeowners
- Local businesses
- Developers or Contractors
- Recreation users
- Elected officials and Government agencies
- Teachers, schools, and other organized youth groups
- Environmental and Conservation groups
- Civic groups and Church groups
- The media
- Others

Successful Watershed Management

Effective watershed management and planning relies on an effective partnership that includes representatives of all stakeholders. All of the persons involved should strive to work cooperatively toward the common watershed goals of the partnership. A study of watershed management efforts highlights some of the keys to successful groups. They are:

- Include all (or as many as possible) stakeholders in the local partnership
- Use sound information in determining your groups goals and objectives
- Set clear/obtainable goals and objectives
- Select effective management alternatives
- Develop innovative educational and assistance programs
- Use strong local leadership
- Use a systems approach that integrates all concerns and challenges.

The Watershed Planning Process

To summarize, an effective watershed planning process should include the following action steps:

Get To Know Your Watershed

- Determine size, boundaries, soils, terrain, and other features
- Understand the people, interest, and institutions
- Determine how the watershed is used

Build Local Partnerships

- Identify and contact local partners and stakeholders
- Divide your work and responsibilities
- Identify and manage conflicts
- Obtain local funding and other resources

Determine Priorities for Action

- Assemble maps and data
- Identify and document problems
- Evaluate water quality
- Assess land uses
- Select critical areas for attention

Conduct Educational Programs

- Identify and understand your target audiences
- Develop specific measures
- Combine communication approaches, channels, and make use of the media

Provide Landowners With Assistance

- Target technical assistance
- Provide financial assistance
- Build social support and recognition

Ensure Implementation and Follow-up

- Continue with monitoring and evaluation
- Provide continued local assistance
- Continue to inform and involve everyone (or as many as possible).

Building Local Watershed Partnerships

Why Build a Local Partnership?

Partnerships are the key to effective watershed management. Through a partnership different people and organizations work together to address they're common interest and concerns. Other terms such as teams, associations, alliances, consortiums, etc. can be used instead of partnerships. What you call your organization and how it is structured is up to your group. In fact, effective organizations are as unique as the watershed itself.

A partnership is the easiest way to develop and implement a successful watershed management plan because everyone is involved from the beginning. That means the ultimate plan will truly have the consensus of all persons who have a stake in the group. In addition, a partnership often results in:

- More efficient use of financial and other resources
- A spirit of sharing and cooperation
- Fairness which minimizes the potential for negative social and economic impacts
- More creative and acceptable ways to protect natural resources

Typical projects of a watershed partnership may include the following:

- Field trips and tours
- Meetings and workshops
- Canoe trips
- Volunteer monitoring
- Cleanup and restoration days
- Education programs for schools, civic groups, and other local organizations
- Media relations
- Opinion surveys
- Focus groups

Building your partnership can be challenging. It takes time and skill to create a successful partnership. Maintaining motivation and enthusiasm is a big challenge, especially if positive results do not happen quickly. All of the relevant stakeholders must believe their efforts are needed, and are important. As you build your partnership, you will encounter these and many other challenges.

Who Should Be Included

Anyone with a stake in the watershed should be involved. A successful watershed plan depends on involving a good mix of people and organizations in putting together and implementing the plan. You will need to find people to play a number of roles. These roles include:

- Technical
- Leadership
- Communication
- Education
- Political liaison
- Public policy

Partners and Contributions

Some people who live outside the watershed may even have a role to play because they may benefit from, or be impacted by the activities within the watershed. Below is a list of possible partners and their contributions.

Mass Media
Coverage of watershed events
Human interest stories
Understanding of local information needs
Ability to get information out quickly

Business & Industry
Distribute information, influence decisions
Donate equipment and services
Funding for programs
Sponsor field demonstrations

Landowners & Managers

Trustworthy information sources
Role models
Peer pressure

Financial Institutions
Influence over management decisions
Linkage with landowners
Prestige for partnership
Funding for programs

Environmental & Conservation Groups
Knowledge of environmental constituents
Awareness of problems & issues
Committed & knowledgeable members

Chamber of Commerce

Compatible goals for local economy
Concerns & interest of business

Students

Influence over efforts in the future
Time & energy for repetitive task

Women's Groups
Influence over family decisions
Interest & concern for health issues
Ability to mobilize & motivate members

Civic Organizations
On-going programs & activities
Interest & concern for community
Fund-raising skills

Local Elected Officials
Political leadership & credibility
Land use & management decisions
Financial support for projects

Local Government Agencies
Financial & technical support
Logistics, equipment, & related support
Data collection & analysis expertise

Teachers
Influence over values and beliefs
Ability to shape future generations
Source of information

Religious Leaders
Commitment to stewardship
Ability to appeal to higher values
Credibility in the community

Retired Persons

Time & talent for teamwork
Understanding of local history & conditions

Keys to Successful Partnerships

Building a successful partnership takes skill, time, and patience. Here are some specific strategies to help.

- **Establish a sense of need and direction** - All partners need to know they're working toward a worthwhile purpose. They also need to know what is expected of them.
- **Select partners based on existing and potential skills, not personalities** - Partnerships will need technical or communications, problem-solving, and interpersonal skills.
- **Pay attention to early meetings and activities** - First impressions mean a lot. People are often skeptical at the first meeting and may be suspicious of other partners.
- **Set some 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 to succeed** - Be sure that early projects are realistic and will be seen as "Winners" in the eyes of the partners.
- **Challenge the group regularly with fresh facts and information** - New information will help better understand your situation and improve your effectiveness.
- **Spend time together** - It will take time to get the partnership working effectively. Spend time (outside the meeting 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.

All people with a stake in the watershed should feel welcome as a partner. Use the list on page 9 as a starting point for possible partners and contributors. In addition, consider the following three distinct groups:

- Those who are both affected by and interested in watershed protection
- Those who are affected, but not interested
- Those who are not affected but are interested.

While each partner should understand and agree to their own roles and responsibilities, all partners should be able to take part in any decision or activity which they have an interest or expertise.

Building a Common Purpose, "The Mission Statement"

An important way to build a partnership is to develop a clear sense of your purpose through a statement. Partners should develop a clear and concise purpose (mission) statement that defines the general goals and responsibilities.

"**The Blue Lake Watershed Association is dedicated to protecting Blue Lake's quality of life and the economic vitality of land users in the watershed**."

A carefully worded statement will serve as a yardstick for decision-making, for measuring progress, and will provide motivation for high quality. Make sure all partners are comfortable with the statement. Steps include:

- Ask for ideals from all partners
- Discuss the ideals and draft a statement
- Revise the draft based on discussion
- Write a final statement based on consensus
- Solicit statements of commitment from all partners

This process is not easy and will take time. Potential conflicts need to be discussed and resolved. Remember, it is important to keep the statement general enough to encourage widespread support, but specific enough to identify goals that measure progress.

To accomplish the purpose (mission) statement the group will need to set short and long-term goals. These goals should include general strategies (e.g., increase support of watershed protection). The goals for more specific activities will also be needed (e.g., series of newspaper articles tree plantings etc.). Focus on the future in setting clear and attainable goals. Partners should assume specific responsibilities to accomplish within a definite time frame. Partnerships often get stuck at this stage because past experiences dictate what the group believes they can or cannot do. Do not let the past dictate the future!

Set up a Flexible Organization

There is no single partnership structure that will work in every watershed. Instead, your group should determine how formal the partnership needs to be. Partners could meet on a regular basis or only be contacted as needed. Some division of labor and

delegation of responsibility should be set up to take advantage of resources and expertise. Your group may want to build on existing community organizations, such as informal groups of land managers, formal organizations, and other community organizations. Your local soil and water conservation district, natural resource agencies, extension, conservation clubs, Chamber of Commerce, service organizations (e.g., Lions Club or Jaycees) or a local business can provide valuable advice on organization and facilitation.

Subcommittees could be formed for activities such as media relations, fund-raising, or demonstrations. Assignments might depend on the scope of the activities, goals and interests. They could also be organized to deal with specific resource management areas such as soil erosion, recycling, nonpoint source pollution problems, litter control, or septic systems. It may be necessary to include representatives from more than one area depending on the watershed boundaries. If the watershed is too large, the group may want to subdivide it into smaller watersheds with their own partners.

How Partnerships Develop

Successful partnerships take time to develop. Your group should come to expect some highs and lows, and some successes and failures during the developmental stages. There are four main stages each involving specific feelings and actions. If you understand and prepare for these different stages, your group will find it easier to move through difficulties, and reach success in the end.

1. **The Forming Stage** - When a partnership is forming, people cautiously explore each other. Feelings at this stage include excitement and optimism mixed with skepticism and anxiety. Some activities to consider during this stage are:

- Defining the job at hand and discussing how to accomplish it
- Deciding what information needs to be gathered
- Discussing concepts and issues
- Identifying all the barriers to getting the job done.

2. **The Storming Stage** - This is often the most difficult stage. Partners have a tendency to become impatient and argumentative. Feelings include resistance to change, and negative attitudes about the success of the partnership. Some of the signs of this stage include:

- Arguing about less important issues
- Becoming defensive or competitive (choosing sides)
- Developing unrealistic goals
- Increasing tension and jealousy

3. **The Normalizing Stage** - In this state people accept their roles in the organization, as well as the ground rules. Conflicts are usually reduced, and competitors become more cooperative. Feelings include acceptance of the teams memberships, and relief that things seem to be working out. Some activities during this stage include:

- Constructive change
- Ability to work through problems
- Closer attachments to the partnership.

Overcome Obstacles

Regardless of how cooperative the people in your partnership are, some problems will ultimately arise. There are several ways to overcome obstacles:

- **Anticipate and prevent obstacles**: This works best by spending time and getting to know each other, establishing ground rules, and agreeing to individual roles and responsibilities.
- **Think of each problem as a challenge**: We have a natural tendency to blame others for our problems. The truth is that many/most problems occur because the group lets them happen.
- **Be careful with difficult people**: When problems do occur with a particular person, try not to over-react. Some behaviors are only a minor disruption. On the other hand, other behaviors are very disruptive and can slow the group's progress. Learn to distinguish the difference.

How to Build Consensus

It is important to recognize and overcome obstacles to establish and maintain a successful partnership. These obstacles include:

- **Lack of time or other resources** - Many partners usually have other commitments. They may not view the time spent in watershed meetings as important use of their time or resources.
- **Low levels of commitment or interest** - This may happen if an effort gets bogged down or if partners are not kept active.
- **Individualism and the "American Way**" - Much of the time the ideal of working together is contrary to beliefs in self-sufficiency and competition. Some people tend to feel it is a sign of strength to be able to solve their own problems.
- **Loss of autonomy or recognition** - Many people worry that a partnership means a loss of freedom or control over their own activities. Some also worry that they may not get enough credit for the work they do within the partnership.
- **Conflicting goals or missions** - Because partnerships involve diverse members including businesses, government agencies, and advocacy groups the members often have very different goals and expectations. In fact, some see the partnership as a way to pursue their own agenda.
- **Blaming others or feeling blame** - It is a natural human tendency to blame others for our problems. Partners may blame each other for the groups lack of progress. This can lead to the perception that they are being unfairly criticized.
- **Overbearing or dominating partners** - Some partners (often those in authority or with expertise) have too much influence over a partnership. Such experts often discourage discussion or criticize the ideals of others.
- **Reluctant partners** - Most groups have one or more members who never speak. Problems can arise unless these partners are encouraged to be active in some way.
- **Feuds and competition between partners** - Partners with long-standing feuds often times attempt to continue their feud in the partnership. These tend to be based on past problems and not the group.
- **Unquestioned acceptance of opinion as fact** - Some people try to present their own personal opinion or values as facts (many times without supporting evidence).

- **Rush for accomplishments** - Some partners may push to do something, either because they are impatient or they are feeling pressures from elsewhere. These partners often reach conclusions before the rest of the group has had time to consider all the options.
- **Attribution and criticism** - People often assign (attribute) negative motives to others when they disagree or do not understand their position. This delays the process of seeking real explanations for problems.
- **Digression and tangents** - People sometimes have a tendency to drift from the subject. Some digression is useful if it promotes new ideals, but it often wastes time. Unfocused discussions can be the result of poor leadership.
- **Floundering** - Partnerships may have trouble starting and finishing projects. They often get stuck in a rut, with some partners resisting moving forward.
- **Lack of Flexibility** - Some partners may have just one way of doing things and seem unable to adapt to change.

Dealing with difficult people

- Do nothing. Ignore the problem if it is only an occasional issue.
- Talk informally with the disruptive partner(s) outside the group setting. Give constructive feedback.
- Discuss the general concerns at the beginning of a meeting without pointing out the particular partners.
- For a particular disruptive behavior, it may be necessary to confront the partner(s) outside the group in a more assertive manner.
- As a last resort (once other approaches have failed) the leader may need to confront the person in the presence of the group. Use constructive feedback, but in an objective and assertive manner.

One of the best ways to overcome obstacles is to build consensus. Effective decisions share the following characteristics:

- **Total participation** - All major interest are identified and brought together.
- **All partners are responsible** - Everyone helps plan the activities and offers suggestions to make them more effective.
- **Partners educate each other** - Members of the group spend time discussing the history of the issues, their perceptions and concerns, and ideals for solutions.
- **People are kept informed** - Partners keep their own group and the rest of the people that live in the watershed well informed.
- **A common definition of the problem is used** - Partners discuss and agree on a constructive definition of the problem.
- **Multiple options are identified** - Partners seek a range of options that may satisfy their respective concerns, and avoid pushing a single position.
- **Decisions are made by mutual agreement** - Partners do not vote! The group modifies its options or seeks alternatives until everyone agrees that the best decisions have been reached.
- **Partners are responsible for implementation** - The group identifies various ways to implement solutions for their problems.

Ways to Maintain Consensus

- Actively involve a broad range of stakeholders and citizens as partners in planning and implementing the watershed management efforts.
- Ensure each partner has the opportunity and is responsible for meaningful contributions.
- Document, publicize, and celebrate the group's successes through an ongoing recognition program and communication campaign.
- Designate an effective and respected project leader(s) who can maintain the activities of the partnership.
- Identify and manage conflicts early.
- Make sure your activities are exciting and fun to maintain interest and commitment.

Teambuilding Exercises

Partnerships do not naturally develop to their highest potential without some time, practice, and a little help. The exercises below can be used during your groups meetings to build a more successful team effort.

Exercise 1 - Member Introductions

This serves as a warm-up activity for the group during the first meeting. Simply go around the room and ask each person to share the following information about them:

- Name
- Job
- Affiliation (who they represent)
- How long they've lived in the area
- Expectations for the partnership or meeting

It could also be helpful to ask each person about his or her perceptions of the most important watershed management issues. This question may be used during later meetings after the partnerships begin to form.

Exercise 2 - Responsibility Matrix

This can be used to match people with their responsibilities for developing and implementing your groups watershed program. The exercise is best used after some type of plan or action items have been developed. The objective is for the partners to assume responsibility for the main tasks.

- Draw a chart (or matrix) on a flip chart
- First let the partners identify all the tasks that need to be carried out
- List these tasks (action items) down the chart (as rows on your matrix)
- Across the top, label three columns (Leader - Group - Partner)
- Consider one task at a time, and let the group decide who should have the primary responsibility for completion of the tasks. The person's name should be listed beside the task (Be sure and keep these list for future reference).

Exercise 3 - **Dealing with Disruptive Group Behavior**

Through this exercise, the group decides how to deal with problems that arise. This is especially useful if the partnership seems to have stalled, or when conflicts arise.

- The group's first step is to list (brainstorm) types of disruptive behaviors. There are no right or wrong answers in brainstorming.
- List all the ideals on a flip chart. Continue until everyone has listed their ideals
- Use consensus to reduce the list to the two or three most disruptive types of behaviors. Discuss reponses for each type of behavior.

- Three types of responses might be:
  - Preventive
  - Minimal Intervention (discussion)
  - Higher Intervention (confrontation)

Using the flip chart put these headings on three columns. The group then may want to brainstorm possible responses for each behavior and write them in the appropriate columns. When the list is complete, discuss the pros and cons of each one. As a group, decide which options are the most appropriate for dealing with these disruptive behaviors.

This exercise is a good method for dealing with many situations that may arise during the group's watershed management planning process. Listing all possibilities and choosing the "do-able" projects is one of the best ways for a watershed partnership to reach consensus decisions (Be sure and keep all documentation for future reference).

Leading and Communicating

Understanding Leadership

Successful partnerships don't just happen. They depend on the leaders who emerge from the groups. Yet, leaders of successful watershed partnerships differ from leaders of many organizations. Watershed leaders do not assume the same amount of control or responsibility, as do leaders of formal organizations.

Effective Leadership

Effective leaders generally coordinate activities and keep the partnership moving forward. They handle or delegate administrative details such as calling and conducting meetings and preparing reports. An effective leader can have a wide range of backgrounds. He or She can be a farmer or rancher, banker, pastor, housewife, salesperson, teacher, or nearly anyone with an interest and commitment. In fact, some successful partnerships have more than one leader. Shared leadership is possible when two or more people rotate responsibilities.

Leadership traits

- Interested in the groups concerns while sensitive to individual needs
- Aware of current social and political situations

- Good communication and group interaction skills
- Respected as knowledgeable and fair
- Able to share responsibility and credit with others
- Promotes consensus, compromise and trade-offs
- Integrates a variety of different perspectives
- Patient, creative and flexible

Technical Advisors

Technical advisors are also important to partnerships. These advisors work closely with the leader to determine tasks. They can focus on the technical validity of a plan and project. Someone from a natural resource agency or consulting group should be involved since they can help address technical issues. In fact, a "team" of technical advisors will likely emerge. The team should reflect the concerns and issues being addressed by the partnership. This team may be part of the local watershed partnership or it may be separate. In either case, the section Building Local Partnerships will help with building the team.

Effective Coordination

Leaders get the partnership started and keep it moving. Effective leaders serve as neutral catalyst for the groups decisions and actions. They also accept some responsibility for helping the partnership focus on common tasks. They do not make decisions for the group. A skillful leader will:

- **Keep the Purpose, Goals, and Approach Relevant and Meaningful** - Help partners determine, clarify, and commit to the groups goals. Leaders can inspire appropriate actions, but should not try to move the partnership in any particular direction.
- **Build Commitment and Confidence** - Understand and try to balance the needs and interest of both individuals and the overall partnership. Positive and constructive feedback helps make the partnership more successful.
- **Strengthen the Mix, Level of Skills** - Recognize and build on the strength and skills of members of the partnership. Effective partnerships depend on having and appropriate balance of technical, interpersonal, management and other types of skills. The leader ensures that all the necessary skills are available for the partnership.
- **Manage Relationships with Outsiders, Including Removing Obstacles** - Ensures that external relationships are developed and maintained. The responsibility may be shared with other partnership members.
- **Create Opportunities for Others** - Leaders should not try to do everything themselves. They must provide opportunities for individuals for the partnership to grow and work effectively. This involves delegation of authority and responsibility.
- **Do Real Work** - Leaders are members of the partnership and are, therefore, responsible for doing their share of the work.

Communication Strategies

Successful partnerships are built on open and ongoing communication. Only this way can partners come to a shared understanding. Communication is a two-way process. Listening is as important as speaking. The communication process is never perfect and some information is always lost or jumbled in the process. Below are several strategies that will help your partnership communicate more effectively:

- **Look for Common Ground** - Find shared values and consider shared personal experiences. Pay attention to and give productive feedback. Always be yourself and expect the same of others. Be willing to accept the difference in perception and opinions.
- **Find Out About Others** - Learn about others interests and needs. Consider their perspectives and appeal to what motivates them the most. Let members of the partnership express themselves freely.
- **Attack Problems, not People** - Don't waste time on personal hostilities. Make other members of the partnership feel welcome and encourage their input. Avoid criticism and insults.
- **Give and Get Respect** - Show respect for the opinions of others. Always be considerate and friendly. Put yourself in the other person's shoes. Speak with confidence, but remain tactful.
- **Precede Slowly** - Present one ideal at a time. Check for the acceptance and understanding of each ideal before moving to the next. Try to speak in a logical and organized sequence.
- **Be Explicit and Clear** - Share your ideals and feelings. Pay attention to nonverbal communication (body language). Speak clearly and look at your partners in the eyes. Select words that have meaning for your listening audience.
- **Remember the Five "C's" of Communication**

  I. Clarity
  II. Completeness
  III. Conciseness
  IV. Concreteness
  V. Correctness

  Listening

  Listening helps us learn and show others that we respect their views. There are three major steps to listening:

  - **First**, focus your mind on the person speaking
  - **Second**, use body language to signal attention and interest
  - **Third**, verbally reflect and respond to what the speaker feels and says.

  Below are more tips to remember for effective listening:

  - **Stop Talking** - You can't listen while your talking. Concentrate on what others are saying. Don’t interrupt or change the subject.

- **Slow Down Your Thoughts** - Realize that you can't listen any faster than a person can talk. Pay attention and summarize what a person is saying. Don't be too quick to judge the other person(s).
- **Understand the Other Person** - Review and summarize what they are saying, get the meaning, not just the words. Paraphrase what you have heard and listen for what is not said.
- **Control your Own Emotions** - Don't mentally argue with the other person, keep an open mind. Avoid jumping to conclusions or going on the defensive. Avoid arguments or criticism.
- **Ask Questions** - Ask for clarification. Remember that there is no such thing as a stupid question. Invite the other person to provide more detail and insights.
- **Control your Body Language** - Remember that actions often speak louder than words. Look at the person, keep eye contact, and respond as appropriate.

Even if you use all of the above strategies and are a skilled communicator, problems can still arise. When communication breaks down, partnerships can get stuck. People lose energy and enthusiasm. It may help your partnership improve communication by keeping some of these barriers in mind.

- **People are different** - They vary in knowledge levels, communication skills and cultural perspectives. They also have different backgrounds and frames of reference.
- **People are impatient** -They jump to conclusions. People think faster than they listen, which means they assume to know what the other person will say next.
- **People are selective** - They tend to hear what they want to hear. People are also more likely to accept something that supports what they already believe.
- **People can be negative** - They can be bossy or sarcastic. They may take things personally and get angry. People can also tend to show cynicism or mistrust.

Discussion

Much of the work done in partnerships involves face-to-face discussions. The main reason for having discussions is to generate new ideals. Brainstorming is an essential mechanism to bring out the creativity in your group. The result is often a variety of good ideals that can lead to new solutions. Below are some guides for brainstorming.

- **Set the Stage** - Define your purpose in terms of what the partnership wants to accomplish. Provide a relaxed and informal atmosphere, and have all the necessary supplies such as markers, flip charts etc.
- **Go for Quantity** - People have different ideas. The key to a brainstorming session is to get these ideas down quickly without concern for quality. The evaluation comes later.
- **Record Ideas** - The ideas need to be recorded on a flip chart by a recorder. If people in your group do not want to share their ideas openly, then another good method s the use of post-it-notes. Allow people to silently write down their ideas and these can be placed on the flip chart so others can see them.
- **Encourage Free Wheeling** - Let people share their ideas no matter how unrealistic they may seem to be. Don't evaluate or criticize at this point.

- **Limit Time** - Set a time limit for generating ideas so people are motivated to get their ideas out quickly. This allows time for discussion and evaluation of ideas, usually during the same meeting time.
- **Use Humor** - Allow the group a break out of existing patterns and habits, be creative, relax and have fun. May be a good opportunity to use team-building exercises.
- **Follow-up** - After ideas are generated, the group should identify some of the more promising suggestions. They can then work on ways to expand or improve these ideas, and decide to include them in their watershed management plan. This is the evaluation and decision stage, and it make take another meeting time to completely evaluate the ideas generated from a brainstorming session.
- **Recognize When to End Discussion** - Learn when there is nothing to be gained from additional discussions. Help the group close the discussions and make decisions. State any decisions that have seem to be made. Check to see if everyone agrees with the summary and can live with decisions (this can be done with a vote or general consensus).

How to Give & Receive Feedback

An important skill development for leaders is learning to give and receive constructive feedback. Good feedback skills are needed for productive meetings and to promote cooperation among partners. Everyone should agree that giving and receiving feedback is an important and acceptable way to work together as a group. No one should be surprised or shocked by open and honest feedback. Be sure to provide both positive and negative feedback. Often times we take the good work for granted and only give feedback when problems arise. It is just as important to point out something you like! Think carefully about what you are going to say and how you are going to say it. Make sure the time and place are right (keep discussions about the partnership limited to meetings).

Giving Feedback

- Be descriptive. Use specific information.
- Don't use labels. Be clear and objective.
- Don't exaggerate. Be exact and avoid absolutes like "always" or "never".
- Don't be judgmental. Don't compare the person you are talking with to others.
- Speak for yourself. Don't refer to what "others" say.
- Talk first about yourself. Start with statements with "I" and not "you".
- Stick to what you know. Don't present opinions as facts.

Receiving Feedback

- Take a deep breath. Relax before responding.
- Listen carefully. Don't interrupt.
- Ask questions for clarity. Ask for specific examples.
- Acknowledge the feedback. Repeat the message in your own words and make sure you understand.
- Acknowledge valid points. Agree with what is true and what is possible.
- Take the time to think about what you have heard. Check with other partners if you are not sure.

Conducting Effective Meetings

Much of the work in a partnership gets planned or done in meetings. Unfortunately, we all have spent time in meetings that turned out to be a waste of time. The tips in this section will help you make your meetings more productive and even enjoyable.

About the group's first meetings

The first meeting is very important for establishing trust and communication. During the first few meetings you'll want to:

- Learn each other's backgrounds, skills, perceptions, and interests.
- Begin to work as a partnership by recognizing each other's strength and interests.
- Set ground rules and determine organizational structure.
- Begin to develop a purpose (mission) statement. See the "Building Local Partnerships" section of this document for more information.

Prior to the Meeting

- **Select a convenient time and location** - Evening meetings are usually the best for most people who work during the day. Lunch meetings are also sometimes possible. Ask the partners what they prefer.
- **Select a "neutral" site** - Many civic clubs, churches, community centers, libraries, restaurants and other provide space for meeting rooms. You may want to consider avoiding government offices or the office/home of a partner.
- **Develop and agenda** - People want to know what to expect. The agenda should be sent out prior to the meeting.
- **Arrange tables and chairs so that everyone can be a part of the discussion** - Circular tables work well as do large rectangular ones. Keep the temperature of the room comfortable and provide plenty of water, coffee, and other refreshments.

During the Meeting

- **Respect your partner's time** - Never allow meetings to begin or end late. Only hold meetings as often as necessary to carry out your work.
- **Use the agenda** - Ask for suggestions on the agenda at the beginning of the meeting. Refer to the agenda regularly during the course of the meeting to keep it focused and on time.
- **Take minutes** - These are very important because they serve as a reminder of what people have discussed and agreed to do. Be sure to record the group's decisions and concerns.
- **Establish specific procedures and objectives** - Clearly define your role as leader. Get agreement on the meeting objectives and procedures for conducting the meeting. Maintain the focus and direction of the group.
- **Promote shared decision making** - Give as few as directions as possible. Check for consensus at appropriate times, ask questions and encourage ideas.
- **Monitor and improve group processes** - Make sure the group is moving along and not getting stuck. Be patient and don't interrupt, however, keep in mind time constraints. Make sure all the partners have had an opportunity to speak and be heard.

- **Foster good relationships and a positive climate** - Allow for creative conflicts and disagreements over issues. Discourage interpersonal confrontations or personal attacks. Avoid being defensive if a group member challenges you.
- **Before the meeting ends, try to get a sense of how it went** - Ask the group what they feel the meeting accomplished. Determine the unfinished business left for the next meeting. Set a time, place, and tentative agenda for the next meeting.

Managing Conflict

Conflict is a natural disagreement resulting from individuals or groups that differ in attitudes, beliefs, values or needs. Many times it originates from past rivalries and personality differences. Other causes of conflict include trying to negotiate before the timing is right or before all the necessary information is available. Conflict is not always negative; in fact, it can be healthy when effectively managed. Healthy conflicts often can lead to:

- Growth and innovations
- New ways of thinking
- Additional options

If the conflict is understood, it can be effectively managed by reaching a consensus that meets both the needs of the individual's and the partnership's needs (Many times these needs are confused with the needs of society - Learn to distinguish the difference). This consensus results in mutual benefits and strengths the relationships. The goal is for all to "Win" by having at least some of their needs met.

The Ingredients of conflict

- **Needs** - Needs are things that are essential to our well being. Conflicts arise when we ignore these needs (our own needs or the needs of the group). Be careful not to confuse needs with desires (things we would like, but are not essential). For an excellent insight into conflict read Robert Fulghum's, Uh Oh, Some Observations from Both Sides of the Refrigerator Door, pg. 143-147, paperback edition.
- **Perceptions** - People interpret reality differently. They perceive differences in the severity, and the causes and consequences of problems. Misperceptions are a common cause of conflicts in many group discussions. Learn to separate personal biases from the perceptions of the watershed issues.
- Power - How people define and use power is an important influence on the number and types of conflicts that occur, which also influences how conflict is managed. Conflict can arise when people try to make others change their actions or try to gain unfair advantages.
- **Values** - Values are beliefs or principals we consider being important. Serious conflicts arise when people hold incompatible values or when these values are not clear. Conflicts also arise when a member(s) of the partnership holds something as a value rather than a preference.
- **Feelings and Emotions** - Many people let their feelings and emotions become the major influence over how they deal with conflict. Dealing with feeling and emotions can be a difficult issue and the partnership should try to deal with solutions to their watershed problems and not the emotions created by them. However, people should not ignore their own emotions or those of others.

Steps to Managing Conflict

There are five steps to managing conflict. These steps are:

I. Analyze the conflict
II. Determine a management strategy
III. Pre-negotiation
IV. Negotiation
V. Post-negotiation

Step One: Analyze the conflict

The first step is to analyze the nature and type of conflict. To do this, it is helpful to ask questions. The answers to the questions may come from your own experience, your partners, local media coverage, etc. You may actually want to interview some of the stakeholders involved.

Step Two: Determine a Management Strategy

Once you have a general understanding of the conflict, the groups involved will need to analyze and select the appropriate strategy. In some cases it may be necessary to have a neutral facilitator to help the group move towards consensus.

Conflict Management Strategies

- **Collaboration** - this result from a high concern for your group's own interest, matched with a high concern for the interests of other partners. The outcome is "Win/Win". The strategy is generally used when the concerns for others are important. It is also a strategy best used when society's interest is at stake. The approach helps build commitment and reduces bad feelings. The drawbacks are that it takes time and energy. In addition, some partners may take advantage of others trust and openness. The objective of collaboration is to reach group consensus.
- **Compromise** - this strategy results from a high concern for your own group's interests along with a moderate concern for the interests of other partners. The outcome is "Win some/Lose some". The strategy is best used to achieve temporary solutions; to avoid power struggles, or when time pressures exists. One major drawback is that partners can loose sight of important values and long term objectives. The approach may also distract from the merits of an issue and create a cynical climate.
- **Competition** - this strategy results from a high concern for your group's interests with less concern for others. The outcome is a "Lose/Win" situation. The strategy includes most attempts at bargaining and it is generally used when basic rights are at stake or to set a precedent. The drawback of this strategy is that it can cause conflict to escalate and losers may try to retaliate.
- **Accommodation** - this result from a low concern for your group's own interests combined with a high concern for the interests of other partners. The outcome is "Lose/Win". The strategy is generally used when an issue is more important to others than it is to you. It is a gesture of goodwill and is appropriate when you

recognize that you are wrong. The drawbacks are that your own ideas and concerns don't get attention and you may loose credibility and future influence.

- **Avoidance** - this results from a low concern for your own group's interests coupled with a low concern for the interests of others. The outcome is "Lose/Lose". The strategy is generally used when an issue is trivial or there are other issues that are more pressing. It may also be used when the chances of confrontation are high or more information is needed. The drawbacks are that important decisions may be made by default.

Conflict Analysis Exercise

Think of a controversial issue to analyze. On a separate sheet of paper, answer the following questions:

Groups Involved

- Who are the groups involved?
- Who do they represent?
- How are they organized?
- What is their power base?
- Are the groups capable of working together?
- What are the historical relationships among the groups?

Substance

- How did the conflict arise?
- How are the main and secondary issues described?
- Can negative issues be re-framed positively?
- Are the issues negotiable?
- Have positions been taken and, if so, are there common interests?
- What information is available and what additional information is needed?
- What values or interests are challenged?

Possible Strategies

- Would consensus serve all interests?
- Are there external constraints or other influences that must be accommodated?
- What are the past experiences (if any) of the groups working together?
- What is the timeline for a decision?
- How will the public and the media be involved and informed?
- Will an outside negotiator (facilitator) be needed?

Step Three: Pre-negotiation

To set the stage for effective negotiation, the groundwork must be laid. The following should occur prior to negotiations:

- **Initiation** - One partner raises the possibility of negotiation and begins the process. If no one is willing to approach the other partners encouraging him or her to reach agreement, then an outside facilitator could be used.

- **Assessment** - Conditions must be right for negotiations to be successful. The key players must be identified and present during the process. Each side must be willing to collaborate with the others. Reasonable deadlines and resources to support the effort should exist. Spokesperson(s) for each group must be identified and involved. The partners need to determine which issues are negotiable and which are not.
- **Ground Rules and Agenda** - The group must agree on ground rules for communication, negotiation and decision-making. They should agree on the objectives of the process. An agenda of issues needs to be developed.
- **Organization** - Meeting logistics must be established, including agreed upon times and places. People should be contacted prior to the meeting and encouraged to attend. Minutes must be taken so that information can be distributed before and after meetings.
- **Joint fact-finding** - The groups must agree on what information is relevant to the conflict. This should include what is known and not known about the social and technical issues. Agreement is also needed on methods for generating answers to questions.

Step Four: Negotiation

- **Interests** - When negotiating, be sure to openly discuss interests, rather than stated positions. Interests include the reasons, needs, concerns and motivations underlying positions. Satisfaction of interests should be the common goals.
- **Options** - To resolve conflicts, concentrate on inventing options for satisfying interests. Do not judge ideas or favor any options suggested. Encourage creativity, not commitment.
- **Evaluation** - Only after the partners have finished listing all the options, should the options be discussed. The partners together should determine which ideas are best for satisfying various interests.
- **Written Agreement** - Document areas of agreement and disagreement to ensure common understandings. This helps to ensure that agreements can be remembered and communicated clearly.
- **Commitment** - Every partner should be confident that the others will carry out their part of the agreement. Discuss and agree upon the methods to ensure that partners understand and honor their commitments

When Evaluating Options:

- Use objective criteria for ranking ideas
- Make trade-offs among different issues
- Combine different options to form acceptable agreements

Step Five: Post-negotiation

Once the negotiation process is complete, the group will need to implement the decisions made. Some key steps include:

- **Ratification** - The partners must get support for the agreement from the organizations that have a role to play in the agreement. These organizations should also be partners/stakeholders and should be involved in the previous steps. Each

organization will need to follow their own procedures to review and adopt the agreement.

- **Implementation** - The partnership's job is not done when agreement is reached. Communication and collaboration should continue as the agreement is carried out. The partnership will need to have a plan to monitor progress, document success, resolve problems, renegotiate terms and celebrate success.

Negotiation Skills

Negotiation is an important skill for coming to an agreement when conflicts develop. When negotiating, remember you're dealing with people who have their own unique needs, emotions and perceptions. Some conflicts are based on differences in thinking and perceptions. These conflicts exist mainly in people's minds. It helps for each party involved put themselves into the other's shoes so they can understand each other's points of view. Identify and openly discuss differences in perception, being careful not to place blame. In addition, recognize and understand the other side's emotions as well as your own.

Interest vs. Position

People often confuse interests with positions. An interest may be reducing litter along the roadside. There may be possible ways of addressing this interest. One position might be to mandate recycling, another might be a deposit on bottles and cans, and still another could be organizing a neighborhood cleanup day. Focusing on interests, rather than positions, makes it possible to come up with better agreements. Even when people stand on opposite positions, they usually have a few shared interests.

It takes time and effort to identify interests. Groups may not even be clear about their own interests. It helps to write down each group's interests as they are discovered. It helps to ask why others take the positions or make the decisions they do. Partners will have multiple interests involving human needs such as security, economic well-being, a sense of belonging, recognition and control over one's own life just to name a few. All of these factors add difficulties to the negotiation process.

Developing Optional Solutions

When developing optimal solutions that meet the interests of all sides, try to meet as many of each side's interests as possible. Start by inviting all sides to brainstorm ideas before reaching a decision. Brainstorming is discussed in the "Leading and Communicating" section of this document. Below are a few obstacles to developing solutions:

- Judging and rejecting prematurely
- Searching for a single best answer
- Putting limits on scope or vision
- Considering only your own interests

To overcome these obstacles, view the situation through the eyes of different partners. Focus on shared interests to make the process smoother for all involved. Look for meaningful opportunities, not just simple solutions.

Developing Objective Criteria

When developing criteria for searching or combining possible alternatives, revisit the conflicting interests. These can't be ignored or "wished" away. Instead, discuss them as you begin to develop criteria for judging alternatives. Keep in mind principals such as fairness, efficiency and scientific merit. Strive for criteria that are legitimate, practical and unbiased. Your group may find it helpful to explore the criteria used in making past decisions and discuss these with your partners or outside experts.

Putting Together a Watershed Management Plan

The goal of watershed management is to plan and work toward an environmentally and economically healthy watershed that benefits the its stakeholders. By now your partnership probably has a good feel for the watershed including maps and other background information. You group should also, by this time, have developed a purpose (mission) statement, which identifies your goals and objectives. See the "Building Local Partnerships" section of this document for more information on developing a mission statement. Putting together a watershed management plan is an important step in the process of the further development of your partnership. Your group should review all information gathered to this point to determine if you are ready to begin the planning process. You should have the following types of information (Keep in mind that not all of this information is needed for each watershed):

- Most interested stakeholders are involved and all have been invited
- The group has map(s) and detailed information such as:

    - Boundaries
    - Terrain
    - Water bodies
    - Soil types
    - Roads
    - Land use
    - Recreational use
    - Fish and game surveys
    - Development trends
    - Employment trends
    - Education trends

- The group has technical advisors to assist them
- The group has committed to meet regularly at a neutral location and agreeable time

Stage-by-Stage

Once you and your partners have pulled together as much information as possible about your watershed, you're ready to start putting together a plan. The planning process can be broken into three stages:

I. The first stage includes uncovering concerns, gathering and analyzing information and data, defining challenges and opportunities, developing objectives, and documenting data and decisions.

II. The second stage includes developing a game plan for addressing the objectives, selecting the best watershed management alternatives, listing strategies for implementing the selected alternatives, and determining how to measure progress.
III. The third stage includes implementing and evaluating efforts.

Remember that your group's efforts will be based on the best available assessment of the natural, economic, and social features of your watershed. It is unrealistic to assume you will have all the information you'll need so, be sure and recognize and weigh the missing information throughout the planning process. Another key point to remember is that these stages are not always accomplished in order. For example, a youth group may want to monitor a stream while the watershed partnership continues to determine or develop objectives and strategies.

Challenges and Objectives

The group goes back and forth between identifying concerns/problems, seeking data, analyzing data and establishing objectives.

Identifying Concerns

Your watershed partnership will need to identify and address concerns about the water and other natural resource systems, local economy and social structure. Some concerns will be based on perceptions and others will be based on science. Since it is difficult to separate perceptual from scientific concerns, all concerns need to be addressed by the group. All concerns will need to be explored to see if there is, in fact, a real problem. Sometimes what you and/or your neighbor may think is a problem (concern), isn't a natural resource issue and thus, needs to be addressed in another way. Or when researching perceived problems, you may discover a new problem that the group will want to address.

When developing the list of concerns to be explored, be sure everyone with a stake in the watershed is involved from the beginning. Getting everyone around the same table takes more than a simple announcement in the paper (although reporters from the local media - newspapers, radio and TV stations - can help bring others to the group by covering your group's activities). You and others from your group will need to make some phone calls and personal visits to explain the purpose of a watershed management plan and how the individual will benefit from getting involved.

Your group may also want to consider how the group envisions future generations using the natural resources within the watershed. You may want to check with your state water quality agency to determine the designated water uses for your watershed. (Most bodies of water in the United States have been designated for a specific type of use.) This information can be used to begin discussion of water and other natural resources. Other key aspects to consider are some of the major economic forces. Who are the major employers? Where are they located? What are the trends? How can your group affect their future? How can your group impact the economic future of the watershed? How do the economic, social and natural resources impact each other? What is the role of education now and in the future?

During this phase all concerns, regardless how minor need to be surfaced. Only in this way will all concerns be addressed. Everyone needs to list his or her concerns. This list should be compiled for all to see. It's important that debate on the merits of the concerns be held for later discussion. The objective is to get all concerns on paper at this point.

Seeking and Analyzing Data

Once stakeholders have listed all concerns, you and your group will need to combine similar subjects. The next step is to seek information and data about the concerns. Many watershed partnerships have a team of advisors (technical team) who assists the group with technical questions. Other groups select a subcommittee to research the concern and report back to the larger group. Some groups bring in consultants for this purpose while others rely on assistance from state, federal and local agencies.

Regardless of which way your group decides to go about it be sure to seek and use any existing monitoring data. This can serve as a baseline for comparison later. The data available will vary considerably from watershed to watershed depending on the extent of past monitoring efforts and resources.

Prioritize Challenges and Opportunities

After listing concerns and exploring them by gathering and analyzing data, challenges and opportunities will surface. Unfortunately, there are not enough funds or time to address all potential watershed management needs. Priorities must be set that target efforts to the most critical problems/opportunities. This is why your group will need to strive for consensus on prioritizing which problems / opportunities to pursue. Many groups begin prioritizing problems by establishing criteria. This might include:

- **Ability to influence change -** Ask you if there is anything the group can do to influence the changes needed to overcome the challenges.
- **Delay between actions and results** - Checking with your advisory team, try to determine the amount of time between when changes occur and when results can be seen. For example, it may take decades to see results from changes on the land that ultimately affect a deep aquifer, but changes near a stream bank may quickly affect the quality of the stream's water.
- **Willingness to change -** Ask yourself if the reasons are strong enough to motivate and if those who will need to change would be willing to do so.
- **Cost/benefit ratio -** Are the costs going to outweigh the benefits or are the benefits going to outweigh the costs?

Documenting challenges and opportunities

One of the most important steps in watershed protection is to correctly identify and document challenges and opportunities. A challenge is an obstacle that prevents positive changes on parts of society, the economy, or the environment. In contrast, an opportunity is a condition that can be created to make a positive affect on society, the economy, or the environment.

By now your group has probably identified several problems and/or opportunities. These will need to be written down so future partners and prospective financial supporters will understand the situation. It may be helpful to document both the resource being affected

and the existing condition (quantity or quality). It also helps to describe damage in both economic ($20,000 annual loss) and resource terms (30 acres or 750 fish). The statement should also include whom, how, where and what is being affected.

Other documentation

In addition to problem/opportunity statements, all data and other information gathered during this initial phase needs to be recorded. Maps will also need to be included. Basically, be sure anything that would help a new partner understand how and why the group has made the decisions are included. The maps and other data will probably be needed later when you are developing brochures and other educational tools for implementing your group's plan. In addition, if the group tries to obtain outside financial assistance, the documentation will be needed to support the request for funding. Having documentation makes it easier to put together a proposal on short notice. Either when a new funding source is located or when "opportunity knocks" with a short time for getting the application or grant request submitted.

Why document?

- Makes it easier to obtain funding
- Useful for creating informational brochures and other educational materials
- Background information for new partners
- Ideal for reporters and others from the media to develop stories about the group's efforts

Establishing Objectives

Once your problems/opportunities have been defined and documented, establishing objectives is relatively easy. The main purpose for establishing objectives is to clarify the goals of the group. Remember these points when establishing objectives. All views of those with a stake in the watershed must be considered and consensus reached on how the group envisions the health of the watershed in the future.

- Existing legal constraints need to be considered. Describe the objective in measurable terms (i.e. Increase number of wild turkeys by 25% or reduce soil erosion on forested land by 60%).
- Recognize the objective may change later as more information becomes available. For instance, an initial objective may be to simply "increase trout population." Later your group will have the necessary information to refine the objective to "increase trout population by 22%."\
- Keep objectives acceptable and achievable. Partners need to ask themselves if they can live with the objective and if they think it is achievable.

The emphasis during this stage is to develop and analyze alternatives, then come to consensus on a game plan that everyone in the partnership can live with.
There are three parts of the game plan your group will need to consider. They are:

I. Selecting Management Alternatives
II. Developing an Action Plan
III. Determine how to Measure Progress

Selecting Management Alternatives

The first step in selecting management alternatives is to develop a "long list" of management alternatives that could help achieve the objective(s). Many watershed partnerships rely on their advisory team to assist them with this. It's important to list as many alternatives as possible. Do not try to rank them at this point. Next, using your advisory team, try to determine the effectiveness of each of the alternatives. Be sure to consider economic, social, and environmental factors.

Group Exercise - Selecting management alternatives

1. List an alternative on a sheet of paper and tape to the wall. Do this for each of the alternatives.
2. Below each alternative, list advantages/disadvantages. The partnership may want to consider the following factors: economic, environmental, social.
3. Using consensus, rate each alternative giving consideration to the likelihood of its success. (You may wish to list some implementation strategies for several of the top alternatives before you do this.)

Developing an Action Plan

By now you and your partners have a vision of the watershed in the future (purpose statement). The watershed partnership also has set objectives and selected management alternatives for achieving those objectives. Now attention needs to be focused on how to make the selected alternatives a reality. Most watershed partnerships begin this process with an action plan. An **Action Plan** is simply a list of the actions the group decides to do, who is responsible and when it's to be done. Chances are local businesses and government agencies already use a similar plan for organizing their actions. They may call it something else, but most plans use the same format.

To put together an **Action Plan**, first list all objectives. Under each objective, list the selected management alternatives. Once all the selected alternatives have been listed, leave blanks for actions, responsibilities and time periods. Make copies for each partner. Brainstorm action items as a group. This will get partners thinking about ways to get the job done. Partners may want to take the papers home and fill in the blanks. Set a time for the partnership to get back together to share their thoughts. When the group gets back together, one person needs to record all the action ideas in one place.

Partners then combine similar actions and select the top three to five choices for each of the selected alternatives. These actions become the partnership's focus. Next, an individual or small group needs to become responsible for the action. This is a good time to look around the watershed for groups who haven't been as involved as they would like to be and get them involved. After responsibilities have been determined, a realistic time period for completing the action can be set. Be sure all groups involved understand their responsibilities and the time frame.

Types of Actions

There are four main types of actions that most watershed partnerships consider.

1. Information/education
2. Technical assistance
3. Funding
4. Regulatory

Most groups use a combination of the first two types of actions (information/education and technical assistance). Some groups also use funding. Few use regulatory approaches. Very few use all four types.

- **Information/education** - Few people will make changes without understanding what changes need to occur, why change is needed, how to make the change, and how the change will affect the individual.
- **Technical assistance -** Many people need more than just information about the change, but also require some type of assistance. This may take many forms including one-on-one discussion, demonstration, drawings and plans, implementation instruction and/or oversight.
- **Funding -** In some case change will cause an economic hardship. This is when many watershed partnerships include cost-share and other forms of financial assistance in action plans.
- **Regulatory -** Occasionally local ordinances, zoning or other types of regulation are necessary. Partnerships are strongly encouraged to explore other options before recommending this action. Rarely is this a positive action for all stakeholders, which makes consensus very difficult to reach.

Funding your Actions

Some of the actions your group has selected will require little, if any, money to do. Often actions require donated time or materials from local individuals, organizations, businesses or industry. Some actions, like cost-share incentives or compensation, do require funding. This is when your group will need to explore funding options. In fact, many watershed partnerships make obtaining financial assistance an action. Responsible individuals or groups are assigned and a time frame agreed upon.
Due to the time and paperwork associated with federal and state funding, most groups start by looking for funding locally. Local utilities, non-profit organizations, and others have funded watershed management actions. This is also a good time to ask for assistance in putting together a workshop on grant proposals. Invite local and state specialists to inform your partnership on the art of grant writing. Many organizations conduct workshops specifically on this topic.

Prioritize Actions

It won't take long to list more actions than your group can possibly do. This is why the group will need to prioritize the actions. When prioritizing, be sure to consider the following:

- Funds available
- Return on funds to be invested
- Time and other financial resources
- Ability to get the actions done
- Early successes motivates more action
- Some actions rely on other actions for success

Be sure to include your advisory team in this process. They may have experience in determining which actions depend on others and how to get the most return on your investment. For example, it's important to get preventive actions (such as erosion control practices) underway before taking restoration actions (such as dredging a lake).

Measure and Report Progress

In addition to establishing a baseline prior to implementation, the partnership needs to consider how to evaluate the effectiveness of the plan and the progress toward the objective. This need not be expensive and should be included in the Action Plan. For instance, turbid water can be measured with a simple secchi disc, pH can be measured with a pH strip, nitrates and phosphorous can also be measured with a simple indicator strip. An annual count or survey can measure wildlife. Another good barometer is the number of hunting and fishing licenses issued.

The method used for measuring change should be determined by the watershed partnership. Again, partners may want to ask for technical assistance from local conservation groups or science teachers. You may also wish to enlist a youth group, Lake Association, conservation group or other group to measure the partnership's progress. Regardless of the measurement, it's very important to report progress back to both the partnership and to the press. Only by everyone seeing progress will they continue to work toward making the plan a success.

- **Review the plan -** As seasons go by, the watershed partnership will need to review the plan. Be sure to ask the tough questions like, do we still need to do this? Why? What else can we do? Has our vision changed? Do we have new or additional information that will change the objectives or selected alternatives? What has been successful? Why? What could have been improved? How?
- **Celebrate success -** Whether it's the 500th fishing license or the 20th mile of buffer or the sighting of the 50th wild turkey or the first 24" secchi disc measurement; it's important to celebrate.

Watershed Stewardship Programs

Once a partnership is developed, communities still need to invest in ongoing watershed stewardship. The goals of watershed stewardship are to increase public awareness about watershed management efforts and to get participation in the process to ensure stewardship on their own property and homes. There are six basic programs that the watershed community should consider to promote a greater watershed stewardship:

1. Watershed advocacy
2. Watershed education
3. Pollution prevention

4. Watershed maintenance
5. Indicator monitoring
6. Watershed restoration

Watershed Advocacy - Promoting watershed advocacy is important because it can lay the foundations for public support and greater watershed stewardship. One of the most important investments that can be made in a watershed is to seed and support a watershed management structure to carry out the long-term stewardship function. Often, grass roots watershed management organizations are uniquely prepared to handle many critical stewardship programs, given their watershed focus, volunteers, low cost and ability to reach into communities. Watershed organizations can be forceful advocates for better land management and can develop broad popular support and involvement for watershed protection. Local governments also have an important role to play in watershed advocacy. In many watersheds, local governments create or direct the watershed management structure.

Watershed Education - A basic premise of watershed stewardship is that we must learn two things - that we live in a watershed and that we understand how to live within it. The design of watershed education programs that create this awareness is of fundamental importance. Four types of watershed education programs are:

- **Watershed awareness** - Raising basic watershed awareness using signs, storm drain stenciling, streamwalks, maps
- **Personal stewardship** - Educating residents about the individual role they play in the watershed and communicating specific messages about positive and negative behaviors
- **Professional training** - Educating the development community on how to apply the tools of watershed protection
- **Watershed engagement** - Providing opportunities for the public to actively engage in watershed protection and restoration.

Pollution Prevention - Some watershed businesses may need special training on how to manage their operations to prevent pollution and thereby protect the watershed. In some cases, local or state government may have a regulatory responsibility to develop pollution prevention programs for certain businesses and industrial categories (e.g., under industrial or municipal NPDES permits).

Watershed Maintenance - Most watershed protection tools require maintenance if they are to properly function over the long run. Some of the most critical watershed "maintenance" functions include management of conservation areas and buffer networks, and maintenance of storm-water practices, septic systems, and sewer networks. Maintenance of the quality of watersheds may even require some reforestation and can also provide an opportunity for public involvement and education.

Watershed Indicator Monitoring - An ongoing stewardship responsibility is to monitor key indicators to track the health of the watershed. Public agencies should seriously consider monitoring to provide high quality and low cost indicator data. One form of monitoring stream quality is to assess the quantity and quality of aquatic biota. A more sophisticated form of monitoring is a hydrologic gaging station, which can compute the stream velocity and measures pollutant levels.

Watershed Restoration - The last phase of watershed stewardship is to restore or at least rehabilitate streams that have been degraded by past development. Urban watershed restoration is an emerging art and science that seeks to remove pollutants and enhance habitat to restore urban streams. The urban watershed restoration process should include three main themes: storm-water retrofitting, source control through pollution prevention, and stream enhancement. In this stream restoration project, pools are created by log-drop structures, which provide a habitat for fish to spawn.

Key Stewardship Choices for the Watershed Partnership

The following are some of the issues that watershed managers should address when designing watershed stewardship programs:

- Is my community ready to undertake restoration?
- Which mix of stewardship programs is best for my watershed?
- Who are the best targets for watershed education?
- How am I going to pay for a stewardship program?

How to Organize a Community Cleanup

Here are some general guidelines for a community cleanup. Tailor them to fit your specific project's needs, depending on the size and scope of the cleanup and the number of volunteers who are involved.

1. Get The Facts - Involve The People - Plan Systematically - Focus on Results - Provide Positive Reinforcement

    - **Who are your volunteers?** Who will be responsible for planning the cleanup? Contact neighbors and friends. Develop a cleanup committee. Appoint a cleanup project coordinator. Hold a meeting and get your volunteers' input. Keep a diary to record the event (including the planning stages) in case you want to stage a future project.
    - **What part of your community needs cleaning?** You may not be able to do it all, so prioritize your project's to-do list. First, take a walk through the area to be cleaned and make a list. Take special note of any large objects (appliances, tires, tree limbs or furniture) so that you can arrange in advance for their removal. For abandoned vehicles, check with your local Sanitation or Public Works Department. If your project plans include someone else's property (like a vacant lot, park or playground) make sure to get permission well in advance from the private owner or the local government agency that manages the site.
    - **When will the cleanup take place?** Saturdays seem to work best, usually from 9 a.m. to noon. In case of bad weather, make sure you plan for an alternate "rain date," usually the following Saturday. For large-scale cleanups, make sure your project is not scheduled on the same day as a popular community event, or one that also relies on volunteers. Make sure that all of your volunteers know the date, the alternate "rain" date, and the times that your cleanup is scheduled to begin and end.
    - **Where will you ask volunteers to meet?** For a community cleanup, a church, recreation center, local business or civic center are possibilities. Make sure to plan for restrooms and first aid, work breaks with simple refreshments like water, juice, cookies and fruit, and provides trash and recycling receptacles.

- How will you separate recyclable and yard waste from trash, and how will you transport them to the landfill, recycling center and composting facility? First, check with the facilities to make sure that you know their hours of operation, the kinds of materials that they accept, and whether special trash bags or receptacles are needed. (For example, some composting facilities accept all kinds of yard waste, some require yard waste to be in special, biodegradable brown bags, and some do not accept tree stumps. Some recycling centers require that recyclable plastics, glass, aluminum/other metals be separated from each other.)

2. Getting Local Officials, Businesses, Community Groups, and Media Involved - Depending on the size and scope of your cleanup, you may want to:

- **Contact your Sanitation or Public Works Department in advance** - It may be possible to arrange for crews and trucks to remove bags of litter or heavy items like appliances, car parts or tree limbs. It may be possible to arrange for your cleanup group to bring the trash they have collected to a waste transfer station, landfill or waste incinerator free of charge on the day of the event. Sanitation or Public Works officials can also work with the Police Department to have abandoned vehicles tagged and removed.
- **Ask local businesses and restaurants to help** - They might be willing to participate because the cleanup will take place nearby, or because the owner wants to do something for the community. Businesses can donate supplies (flowers, bulbs, paint and paint brushes, t-shirts, refreshments), help truck debris to the waste facility or recycling and composting centers, provide window space for posters advertising the cleanup, or ask employees to volunteer. Make sure that anyone donating goods or services has a contact name and number to call for information.
- **Ask for volunteers** - Contact chambers of commerce, scout troops, church groups, garden clubs, and other community and civic organizations.
- **Contact your local media in advance** - Your local newspaper, radio or TV station may be interested in your project. Make sure they have a name and telephone number to call for more information. Make a reminder telephone call the day before the cleanup. Take good "before" and "after" photos, record the number of volunteers, amount of trash collected, flowers planted, etc., -- this makes a great "good news" story for local media.

3. Materials you Will Need

- Encourage volunteers to wear proper clothing, sturdy shoes and work gloves. Have extra gloves, caps and sunscreen on hand.
- Based on your to-do list, you may need spades, rakes, paintbrushes and paint, brooms, shovels, flower bulbs, watering cans, hoses, etc. Make a checklist of the equipment that you will need and line it up in advance; start by asking as many volunteers as possible to bring their own equipment.
- First-aid kit.
- Refreshments for volunteers like water, juice, cookies and fruit. Remember to arrange for restrooms and to schedule work breaks!
- Do not forget to provide plenty of trash bags, plus separate containers (or different color trash bags) for recyclable and yard waste.

- A camera, to take before-and-after photos.

4. Safety First!

Make sure that children are under an adult's supervision at all times. Use sunscreen and dress appropriately. Use heavy work gloves to protect your hands. Take special care and use appropriate tools to handle broken glass and sharp objects. Remind volunteers not to handle containers or drums that may contain hazardous materials.

5. Always Say Thank you!

- Volunteers are special people. Hold a picnic or cookout immediately after the cleanup to thank them, and invite the local officials, business owners, community and civic groups that helped you get the job done.
- Write thank-you notes to local officials, business owners, community and civic groups that helped with any aspect of your project.
- If you are being interviewed by the media, don't forget to mention that volunteers and local officials (use name and title), business owners (use owner's name and name of business), community and civic groups (use name of your contact and name of their group) helped to make your project a success.

6. Why are you doing this?

For smaller-scale cleanups, neighbors and friends know the obvious answer: because you are proud of your neighborhood and want to make it look as clean and beautiful as possible. For larger-scale community cleanups, you may want to develop a mission statement to give to your local newspaper, TV or radio station ahead of time, since they may be interested in what you are doing and may wish to cover some aspect of your cleanup and beautification project. A mission statement is also useful if you plan to organize periodic cleanup and beautification projects; it is a good way to enlist volunteers and potential community partners, like local business owners and civic groups.

References, Definitions and Additional Information

A

Ablation. The process by which ice and snow waste away owing to melting and evaporation.
Absorption. The entrance of water into the soil or rocks by all natural processes. It includes the *infiltration* of precipitation or snowmelt, gravity flow of streams into the valley alluvium (*see* **Bank storage)** into sinkholes or other large openings, and the movement of atmospheric moisture.
Acre-foot. A unit for measuring the volume of water is equal to the quantity of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet or 325,851 gallons. The term is commonly used in measuring volumes of water used or stored.
Anabranch. A diverging branch of a river which reenters the mainstream.
Anchor ice. Ice in the bed of a stream or upon a submerged body or structure. *(See also* Schaefer, V. J., 1950, p. 888.)
Annual flood. The highest peak discharge in a *water year*.
Annual flood series. A list of *annual floods*.
Antecedent precipitation index. An index of moisture stored within a drainage basin before a storm. (Linsley and others, 1949, p. 414.)
Area-capacity curve. A graph showing the relation between the surface area of the water in a reservoir and the corresponding volume.

Average discharge. In the annual series of the Geological Survey's reports on surface-water supply--the arithmetic average of all complete water years of record whether or not they are consecutive. Average discharge is not published for less than 5 years of record. The term "average" is generally reserved for average of record and "mean" is used for averages of shorter periods, namely, daily mean discharge.

B

Backwater. Water backed up or retarded in its course as compared with its normal or natural condition of flow. In *stream gaging,* a rise in *stage* produced by a temporary obstruction such as ice or weeds, or by the flooding of the stream below. The difference between the observed stage and that indicated by the *stage-discharge relation,* is reported as backwater.

Bank. The margins of a *channel.* Banks are called right or left as viewed facing in the direction of the flow.

Bankfull stage. Stage at which a stream first overflows its natural banks. *(See also* **Flood stage.** Bankfull stage is a hydraulic term, whereas flood stage implies damage.)

Bank storage. The water absorbed into the banks of a stream channel, when the stages rise above the water table in the bank formations, then returns to the channel as effluent seepage when the stages fall below the water table. (After Houk, 1951, p. 179.)

Base discharge (for peak discharge). In the Geological Survey's annual reports on surface-water supply, the discharge above which peak discharge data are published. The base discharge at each station is selected so that an average of about three peaks a year will be presented. (*See also* **Partial-duration flood series.)**

Base flow. *See* **Base runoff.**

Base runoff. Sustained or fair weather runoff. In most streams, base runoff is composed largely of groundwater effluent. (Langbein and others, 1947, p. 6.) The term *base flow is* often used in the same sense as base runoff. However, the distinction is the same as that between streamflow and runoff. When the concept in the terms *base flow* and base runoff is that of the natural flow in a stream, base runoff is the logical term. *(See also* ***Ground-water runoff*** *and* **Direct runoff.)**

Basic hydrologic data. Includes inventories of features of land and water that vary only from place to place (topographic and geologic maps are examples), and records of processes that vary with both place and time. (Records of precipitation, streamflow, ground-water, and quality-of-water analyses are examples.)

Basic hydrologic information is a broader term that includes surveys of the water resources of particular areas and a study of their physical and related economic processes, interrelations and mechanisms.

Basic-stage flood series. *See* **Partial duration flood series.**

Braiding of river channels. Successive division and rejoining (of riverflow) with accompanying islands is the important characteristic denoted by the synonymous terms, braided or anastomosing stream. (Leopold and Wolman, 1957, p. 40.) A braided stream is composed of *anabranches.*

C

Catchment area. *See* **Drainage basin.**

Cfs. Abbreviation of *cubic feet per second .*

Cfs-day. The volume of water represented by a flow of 1 cubic foot per second for 24 hours. It equals 86,400 cubic feet, 1.983471 acre-feet, or 646,317 gallons.

Cfsm (cubic feet per second per square mile). The average number of cubic feet of water per second flowing from each square mile of area drained by a stream, assuming that the runoff is distributed uniformly in time and area.

Channel (watercourse). An open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. River, creek, run, branch, anabranch, and tributary are some of the terms used to describe natural channels. Natural channels may be single or braided *(see* **Braiding of river channels**) . Canal and floodway are some of the terms used to describe artificial channels.

Channel storage. The volume of water at a given time in the *channel* or over the *flood plain* of the *streams* in a *drainage basin* or river *reach.* Channel storage is great during the progress of a *flood event. (See* Horton, 1935, p. 3.)

Climate. The sum total of the meteorological elements that characterize the average and extreme condition of the atmosphere over a long period of time at any one place or region of the earth's surface. The collective state of the atmosphere at a given place or over a given area within a specified period of time. (Landsberg, 1945, p. 928.)
Climatic year. A continuous 12-month period during which a complete annual cycle occurs, arbitrarily selected for the presentation of data relative to hydrologic or meteorologic phenomena. The climatic year is usually designated by the calendar year during which most of the 12 months occur. (*See* **Water year**.)
Cloudburst. A torrential downpour of rain, which by its spottiness and relatively high intensity suggests the bursting and discharge of a whole cloud at once. (Woolley, 1946, p. ii.)
Concentration time. *See* **Time of concentration**.
Concordant flows. Flows at different points in a river system that have the same *recurrence interval,* or the same frequency of occurrence. It is most often applied to floodflows.
Condensation. The process by which water changes from the vapor state into the liquid or solid state. It is the reverse of evaporation.
Conservation storage. Storage of water for later release for useful purposes such as municipal water supply, power, or irrigation in contrast with storage capacity used for flood control.
Consumptive use. The quantity of water absorbed by the crop and transpired or used directly in the building of plant tissue together with that evaporated from the cropped area. (U.S. Bur. of Reclamation, 1952, p. 3.)
The quantity of water transpired and evaporated from a cropped area or the normal loss of water from the soil by evaporation and plant transpiration. (Blaney, 1951b, p. 190.) (*see also* **Water requirement** *and* Blaney, 1951a, p. 4.)
The quantity of water discharged to the atmosphere or incorporated in the products of the process in connection with vegetative growth, food processing, or an industrial process (MacKichan, 1957, p. 2.)
Consumptive use, net. The consumptive use decreased by the estimated contribution by rainfall toward the production of irrigated crops. (Simons, 1953, p. 12.) *(See* **Effective precipitation (3)**.) Net consumptive use is sometimes called crop irrigation requirement.
Consumptive waste. The water that returns to the atmosphere without benefiting man. (Thomas, 1951, p. 217.)
Contents. The volume of water in a reservoir. Unless otherwise indicated reservoir content is computed on the basis of a level pool and does not include *bank storage.*
Control. A natural constriction of the channel, a long reach of the channel, a stretch of rapids, or an artificial structure downstream from a *gaging station* that determines the *stage-discharge relation* at the gage.
A control may be complete or partial. A complete control exists where the stage-discharge relation at a gaging station is entirely independent of fluctuations in stage downstream from the control. A partial control exists where downstream fluctuations have some effect upon the stage-discharge relation at a gaging station. A control, either partial or complete, may also be shifting. Most natural controls are shifting to a degree, but a shifting control exists where the stagedischarge relation experiences frequent changes owing to impermanent bed or banks.
Correlation. The process of establishing a relation between a variable and one or more related variables. Correlation is simple if there is only one independent variable; multiple, if there is more than one independent variable. For gaging station records, the usual variables are the short-term gaging-station record and one or more long-term gaging-station records. (Searcy, 1960.)
Correlative estimate. A discharge determined by correlation. A correlative estimate represents a likely value of the discharge for any particular period--commonly a month--according to a specified method of analysis. (After Langbein and Hardison, 1955, [no. 826], p. 826-8.)
Cryology. Science of ice and snow.
Cubic feet per second. A unit expressing rates of discharge. One cubic foot per second is equal to the discharge of a stream of rectangular cross section, 1 foot wide and 1 foot deep, flowing water an average velocity of 1 foot per second.
Current meter. An instrument for measuring the speed of flowing water. The Geological Survey uses a rotating cup meter.
FIGURE

Cusec. This abbreviation for cubic foot per second, common in the British Commonwealth countries (except Canada), is not used by the U.S. Geological Survey; instead, *cfs* is used.
Cycle. A regularly recurring succession of events such as the cycle of the seasons. Use of cycle to describe a group of wet years followed or preceded by a group of dry years is to be avoided.
D
Dead storage. The volume in a reservoir below the lowest controllable level. (Thomas and Harbeck, 1956, p. 13.)
Dependable yield, *n*-years. The minimum supply of a given water development that is available on demand, with the understanding that lower yields will occur once in *n* years, on the average. (Paulsen, 1950, p. 801.)
Depletion. The progressive withdrawal of water from surface- or ground-water reservoirs at a rate greater than that of replenishment. (*see* **Recession curve** *and* **streamflow depletion**.)
Depression storage. The volume of water contained in natural depressions in the land surface, such as puddles. (After Horton, 1935, p. 2)
Direct runoff. The runoff entering stream channels promptly after rainfall or snowmelt. Superposed on *base runoff,* it forms the bulk of the hydrograph of a *flood.*
See also **surface runoff**. The terms *base runoff* and *direct runoff* are time classifications of runoff. The terms *ground-water runoff* and *surface runoff* are classifications according to source.
Discharge. In its simplest concept discharge means outflow; therefore, the use of this term is not restricted as to course or location, and it can be applied to describe the flow of water from a pipe or from a drainage basin. If the discharge occurs in some course or channel, it is correct to speak of the discharge of a canal or of a river. It is also correct to speak of the discharge of a canal or stream into a lake, a stream, or an ocean. *(See also* **Streamflow** *and* **Runoff**.)
The data in the reports of the Geological Survey on surface water represent the total fluids measured. Thus, the terms discharge, streamflow, and runoff represent water with the solids dissolved in it and the sediment mixed with it. Of these terms, discharge is the most comprehensive. The discharge of drainage basins is distinguished as follows:

- Yield. Total water runout or crop; includes runoff plus underflow.
- Runoff. That part of water yield that appears in streams.
- Streamflow. The actual flow in streams, whether or not subject to regulation, or underflow.

Each of these terms can be reported in total volumes (such as acre-feet) or time rates (such as cubic feet per second or acre-feet per year). The differentiation between runoff as a volume and streamflow as a rate is not accepted.
Discharge rating curve. *See* **Stage discharge relation.**
Distribution graph (distribution hydrograph). A *unit hydrograph* of *direct runoff* modified to show the proportions of the volume of runoff that occurs during successive equal units of time. (After Hoyt and others, 1936, p. 124.)
Diversion. The taking of water from a stream or other body of water into a canal, pipe, or other conduit.
Double-mass curve. A plot on arithmetic cross-section paper of the cumulated values of one variable against the cumulated values of another or against the computed values of the same variable for a concurrent period of time. (*See* Searcy and Hardison, 1960.)
Drainage area. The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is enclosed by a drainage divide. *(See* [U.S.] Federal Inter-Agency River Basin Committee, Subcommittee on Hydrology, 1951, p. 11.) 1
Drainage basin. A part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.
Drainage density. Length of all *channels* above those of a specified *stream order* per unit of *drainage area.*
Drainage divide. The rim of a *drainage basin. (See* **Watershed.**)
Drought. A period of deficient precipitation or runoff extending over an indefinite number of days, but with no set standard by which to determine the amount of deficiency needed to constitute a drought. Thus, there is no universally accepted quantitative definition of drought; generally, each investigator establishes his own definition.

The following paragraph (Hoyt, 1936, p. 2) discusses the problem of defining a drought:
When in an area that is ordinarily classed as humid, natural vegetation becomes desiccated or defoliates unseasonably and crops fail to mature owing to lack of precipitation, or when precipitation is insufficient to meet the needs of established human activities, drought conditions may be said to prevail. Although water for irrigation or other uses in arid areas is always limited, special shortages in such areas are also regarded as droughts. Unsatisfactory distribution of precipitation throughout the year may be as effective a factor in causing a drought as a shortage in the total amount. Temperature and wind may also play an important part, especially in relation to the damage done.

Duration curve. *See* **Flow-duration curve** for one type.

E

Effective precipitation (rainfall). 1. That part of the precipitation that produces runoff. 2. A weighted average of current and antecedent precipitation that is "effective" in correlating with runoff. 3. As described by U.S. Bureau of Reclamation (1952, p. 4), that part of the precipitation falling on an irrigated area that is effective in meeting the *consumptive use* requirements.

Epilimnion. *See* **thermal stratification.**

Evaporation. The process by which water is changed from the liquid or the solid state into the vapor state. In hydrology, evaporation is vaporization that takes place at a temperature below the boiling point.

Evaporation opportunity (relative evaporation). The ratio of the rate of evaporation from a land or water surface in contact with the atmosphere, to the *evaporativity* under existing atmospheric conditions. It is the ratio of actual to potential rate of evaporation, generally stated as a percentage. (Derived from Meinzer, 1923, p. 14.)

The opportunity for a given rate of evaporation to continue is determined by the available moisture supply. (Meyer, 1928, p. 244.)

Evaporation pan. An open tank used to contain water for measuring the amount of evaporation. The U.S. Weather Bureau class *A* pan is 4 feet in diameter, 10 inches deep, set up on a timber grillage so that the top rim is about 16 inches from the ground. The water level in the pan during the course of observation is maintained between 2 and 3 inches below the rim.

Evaporation, total. The sum of water lost from a given land area during any specific time by transpiration from vegetation and building of plant tissue; by evaporation from water surfaces, moist soil, and snow; and by interception. *** It has been variously termed "evaporation," "evaporation from land areas," "evapotranspiration," "total loss," "water losses," and "fly off." (Lee, 1949, p. 314.)

Evaporativity (potential rate of evaporation). The rate of evaporation under the existing atmospheric conditions from a surface of water that is chemically pure and has the temperature of the atmosphere. (Meinzer, 1923, p. 13.)

Evapotranspiration. Water withdrawn from a land area by *evaporation* from water surfaces and moist soil and plant *transpiration.* It is a coined word; probably the first recorded use is on page 296 of the Transactions of the American Geophysical Union, part 2, 1934.

Evapotranspiration, potential. *See* **Potential evapotranspiration.**

Excessive rainfall. *See* **Rainfall, excessive.**

F

Field capacity. *See* **Field-moisture capacity.**

Field-moisture capacity. The quantity of water which can be permanently retained in the soil in opposition to the downward pull of gravity. (Horton, 1935, p. 3.)

Field-moisture deficiency. The quantity of water, which would be required to restore the *soil moisture* to *field-moisture capacity.* (Horton, 1935, p. 3.)

Firn (firn snow). Old snow on the top of glaciers, granular and compact but not yet converted into ice. It is a transitional stage between snow and ice. Also called ne've'.

Firn line. The highest level to which the fresh snow on a glacier's surface retreats during the melting season. (Matthes, 1949, p. 161.) The line separating the accumulation area from the *ablation* area.

Flood. An overflow or inundation that comes from a river or other body of water (Barrows, 1948, p. 4), and causes or threatens damage.

Any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. (Leopold and Maddock, 1954, p. 249-251.)
A relatively high flow as measured by either gage height or discharge quantity. (Jarvis and others, 1936, p. 463.)
A glossary of flood terms is given in "The Flood Control Controversy." (Leopold and Maddock, 1954, p. 249-251.) *See* **Annual flood.**
Flood-control storage. Storage of water in reservoirs to abate flood damage. *(See* **Retarding reservoir**.)
Flood crest. *See* **Flood peak**.
Flood event. *See* **Flood wave**.
Flood-frequency curve. 1. A graph showing the number of times per year on the average, plotted as abscissa, that floods of magnitude, indicated by the ordinate, are equaled or exceeded. 2. A similar graph but with *recurrence intervals* of floods plotted as abscissa. *(See* Dalrymple, 1960.)
Flood, maximum probable. The largest flood for which there is any reasonable expectancy in this climatic era. (Leopold and Maddock, 1954, p.112.)
Flood peak. The highest value of the stage or discharge attained by a flood; thus, peak stage or peak discharge. Flood crest has nearly the same meaning, but since it connotes the top of the *flood wave,* it is properly used only in referring to stage--thus, crest stage, but not crest discharge.
Flood plain. A strip of relatively smooth land bordering a stream, built of sediment carried by the stream and dropped in the slack water beyond the influence of the swiftest current. It is called a living flood plain if it is overflowed in times of highwater; but a fossil flood plain if it is beyond the reach of the highest flood. (Bryan, 1922, p. 88.)
The lowland that borders a river, usually dry but subject to flooding. (Hoyt and Langbein, 1955, p. 12.)
That land outside of a stream channel described by the perimeter of the *maximum probable* flood. (After White, 1945, p. 44.)
Flood plane. The position occupied by the water surface of a stream during a particular flood. Also, loosely, the elevation of the water surface at various points along the stream during a particular flood.
Flood profile. A graph of elevation of the water surface of a river in flood, plotted as ordinate, against distance, measured in the downstream direction, plotted as abscissa. A flood profile may be drawn to show elevation at a given time, crests during a particular flood, or to show stages of *concordant flows.*
Flood routing. The process of determining progressively the timing and shape of a *flood wave* at successive points along a river. *(See* Carter and Godfrey, 1960.)
Floods above a base. *See* **Partial-duration flood series.**
Flood stage. The gage height of the lowest bank of the reach in which the gage is situated. The term "lowest bank" is, however, not to be taken to mean an unusually low place or break in the natural bank through which the water inundates an unimportant and small area. (Linsley, 1942, p. 89.)
The stage at which overflow of the natural banks of a stream begins to cause damage in the reach in which the elevation is measured. (U.S. Weather Bur.)
See also **Bankfull stage.**
Flood wave. A distinct rise in stage culminating in a crest and followed by recession to lower stages.
Floodway. A part of the flood plain otherwise leveed, reserved for emergency diversion of water during floods. A part of the flood plain which, to facilitate the passage of floodwater, is kept clear of encumbrances.
The channel of a river or stream and those parts of the flood plains adjoining the channel, which are reasonably required to carry and discharge the floodwater or floodflow of any river or stream (Erbe and Flores, 1957, p. 443).
Flood zone. The land bordering a stream which is subject to floods of about equal frequency; for example, a strip of the *flood plain* subject to flooding more often that once but not as frequently as twice in a century. (*See* White, 1945, p. 44.)

Flow-duration curve. A cumulative frequency curve that shows the percentage of time that specified discharges are equaled or exceeded. *(See* Searcy, 1959.)
FIGURE
Forest influences. Effects resulting from the presence of forest or brush upon climate, soil water, runoff, streamflow, floods, erosion, and soil productivity. (Kittredge, 1948, p. l.)
Frazil (frazil ice). A French-Canadian term for fine spicular ice, derived from the French for cinders which this variety of ice most resembles. When formed in salt water, it is known as lolly ice. It is composed of fine particles which, when first formed, are colloidal and not seen in the water in which they are floating. (Barnes, 1928, p. 108; *see also* Schaefer, 1950, p. 888.)
G
Gage height. The water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term *stage* although gage height is more appropriate when used with a reading on a gage.
Gaging station. A particular site on a stream, canal, lake, or reservoir where systematic observations of *gage height* or *discharge* are obtained. (*See also* **Stream-gaging station.)**
Glacier. Bodies of land ice that consist of recrystallized snow accumulated on the surface of the ground (Matthes, 1949, p. 150), and that move slowly downslope.
Ground water. Water in the ground that is in the *zone of saturation,* from which wells, springs, and *ground-water runoff* are supplied. (After Meinzer, 1949, p. 385.)
Ground-water outflow. That part of the discharge from a drainage basin that occurs through the ground water. The term "underflow" is often used to describe the ground-water outflow that takes place in valley alluvium (instead of the surface *channel)* and thus is not measured at a *gaging station.*
Ground-water runoff. That part of the runoff which has passed into the ground, has become ground water, and has been discharged into a stream channel as spring or seepage water. *See also* **Base runoff** *and* **Direct runoff**.
Guttation. The loss of water in liquid form from the uninjured leaf or stem of the plant, principally through water stomata. (Lee, 1949, p. 260.)
H
Heat budget, annual (of a lake). The amount of heat necessary to raise the water from the minimum temperature of winter to the maximum temperature of summer. (Welch, 1952, p. 65.)
Hydrograph. A graph showing stage, flow, velocity, or other property of water with respect to time.
FIGURE
Hydrologic budget. An accounting of the inflow to, outflow from, and storage in, a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake, reservoir, or irrigation project.
Hydrologic cycle. A convenient term to denote the circulation of water from the sea, through the atmosphere, to the land; and thence, with many delays, back to the sea by overland and subterranean routes, and in part by way of the atmosphere; also the many short circuits of the water that is returned to the atmosphere without reaching the sea. (After Meinzer, 1949, p. 1.)
Hydrologic equation. The equation balancing the *hydrologic budget.*
Hydrology. The science encompassing the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground. (Am. Soc. Civil Engineers, 1949, p. 1.)
The science that relates to the water of the earth. (Meinzer, 1923, p. 9.)
The science treating of the waters of the earth, their occurrence, distribution, and movements. (Jarvis and others, 1936, p. 464.)
In practice the study of the water of the oceans and the atmosphere is considered part of the sciences of oceanography and meteorology.
Hyetograph. Graphical representation of rainfall intensity against time.
Hypolimnion. *See* **Thermal stratification.**
I
Infiltration. The flow of a fluid into a substance through pores or small openings. It connotes flow into a substance in contradistinction to the word *percolation,* which connotes flow through a porous substance. (Horton, 1942, p. 480.) *See also* Schiff and Dreibelbis (1949, p. 76) and Musgrave (1946, p. 726-747).

Infiltration capacity. The maximum rate at which the soil, when in a given condition, can absorb falling rain or melting snow. (After Horton, 1935, p. 2.)
Infiltration index. An average rate of infiltration, in inches per hour, equal to the average rate of rainfall such that the volume of rain fall at greater rates equals the total direct runoff. (Langbein and others, 1947, p. 11.)
Interception. The process and the amount of rain or snow stored on leaves and branches and eventually evaporated back to the air. Interception equals the precipitation on the vegetation minus *stem flow* and *throughfall* (after Hoover, 1953, p. 1.)
Irrigated area. The gross farm area upon which water is artificially applied for the production of crops, with no reduction for access roads, canals, or farm buildings. (Simons, 1953, p. 8.)
Irrigation. The controlled application of water to arable lands to supply water requirements not satisfied by rainfall. (After Houk, 1951, p. 1.)
Irrigation Efficiency. The percentage of water applied that can be accounted for in soil-moisture increase. (Pillsbury, Compton, and Picker, 1944, p. 7.)
Irrigation requirement. The quantity of water, exclusive of precipitation, that is required for crop production. It includes surface evaporation and other economically unavoidable wastes. (Blaney, 1951a, p. 4.)
Irrigation, supplemental. *See* **Supplemental irrigation**.
Isohyet. *See* **Isohyetal line.**
Isohyetal line (isohyet). A line drawn on a map or chart joining points that receive the same amount of precipitation.
L
Lag. Variously defined as time from beginning (or center of mass) of rainfall to peak (or center of mass) of runoff. (After Am. Soc. Civil Engineers, 1949, p. 106.)
Limnology. That branch of hydrology pertaining to the study of lakes.
Long-period variations. Secular when a cycle or a change in trend is completed within a century; climatic when the period of change runs through centuries or a few millenia; geologic when the period runs into geological time. (Willett, 1948, p. 806.) *(See* **Trend**.)
Low-flow frequency curve. A graph showing the magnitude and frequency of minimum flows for a period of given length. Frequency is usually expressed as the average interval, in years, between recurrences of an annual minimum flow equal to or less than that shown by the magnitude scale.
Lysimeter. Structure containing a mass of soil, and designed to permit the measurement of water draining through the soil. (Harrold and Dreibelbis, 1951, p. 3.) *(See also* Kohnke, Dreibelbis, and Davidson, 1940, p. 1-67.)
M
Mass curve. A graph of the cumulative values of a hydrologic quantity (such as precipitation or runoff), generally as ordinate, plotted against time or date as abscissa. *(See* **Double-mass curve**, *and* **Residual-mass curve**.)
Maximum probable flood. *See* **Flood, maximum probable.**
Meander. The winding of a stream channel.
FIGURE
Meander amplitude. Distance between points of maximum curvature of successive meanders of opposite phase in a direction normal to the general course of the meander belt, measured between centerlines of channels.
Meander belt. Area between lines drawn tangential to the extreme limits of fully developed meanders.
Meander breadth. The distance between the lines used to define the *meander belt*.
Meander length. Distance in the general course of the meanders between corresponding points of successive meanders of the same phase.
Twice the distance between successive points of inflection of the meander wave. (Leopold and Wolman, 1957, p. 55.)
Meromictic lake. A lake in which some water remains partly or wholly unmixed with the main water mass at circulation periods is said to be meromictic. The process leading to a meromictic state is termed meromixis The perennially stagnant deep layer of a meromictic lake is called the monimolimnion. The part of a meromictic lake in which free circulation can occur is called the

mixolimnion. The boundary between the monimolimnion and the mixolimnion is called thechemocline. (Hutchinson, 1957, p. 480.)

Moisture. Water diffused in the atmosphere or the ground.

Moisture equivalent. The ratio of (a) the weight of water which the soil, after saturation, will retain against a centrifugal force 1,000 times the force of gravity, to (b) the weight of the soil when dry. The ratio is stated as a percentage. (Meinzer, 1923, p. 25; *see also* Briggs and McLane, 1907, p. 5.)

Mudflow. A well-mixed mass of water and alluvium which, because of its high viscosity and low fluidity as compared with water, moves at a much slower rate, usually piling up and spreading over the fan like a sheet of wet mortar or concrete. (Woolley, 1946, p. 75.)

N

Normal. A central value (such as arithmetic average or median) of annual quantities for a 30-year period ending with an even 10-year, thus 1921-50; 1931-60, and so forth. This definition accords with that recommended by the Subcommittee on Hydrology of the Federal Inter-Agency Committee on Water Resources.

O

Overland flow. The flow of rainwater or snowmelt over the land surface toward stream channels. After it enters a stream, it becomes *runoff.*

P

Partial-duration flood series. A list of all flood peaks that exceed a chosen base stage or discharge, regardless of the number of peaks occurring in a year. (Also called *basic-stage flood series,* or *floods above a base.)*

Percolation. The movement, under hydrostatic pressure, of water through the interstices of a rock or soil, except the movement through large openings such as caves. (Meinzer, 1923, p. 42; *see also* Rorabaugh, 1951, p. 165.)

Percolation, deep. In irrigation or farming practice, the amount of water that passes below the root zone of the crop or vegetation. (Barrett and Milligan, 1953, p. 24.)

Pondage. Small-scale storage at a waterpower plant to equalize daily or weekly fluctuations in riverflow or to permit irregular hourly use of the water for power generation to accord with fluctuations in load. (After Barrows, 1943, p. 166.)

Pool. A deep reach of a stream. The reach of a stream between two riffles. Natural streams often consist of a succession of pools and riffles.

Potential evapotranspiration. *Water loss* that will occur if at no time there is a deficiency of water in the soil for use of vegetation. (Thornthwaite, 1944, p. 687.)

Potential natural water loss. The *water loss* during years when the annual precipitation greatly exceeds the average water loss. It represents the approximate upper limit to water loss under the type and density of vegetation native to a basin, actual conditions of moisture supply, and other basin characteristics, whereas *potential evapotranspiration* represents the hypothetical condition of no deficiency of water in the soil at any time for use of the type and density of vegetation that would develop. (After Troxell and others, 1954, pl. 11*B*.)

Potential rate of evaporation. *See* **Evaporativity**.

Precipitation. As used in hydrology, precipitation is the discharge of water, in liquid or solid state, out of the atmosphere, generally upon a land or water surface. It is the common process by which atmospheric water becomes surface or subsurface water * * *. The term "precipitation" is also commonly used to designate the quantity of water that is precipitated. (Meinzer, 1923, p. 15.) Precipitation includes rainfall, snow, hail, and sleet, and is therefore a more general term than rainfall.

R

Rain. Liquid *precipitation.*

Rainfall. The quantity of water that falls as rain only. Not synonymous with *precipitation.*

Rainfall excess. The volume of rainfall available for direct runoff. It is equal to the total rainfall minus *interception, depression storage,* and *absorption. (See* Am. Soc. Civil Engineers, 1949, p. 106.)

Rainfall, excessive. Rainfall in which the rate of fall is greater than certain adopted limits, chosen with regard to the normal precipitation (excluding snow) of a given place or area. In the U.S.

Weather Bureau, it is defined, for States along the southern Atlantic coast and the Gulf coast, as rainfall in which the depth of precipitation is 0.90 inch at the end of 30 minutes and 1.50 inches at the end of an hour, and for the rest of the country as rainfall in which the depth of precipitation at the end of each of the same periods is 0.50 and 0.80 inch, respectively.

Reach. 1. The length of channel uniform with respect to discharge, depth, area, and slope. 2. The length of a channel for which a single gage affords a satisfactory measure of the stage and discharge. 3. The length of a river between two gaging stations. 4. More generally, any length of a river.

Recession curve. A hydrograph showing the decreasing rate of *runoff* following a period of rain or snowmelt. Since direct runoff and base runoff recede at different rates, separate curves, called direct runoff recession curves or base runoff recession curves, are generally drawn. The term "depletion curve" in the sense of base runoff recession is not recommended.

Recurrence interval (return period). The average interval of time within which the given flood will be equaled or exceeded once. (Am. Soc. of Civil Engineers, 1953, p. 1221.)

Regime. "Regime theory" is a theory of the forming of channels in material carried by the streams. As used in this sense, the word "regime" applies only to streams that make at least part of their boundaries from their transported load and part of their transported load from their boundaries, carrying out the process at different places and times in any one stream in a balanced or alternating manner that prevents unlimited growth or removal of boundaries. A stream, river, or canal of this type is called a "regime stream, river, or canal." A regime channel is said to be "in regime" when it has achieved average equilibrium; that is, the average values of the quantities that constitute regime do not show a definite trend over a considerable period--generally of the order of a decade. In unspecialized use "regime" and "regimen" are synonyms. (After Blench, 1957, p. 2.)

Regimen of a stream. The system or order characteristic of a stream; in other words, its habits with respect to velocity and volume, form of and changes in channel, capacity to transport sediment, and amount of material supplied for transportation. The term is also applied to a stream which has reached an equilibrium between corrosion and deposition or, in other words, to a graded stream. (Bryan, 1922. p. 89)

Regulation. The artificial manipulation of the flow of a stream.

Re-regulating reservoirs. A reservoir for reducing diurnal fluctuations resulting from the operation of an upstream reservoir for power production.

Reservoir. A pond, lake, or basin, either natural or artificial, for the storage, regulation, and control of water.

Residual-mass curve. A graph of the cumulative departures from a given reference such as the arithmetic average, generally as ordinate, plotted against time or date, as abscissa. (*See* **Mass curve**.)

Retarding reservoir. Ungated reservoir for temporary storage of flood water. Sometimes called detention reservoir.

Return flow. That part of irrigation water that is not consumed by evapotranspiration and that returns to its source or another body of water. The term is also applied to the water that is discharged from industrial plants. Also called return water.

Riffle. A rapid in a stream.

Riparian. Pertaining to the banks of a stream.

Runoff. That part of the precipitation that appears in surface streams. It is the same as *streamflow* unaffected by *artificial diversions, storage*, or other works of man in or on the stream channels. Runoff may be classified as follows:

Classification as to speed of appearance after rainfall or snow melting:

- Direct runoff
- Base runoff

Classification as to source:

- Surface runoff (*see* **Overland flow**)
- Storm seepage
- Ground-water runoff (*see* **Stream, gaining)**

Runout. *See* **Water yield.**

S

Second-foot. Same as *cfs*. This term is no longer used in published reports of the U.S. Geological Survey.
Sediment. Fragmental material that originates from weathering of rocks and is transported by, suspended in, or deposited by water or air or is accumulated in beds by other natural agencies. (Colby, Hembree, and Jochens, 1953, p. 24.)
Sediment discharge. The rate at which dry weight of sediment passes a section of a stream or is the quantity of sediment, as measured by dry weight, or by volume, that is discharged in a given time. (Colby, Hembree, and Jochens, 1953, p. 24.)
Seiche. The free oscillation of the bulk of water in a lake and the motion caused by it on the surface of the lake. (Bergsten, 1926, p. 1.)
Shifting control. *See* **Control.**
Skimming. The diversion of water from a stream or conduit by a shallow overflow used to avoid diversion of sand, silt, or other debris carried as bottom load.
Snow. A form of precipitation composed of ice crystals.
Snow course. A line or series of connecting lines along which snow samples are taken at regularly spaced points. (U.S. Dept. Agriculture, Soil Conserv. Service and Nevada State Engineer, 1948, p. 2.)
Snow density. Ratio between the volume of melt water derived from a sample of snow and the initial volume of the sample. This is numerically equal to the specific gravity of the snow. (Linsley, Kohler, and Paulhus, 1949, p. 127.)
Snowline. The general altitude to which the continuous snow cover of high mountains retreats in summer, chiefly controlled by the depth of the winter snowfall and by the temperature of the summer.
Snowline, temporary. A line sometimes drawn on a weather map during the winter showing the southern limit of the snow cover.
Snow, quality of. The ratio of heat of melting of snow, in calories per gram to the 80 calories per gram for melting pure ice at 0 degrees C. (Bernard and Wilson, 1941, p., 178-179.) *(See also* Wilson, 1942b, p. 553-556.)
Percentage by weight which is ice (Linsley, Kohler, and Paulhus, 1949, p. 129).
Soil moisture (Soil water) . Water diffused in the soil, the upper part of the *zone of aeration* from which water is discharged by the *transpiration* of plants or by soil evaporation. ***See* Field-moisture capacity** *and* **Field-moisture deficiency**.
Stage. The height of a water surface above an established datum plane; also *gage height*.
Stage-capacity curve. A graph showing the relation between the surface elevation of the water in a reservoir, usually plotted as ordinate, against the volume below that elevation, plotted as abscissa.
Stage-discharge curve (rating curve). A graph showing the relation between the gage height, usually plotted as ordinate, and the amount of water flowing in a channel, expressed as volume per unit of time, plotted as abscissa.
Stage-discharge relation. The relation expressed by the *stage-discharge curve.*
Stage, flood. *See* **Flood stage.**
Stemflow. Rainfall or snowmelt led to the ground down the trunks or stems of plants. (Hoover, 1953, p. 1).
Storage. 1. Water artificially impounded in surface or underground reservoirs, for future use. The term *regulation* refers to the action of this storage in modifying *streamflow. See also* **Conservation storage, Total storage, Dead storage,** *and* **Usable storage**. 2. Water naturally detained in a drainage basin, such as *ground water, channel storage,* and *depression storage*. The term "drainage basin storage" or simply "basin storage" is sometimes used to refer collectively to the amount of water in natural storage in a drainage basin.
Storage, bank. *See* **Bank storage.**
Storage, conservation. *See* **Conservation storage.**
Storage, dead. *See* **Dead storage**.
Storage, depression. *See* **Depression storage.**
Storage ratio. The net available storage divided by the mean flow for 1 year. (Hazen, 1930, p. 1446.) *(See also* Thomas and Harbeck, 1956, p. 14.)

Storage-required frequency curve. A graph showing the frequency with which storage equal to or greater than selected amounts will be required to maintain selected rates of regulated flow.
Storage, total. *See* **Total storage.**
Storage, usable. *See* **Usable Storage.**
Storm. A disturbance of the ordinary average conditions of the atmosphere which, unless specifically qualified, may include any or all meteorological disturbances, such as wind, rain, snow, hail, or thunder.
Stormflow. *See* **Direct runoff**.
Storm seepage. That part of precipitation which infiltrates the surface soil, and moves toward the streams as ephemeral, shallow, perched ground water above the main ground-water level. Storm seepage is usually part of the *direct runoff*.
Stream. A general term for a body of flowing water. In hydrology the term is generally applied to the water flowing in a natural *channel* as distinct from a canal. More generally as in the term *stream gaging,* it is applied to the water flowing in any channel, natural or artificial. Streams in natural channels may be classified as follows (after Meinzer, 1923, p. 5658):

- Relation to time.
    - **Perennial.** One which flows continuously.
    - **Intermittent or seasonal**. One which flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow in mountainous areas.
    - **Ephemeral.** One that flows only in direct response to precipitation, and whose channel is at all times above the water table.
- Relation to space.
    - **Continuous**. One that does not have interruptions in space.
    - **Interrupted**. One which contains alternating reaches, that are either perennial, intermittent, or ephemeral.
- Relation to ground water.
    - **Gaining**. A stream or reach of a stream that receives water from the *zone of saturation.*
    - **Losing.** A stream or reach of a stream that contributes water to the *zone of saturation.*
    - **Insulated**. A stream or reach of a stream that neither contributes water to the *zone of saturation* nor receives water from it. It is separated from the zones of saturation by an impermeable bed.
    - **Perched**. A perched stream is either a losing stream or an insulated stream that is separated from the underlying ground water by a *zone of aeration.*

Streamflow. The discharge that occurs in a natural *channel.* Although the term *discharge* can be applied to the flow of a canal, the word streamflow uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than *runoff,* as streamflow may be applied to discharge whether or not it is affected by *diversion* or *regulation.*
Streamflow depletion. The amount of water that flows into a valley, or onto a particular land area, minus the water that flows out the valley or off from the particular land area. (Blaney, 1951a, p. 4.)
Stream gaging. The process and art of measuring the depths, areas, velocities, and rates of flow in natural or artificial channels. (*see* Corbett and others, 1943.)
Stream-gaging station. A *gaging station* where a record of discharge of a stream is obtained. Within the Geological Survey this term is used only for those gaging stations where a continuous record of discharge is obtained.
Stream order. A method of numbering streams as part of a drainage basin network. The smallest unbranched mapped tributary is called first order, the stream receiving the tributary is called second order, and so on. It is usually necessary to specify the scale of the map used. A first-order stream on a 1:62,500 map, may be a third-order stream on a 1:12,000 map. (After Leopold and Miller, 1956, p. 16.)
Tributaries which have no branches are designated as of the first order, streams which receive only first-order tributaries are of the second order, larger branches which receive only first-order

and second-order tributaries are designated third order, and so on, the main stream being always of the highest order. (Horton, 1932, p. 356.)
FIGURE
Submeander. Small meander contained with banks of main channel, associated with relatively low discharges.
Subsurface runoff. *See* **Storm seepage.**
Supplemental irrigation. Commonly, irrigation as carried on in humid areas. The term means that the irrigation water is supplementary to the natural rainfall rather than being the primary source of moisture as in the arid and semiarid West. Supplementary irrigation is used generally to prevent retardation of growth during periods of drought. (Huffman, 1953, p. 231.)
Supplemental sources. When irrigation water supplies are obtained from more than one source, the source furnishing the principal supply is commonly designated the primary source, and the sources furnishing the additional supplies, the supplemental sources. (Houk, 1951, p. 396.)
Surface runoff. That part of the runoff which travels over the soil surface to the nearest stream channel. It is also defined as that part of the runoff of a drainage basin that has not passed beneath the surface since precipitation. The term is misused when applied in the sense of **direct runoff.** *See also,* **Runoff, Overland flow, Direct runoff, Ground-water runoff,** *and* **Surface water**.
Surface water. Water on the surface of the earth.
T
Tank. An artificial reservoir for stock water; local in Southwest.
Terrace. A berm or discontinuous segments of a berm, in a valley at some height above the *flood plain,* representing a former abandoned flood plain of the stream.
Thermal stratification (of a lake) . Vertical temperature stratification that shows the following: The upper layer of the lake, known as the epilimnion, in which the water temperature is virtually uniform; a stratum next below, known as the thermocline, in which there is a marked drop in temperature per unit of depth; and the lowermost region or stratum, known as the hypolimnion, in which the temperature from its upper limit to the bottom is nearly uniform. (Welch, 1952, p. 51.)
FIGURE
Thermocline. *See* **Thermal stratification**.
Throughfall. In a vegetated area, the precipitation that falls directly to the ground or the rainwater or snowmelt that drops from twigs or leaves. (After Hoover, 1953, p. 1.) (*See* **Stemflow.**)
Time of concentration. The time required for water to flow from the farthest point on the watershed to the gaging station. (Ramser, 1927, p. 804.)
Total storage. The volume of a reservoir below the maximum controllable level including dead storage. (Thomas and Harbeck, 1956, p. 13.)
Transpiration. The quantity of water absorbed and transpired and used directly in the building of plant tissue, in a specified time. It does not include soil evaporation. (After Blaney, 1951a, p. 4.)
The process by which water vapor escapes from the living plant, principally the leaves, and enters the atmosphere. * * * As considered practically, transpiration also includes *guttation.* (Lee, 1949, p. 260.)
Trend. A statistical term referring to the direction or rate of increase or decrease in magnitude of the individual members of a time series of data when random fluctuations of individual members are disregarded.
U
Underflow. The downstream flow of water through the permeable deposits that underlie a stream and that are more or less limited by rocks of low permeability.
Unit hydrograph. The *hydrograph* of *direct runoff* from a storm uniformly distributed over the *drainage basin* during a specified unit of time; the hydrograph is reduced in vertical scale to correspond to a volume of runoff of 1 inch from the drainage basin. (After Am. Soc. Civil Engineers, 1949, p. 105.)
The hydrograph of surface runoff (not including ground-water runoff) on a given basin due to an *effective rainfall* falling for a unit of time. (Sherman, 1949, p. 514.) *(See also* Hoyt and others, 1936, p. 124.)
Usable storage. The volume normally available for release from a reservoir below the stage of the maximum controllable level. (Thomas and Harbeck, 1956, p. 13.)

W

Water balance. *See* **Hydrologic budget.**

Water content of snow. *See* **Water equivalent of snow.**

Water crop. *See* **Water yield.**

Water equivalent of snow. Amount of water that would be obtained if the snow should be completely melted. Water content may be merely the amount of liquid water in the snow at the time of observation. (Wilson, 1942a, p. 153-154.)

Water loss. The difference between the average precipitation over a drainage basin and the *water yield* from the basin for a given period. (After Williams and others, 1940, p. 3.) The basic concept is that water loss is equal to *evapotranspiration,* that is, water that returns to the atmosphere and thus is no longer available for use. However, the term is also applied to differences between measured inflow and outflow even where part of the difference may be seepage.

Water requirement. The quantity of water, regardless of its source, required by a crop in a given period of time, for its normal growth under field conditions. It includes surface evaporation and other economically unavoidable wastes. (Blaney, 1951a, p. 4.)

Watershed. The divide separating one *drainage basin* from another and in the past has been generally used to convey this meaning. However, over the years, use of the term to signify drainage basin or catchment area has come to predominate, although drainage basin is preferred. *Drainage divide,* or just divide, is used to denote the boundary between one drainage area and another. Used alone, the term "watershed" is ambiguous and should not be used unless the intended meaning is made clear.

Water table. The upper surface of a zone of saturation. No water table exists where that surface is formed by an impermeable body. (Meinzer ,1923, p. 22.)

Water year. In Geological Survey reports dealing with surface-water supply, the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ended September 30, 1959, is called the "1959 water year."

Water yield (water crop or runout). The runoff from the drainage basin, including *ground-water outflow* that appears in the stream plus ground-water outflow that bypasses the gaging station and leaves the basin underground. Water yield is the *precipitation* minus the *evpotranspiration*.

Withdrawal use of water. The water removed from the ground or diverted from a stream or lake for use. (MacKichan, 1957, p. 2.)

Year. *See* **Climatic year**; **Water year.**

Z

Zone of aeration. The zone above the water table. Water in the zone of aeration does not flow into a well.

Zone of saturation. The zone in which the functional permeable rocks are saturated with water under hydrostatic pressure. (Meinzer, 1923, p. 21.) Water in the zone of saturation will flow into a well, and is called *ground water.*

References

Creating the High Performance Team.
Steve Buchholz and Thomas Roth, 1987, New York, NY: Wiley.

Solving Community Problems by Consensus.
Susan Carpenter, 1990, Washington. DC: Program for Community Problem Solving.

Team Building: Issues and Alternatives.
William G Dyer, 1977, Reading, MA: Addison-Wesley.

The Team Handbook: How to Use Teams to Improve Quality.
Peter R. Scholtes and Associates, 1988, Madison, WI: Joiner Associates, Inc.

The Wisdom of Teams: Creating the High-Performance Organization.
Jon R. Katzenbach and Douglas K. Smith, 1993, New York, NY: HarperCollins.

Clean Water in Your Watershed: A Citizen's Guide to Watershed Protection.
Terrene Institute Tel: 202-833-8317

Evaluation of the Experimental Rural Clean Water Program - Project Report.
North Carolina State University. Tel: 919-515-3723.

Managing Nonpoint Pollution: An Action Plan for Puget Sound Watersheds.
Puget Sound Water Quality Authority Tel: 206-464-7320
Public Perception and Communication of Risk.
North Carolina Cooperative Extension Service Tel: 919-515-1676
Executive Communication Power: Basic Skills for Management Success.
Frederick Williams, 1983, Englewood Cliffs, NJ: Prentice Hall.
Leadership Skills: Developing Volunteers for Organizational Success.
Emily Kittle Morrison, 1994, Tucson, AZ: Fisher Books
Breaking the Impasse: Consensual Approaches to Resolving Public Disputes.
Lawrence Susskind and Jeffrey Cruikshank, 1987, New York, NY: Basic Books.
The Eight Essential Steps to Conflict Resolution: Preserving Relationship at Work, at *Home, and in the Community.*
Dudley Weeks, 1992, New York, NY: St. Martins Press.
Getting to Yes: Negotiating Agreement without Giving In.
Robert Fisher, William Ury, and Bruce Patton, 1991, New York, NY: Penguin Books.
Managing Public Disputes: A Practical Guide to Handling Conflict and Reaching Agreements. Susan L. Carpenter and W.J.D. Kennedy, 1988, San Francisco, CA: Jossey-Bass
The Planner as Dispute Resolver: Concepts and Teaching Materials.
A. Bruce Dotson, David Godschalk, and Jerome Kaufman, 1989, Washington, DC: National Institute for Dispute Resolution.

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