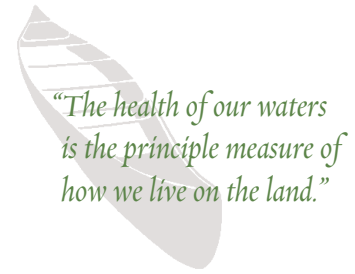


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USING LAND CONSERVATION TO  
PROTECT DRINKING WATER SUPPLIES

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# SOURCE PROTECTION HANDBOOK





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USING LAND CONSERVATION TO  
PROTECT DRINKING WATER SUPPLIES

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## Foreword

Earlier this year, the Trust for Public Land (TPL) and the American Water Works Association (AWWA) released *Protecting the Source*, a report that makes the case for land conservation as a source water protection strategy. The *Source Protection Handbook* is the manual for implementing many of the policy recommendations in that report. It brings together lessons learned during years of field work by TPL staff and AWWA members and presents some of the best practices for protecting drinking water sources.

This year the EPA's Source Water Assessment Program (SWAP) detailed serious threats to drinking water sources in every state. States and local water suppliers compiled databases of current and future drinking water sources and threats to those sources. Not surprisingly, they found that most threats to drinking water came from various land uses. At one time, new housing developments, shopping malls, and schools were sited far from drinking water sources. Today, they are often built above source water aquifers, adjacent to public reservoirs, and along streams that feed reservoirs and other water sources.

While EPA allocated some monies for states and local suppliers to assess the threats to drinking water, little money is available to address those threats. TPL and AWWA understand the value of a stronger partnership between water resource managers and conservationists, who in making the case for conservation are already tapping into strong public sentiment to protect drinking water quality. State and local land conservation programs are increasingly focusing on water quality protection. These programs are growing based on state and local land conservation funding that has blossomed from millions of dollars to billions of dollars in the last ten years. As a result, an opportunity exists for water suppliers to work more closely with conservationists in implementing source protection strategies.

The goal of the *Source Protection Handbook* is to strengthen the ability of water suppliers to

develop protection strategies that address the threats posed by development to drinking water sources. The handbook provides guidance and action steps for water suppliers to address each of the problems identified in *Protecting the Source*. In particular it details how to understand the dynamics in the watershed, how to prioritize land for protection and find the partners, and how to fund and manage watershed protection programs.

TPL and AWWA are strongly committed to source water protection. AWWA recommends that suppliers strive to secure drinking water from the cleanest available sources and to "actively and aggressively" protect those sources. Land conservation is central to TPL's mission, and over 30 years of collaborating with local and state governments on land protection strategies make it well-suited to partner with water suppliers.

For at least sixty years, many water suppliers have relied on water treatment technology to keep America's drinking water safe. Today we have learned that although it is important, technology is not enough. Water suppliers are learning to trace water back to its source, where its quality is highest, and to prevent degradation of water before it reaches the treatment plant.

We believe that this report will help guide these source protection activities, providing new tools, partnerships, case studies and proven practices so water suppliers can continue to meet the challenge of providing clean drinking water to the nation's people.



Will Rogers



Jack Hoffbuhr

Handwritten signature of Will Rogers in black ink.

Will Rogers  
PRESIDENT  
TPL

Handwritten signature of Jack W. Hoffbuhr in black ink.

Jack W. Hoffbuhr  
EXECUTIVE DIRECTOR  
AWWA

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# MAKING THE CASE

## A MULTIPLE BARRIER APPROACH TO DRINKING WATER PROTECTION

In Virginia Lee Burton's classic children's tale, *The Little House*, readers witness the transformation of a picturesque countryside, first by roads and homes and later by apartment buildings, trolley cars, and skyscrapers. Once surrounded by a "field of daisies with apple trees growing around," the Little House finds herself plump in the middle of a booming metropolis. Finally rescued, she is picked up from her foundation and moved beyond to yet another untouched and idyllic landscape of rolling hillside and bubbling brooks.

Written in 1942, Burton's story resonates today as development presses in on all sides and sprawls in all directions. Such unchecked growth threatens not only our open spaces and quality of life, but also the air and water resources we need to survive. What was once a bubbling brook (or wellhead or reservoir) may be lost forever as a source of clean, safe drinking water.

Across the country, population growth and sprawling development threaten undeveloped land that protects regional and local water supplies. Not surprisingly, the fastest growing threat to our water quality is pollution from nonpoint sources related to development—the parking lots, roadways, and housing subdivisions that consume today's landscape. Polluted runoff from these areas often contains oil, toxic metals, pesticides, and other contaminants that flow into surface water supplies or underground aquifers.

While point sources of pollution such as sewage discharge and industrial waste have been regulated effectively for decades, nonpoint source pollution is more difficult to combat. Nonpoint sources of pollution appear and increase as a community grows, and the quality of the water shifts to reflect the changes of the land. The problem is exacerbated when developed areas consume former forestlands and

wetlands that served as natural water filters and buffers to water supplies.

According to the U.S. Environmental Protection Agency, the leading cause of source water degradation is nonpoint source pollution. Although agriculture is currently the greatest nonpoint source threat to drinking water quality, urban runoff is the fastest growing threat nationwide.

New development—particularly unplanned development and development that replaces forests and wetlands—greatly exacerbates the impact of agricultural pollution because it removes the natural barriers that filter pollutants and increases storm water runoff and soil erosion. While there is debate about whether changing land from agricultural use to low- or moderate-density development negatively impacts water, it is clear that new development on formerly natural lands threatens water quality and increases the impacts of agricultural pollution.

With new development comes greater demand for water. Population growth is leading to water supply crises in many parts of the

*By preserving the land that drains to its sources, the vast majority of contaminants are prevented from entering drinking water in the first place.*

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U.S., and battles over water rights have long been part of the political landscape in the Southeast and West. It is inevitable that demand for potable water will continue to increase, forcing communities to limit growth and protect their remaining resources.

So how do municipalities and water suppliers combat the threats? From source to tap, there are numerous points to capture and safeguard clean water or treat contaminated water. The most fundamental approach begins at the source—the lakes, rivers, streams, reservoirs, and ground water that provide drinking water. By preserving the land that drains to these sources, the vast majority of contaminants are prevented from entering drinking water in the first place. This is a critical component of source protection and the focus of this handbook.

Land conservation emphasizes the permanent preservation of land around both groundwater sources (aquifer recharge areas and wellheads) and surface water sources (land that buffers streams, rivers, and lakes). It's an extremely effective tool that can protect public health, prevent increased treatment costs, ensure consumer confidence, and maintain real estate values in areas where water supplies are protected.

Treatment, through filtration and disinfection, is the next barrier against contaminated water. Should pollutants enter water supplies, treatment removes most contaminants. Even in the most pristine watersheds, natural pollutants such as animal waste and organic matter can impair water quality, making treatment essential to the delivery of clean, safe drinking water.

The final barrier is infrastructure. From treatment plants, water travels into canals, pipes, wells, holding tanks, and finally consumer operated spigots. Contamination can occur through the corrosion of pipes and solder material (copper, lead, asbestos), the growth of bacteria in pipes, and untreated water that enters through a break in the distribution system itself.<sup>1</sup> Sound and up-to-date distribution systems help prevent such contamination and disruption of service.

Land conservation, treatment and filtration, and distribution system integrity are all parts of a multiple-barrier approach to providing clean drinking water; each is essential to long-term protection of our water supplies. Yet the emphasis on land conservation as a source protection tool is in flux. Many older cities

have historically protected source lands, employing the only water protection approach available before the advent of treatment technologies. High-growth areas, particularly newly developing mid-sized cities and suburbs, however, often lag in protecting drinking water supply lands. Demand for new development in source areas, along with advancements in treatment technologies, have had the unintended effect of lessening overall interest in source protection.

Fortunately this mindset is changing, as fast-growing communities and water suppliers are recognizing the benefits of conserving source lands and the limitations of treatment alone. Despite tremendous advancements in science and technology, treating water in heavily used watersheds with degraded water quality is challenging and expensive for several reasons:

- ◆ treatment measures must be continually expanded to address new forms of contamination, including pathogens, chemicals, metals, and pharmaceuticals.
- ◆ standards are constantly changing as we learn more about the potential health effects of new contaminants, and the costs of upgrading systems is extremely expensive;
- ◆ heavy rainfall causes pollutant loads at the intake to spike, making safe and effective treatment more difficult.

Dangerous levels of contamination yield significant treatment costs to the supplier and the community: increased treatment or treatment upgrades; remediation of the contaminant source; purchase of bottled water; consulting services and staff time; litigation costs against responsible parties; and provision of public information to satisfy public and media concerns.<sup>2</sup> Other costs are more difficult to measure: when water quality is threatened, consumer confidence is lost and human health is at risk.

Conversely, prevention measures, including the conservation of forests and other natural areas, can minimize the need for filtration and treatment, and produce long-term cost savings. According to the U.S. Environmental Protection Agency (EPA), the costs of treating contaminated groundwater supplies was, on average, 30 to 40 times more (and up to 200 times greater) than preventing their contamination.<sup>3</sup> The Trust for Public Land and the American Water Works Association also found

in a 2002 survey of 27 water suppliers that the more forest cover in a watershed, the lower the costs of treatment.<sup>4</sup>

Increasing demand, decreasing supply, and reducing pollution from a rising number of contaminants are today's challenges. What's clear is the need for a multiple-barrier approach that focuses on the permanent protection of drinking water sources. This handbook is designed to help municipalities, water suppliers, and land-use advocates address source protection needs through the conservation of source lands. It compliments TPL's 2004 *Protecting the Source* report, which makes a case for source protection and provides best practices for implementation. (For copies of *Protecting the Source*, visit TPL's Web site at [www.tpl.org](http://www.tpl.org)).

## LAND CONSERVATION AND ITS ROLE IN SOURCE PROTECTION

Land conservation is a powerful tool that can help communities meet multiple planning challenges, including the protection of drinking water resources. The fiscal and economic benefits are also considerable: in general, source protection, including land conservation, is much less costly than clean-up.

Proactive and strategic land conservation—*greenprinting*—is completely voluntary and incentives-based; open space and development rights are acquired from willing sellers. The method offers a variety of techniques, including fee simple ownership and conservation easements, each offering permanent protection for natural resources while fairly compensating landowners for their property.

Voluntary approaches are part of a source protection strategy that includes regulation, planning, and zoning. Land-use regulations can help prevent development in sensitive areas, control development patterns, and mitigate the impacts of pollution, flooding, and other costly disasters. However, regulations should be combined with compensatory, voluntary programs, such as land conservation, to avoid placing excessive burden on landowners in the watershed and to share the costs of protection with communities drinking the water.

Although regulation and planning are important components of source protection, acquiring land through purchase or conservation easement guarantees the most complete and permanent protection. The American Water

### CONSIDER THIS...

#### THE BENEFITS OF OPEN SPACE PROTECTION

**In addition to buffering drinking supplies, land conservation provides communities with a variety of economic and environmental benefits, including:**

- ◆ **enhancing property values and generating tax revenues,**
- ◆ **attracting businesses and boosting tourism,**
- ◆ **improving air quality and controlling erosion,**
- ◆ **preserving community character and improving quality of life, and**
- ◆ **providing recreational opportunities and expanding a community's nonmotorized transportation network.**

Works Association views watershed protection as key to protecting drinking water, concluding in a 1991 study that, "the most effective way to ensure the long-term protection of water supplies is through landownership by the water supplier and its cooperative public jurisdictions."<sup>5</sup>

Yet some policy-makers and water suppliers still see increased treatment as the best and only option. A number of challenges have made land conservation a less feasible option: federal, state, and local programs often fail to provide adequate funding or programmatic support; and some water suppliers lack technical support or resources to implement land conservation strategies.

This handbook is designed to help municipalities, water suppliers, and land-use advocates address these challenges, identify existing resources and technical support, and design a strategy to preserve land that protects drinking water supplies. It's a "how-to" guide for a range of local and regional partners, describing techniques to prioritize, finance, acquire, and manage key source lands. As it is intended to reach a broad audience, a thorough overview of conservation and source protection techniques is included. Keep in mind as well that although this handbook lays out a comprehensive and sequential land conservation program for source protection, it is also designed to serve as a reference document for readers who need guidance at any stage of the process.

## NATIONAL POLICIES AND PROGRAMS GOVERNING LOCAL SOURCE PROTECTION

It is important to understand national drinking water protection programs and policies before launching a local or regional source protection strategy. The Clean Water Act, passed in 1972, was one of the country's first comprehensive initiatives to address the clean-up of badly contaminated waterways. A legislative milestone administered through the U.S. EPA, this Act funds programs that help states and local communities protect their waterways.

Two years later, Congress passed the Safe Drinking Water Act (SDWA), the first comprehensive law to establish national drinking water standards. EPA oversees the states, localities, and water suppliers who implement these standards.<sup>6</sup> The legislation emphasizes a multiple-barrier approach to drinking water protection by funding both state and local source protection initiatives.

A 1981 EPA groundwater survey revealed

new risks from chemical and bacterial contaminants in both urban and rural water systems.<sup>7</sup> These new threats resulted in tremendous advances in treatment technologies and an even greater emphasis on protecting source lands. The ultimate result was a landmark amendment to the Safe Drinking Water Act in 1996: the Source Water Assessment Program or SWAP. SWAP is designed to inform communities about the location of their drinking water resources and threats to water quality in order to encourage and assist local protection activities.

SWAP legislation required every state to examine existing and potential threats to the quality of all public water supplies. It also mandated that states develop a source water assessment program by 2003. Assessments were made for every public water system, from small towns to major metropolitan areas. States were given great flexibility in the design of their programs, yet four common elements exist:<sup>8</sup>

- ◆ Delineate or map the source water assessment area (the land area that contributes water and pollutants to the water supply).
- ◆ Conduct an inventory of potential contamination sources in the delineated area.
- ◆ Determine the susceptibility of the water supply to identified contamination sources.
- ◆ Make the results public.

Most states have completed assessments of their supplies, laying the groundwork for the creation of comprehensive source protection initiatives by local suppliers. Though not mandated, water suppliers are now expected to develop management measures to protect their drinking water sources.

Several challenges exist: While some monies were allocated for the assessments, few implementation dollars currently exist and, in some cases, state source water assessments may need to be expanded in order to fully understand threats to local drinking water supplies. Yet resources are expanding to help local suppliers increase funding, forge partnerships, effectively use the data, and understand how to use land conservation as a source protection strategy. This publication and the Trust for Public Land's companion publication, *Protecting the Source*, are designed to help, providing best practices, case studies, and funding options to protect source lands.

### CONSIDER THIS...

#### STATE LEADERSHIP IN SOURCE WATER PROTECTION

**With the flexibility of federal programs, such as the Drinking Water and Clean Water State Revolving Funds, and the ability of states to create their own programs, states can have significant influence on the success of local source protection efforts. States can and should make source water protection a high priority and actively promote and support local efforts by:**

- ◆ Integrating source protection goals into other state programs, particularly funding programs;
- ◆ Creating new state funding sources for watershed protection and restoration;
- ◆ Actively distributing the source water assessments as widely as possible in an easily accessible format;
- ◆ Providing technical assistance grants to local groups so as to increase capacity for implementing source protection strategies, such as small watershed grant programs;
- ◆ Creating one-stop shopping for water-related funding sources; and
- ◆ Updating state databases and making them easily accessible to local stakeholders, including data on source water delineations, threats, land use, and soils.







# A LAND-CONSERVATION “HOW-TO”

In recent years communities have begun to use land conservation, blended with existing regulatory tools, to implement their land-use and natural resource protection goals. A community will likely have multiple conservation goals that include protecting open space, increasing recreational opportunities, and hopefully, preserving drinking water source lands. Taken together, these goals define a conservation vision or greenprint. A community can design a broad greenprinting plan that incorporates source protection and/or adopt a specific source protection plan that reflects local conservation and planning initiatives. In either case, suppliers should be prepared to act, help steer the broader land conservation visioning process, and find ways to leverage resources to specifically meet conservation goals that protect source water lands. The steps in the greenprinting process as it relates to source water protection are:

- ◆ **Understand your watershed.** Determine the source and threats to the community’s water supply.
- ◆ **Prioritize land for protection.** Use maps and models to identify and rank high priority lands for protection.
- ◆ **Build strong partnerships.** Forge partnerships with source protection stakeholders throughout your source area during the design and implementation of a conservation plan.
- ◆ **Design a comprehensive source protection plan.** Develop a vision and a plan of action that integrates a community’s land conservation goals with a broader source protection strategy.
- ◆ **Finance land conservation.** Identify and secure funds to implement the source protection plan.
- ◆ **Protect priority lands.** Use the most effective acquisition tools to permanently protect targeted land.
- ◆ **Manage protected lands.** Carefully plan and fund the stewardship of protected land.

The following pages take you step-by-step through the design and implementation of a land conservation plan to protect source areas. Keep in mind that this “how to” is designed to meet the needs of water suppliers with various challenges and resources; following a sequential ordering of the steps is not necessary.

At this point it is also important to consider potential staffing needs and resources. Successful water suppliers or local governments typically rely on a full-time staff person dedicated to source protection—a water resource planner, watershed coordinator, resource protection specialist, or groundwater specialist. Assessing your resources and the scope or your source protection challenges early on can help smooth the planning process to come.

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## *Getting Started: Is land conservation a good approach for you?*

Source protection involves several voluntary approaches (i.e., land conservation, best management practices, public education), as well as regulatory and planning approaches. While conservation may be most effective in defined circumstances, it is likely that a combination of voluntary and regulatory tools will be needed to protect a watershed. So when is land conservation an appropriate and effective tool to protect source lands? An understanding of a watershed's characteristics is essential in answering this question.

- ◆ **Watershed size.** The smaller the drainage area, the easier it will be to accomplish measurable water quality objectives using conservation strategies. Water suppliers that choose land conservation as a primary strategy usually have drainage basins or aquifer recharge areas of 300,000 acres or less.<sup>9</sup> For water suppliers and municipalities whose sources come from and are affected by a large watershed (more than 300,000 acres) with multiple political jurisdictions, public-private partnerships are both a necessity and an opportunity, offering potential economies of scale and significant water quality benefits.
- ◆ **Natural Resources.** As a strategy to protect natural lands, conservation is most appropriate in source areas where there are still tracts of unprotected forest or grassland in private ownership that could be threatened by new development.
- ◆ **Development patterns.** Land conservation is most critical in source areas that are vulnerable to development or where water quality has declined as a result of changing land use. Identifying and protecting highly sensitive lands that are vulnerable to development allows local partners to be proactive and avoid costly mitigation or restoration activities. Local plans will reveal whether any growth activities are slated to occur in or around public water supply watersheds. In addition to immediate plans, look closely at longer-term growth trends and development patterns in the community to assess potential threats.
- ◆ **Overlapping benefits.** People may be more likely to support conservation of source lands when they can also achieve other objectives,

such as growth management, new recreation opportunities, flood control, and so on. Overlapping benefits can provide increased incentive or motivation to implement conservation, and access to a broader array of funding tools.

## **UNDERSTAND YOUR WATERSHED**

An understanding of your watershed and aquifer recharge areas is the foundation upon which an effective source protection plan is built. In order to plan and implement protection strategies, you need to assess current conditions and how changes in land use, contamination, and protection and restoration efforts impact source lands over time. This requires a baseline of data for monitoring and measuring future impacts of changing land-use. By communicating important data and analysis about your watershed, potential threats, and the benefits of source protection, you can build the case for source protection with stakeholders and the public.

There are several steps to the information-gathering process.

- ◆ **STEP 1: Identify water supply lands.** Gather existing information about the location of water supply lands in the community, including watersheds and groundwater recharge areas that drain to intake or wells.
- ◆ **STEP 2: Evaluate current and future land uses.** Determine land use and the purpose for which it is being managed (agriculture, commercial, industrial, residential, and so on). Evaluate how potential development and other land-use changes will impact source lands over time.
- ◆ **STEP 3: Determine land ownership and management.** Identify landownership patterns and key landowners whose property is significant to the health of the watershed.
- ◆ **STEP 4: Assess threats and monitor water quality.** Monitor water quality throughout your source area in order to understand the link between current land use and water quality. Establish a baseline for your watershed for monitoring changes to water quality in the future.

## STEP 1: Identify Water Supply Lands

States are required through the Source Water Assessment Program to delineate all source areas and potential threats to drinking water. SWAP reports can be used to identify the public water supply watersheds and aquifer protection areas located in your area, and existing threats to water supplies. EPA's Web site contains links to state source water contacts and its organization's regional contacts (<http://www.epa.gov/safewater/protect/contacts.html>). State-level environmental protection departments or similar state agencies and large water utilities may also have maps of ground and surface water supplies. Additionally, local water boards, health departments, and inland wetlands commissions may be helpful sources of information.

## STEP 2: Evaluate Current and Future Land Uses

To plan effectively, you must understand your source land and how it is changing. Begin by determining how the land is currently used, and then look ahead—assess where growth has been occurring in order to determine where change is likely in the future and, therefore, the most critical areas for protection.

To determine current land uses, look at the type of land cover in your source area (e.g., residential, forest, wetlands, and so on). Maps for land use (the activity or type of development on the land) and land cover (vegetation found on the surface of non-urban land) may be available from the state and/or regional planning commissions. It is preferable to obtain information from the state so that it is consistent across jurisdictions, but it may be necessary to assemble information from various local or regional sources.

Next, assess potential land-use changes that may impact source lands. Take advantage of the wealth of information at the federal, state, regional, and local levels that exists about your region, where it is developing, and the impact of growth trends on your watershed lands and aquifer recharge areas. State and regional planning reports, for instance, may include plans for growth, development, and conservation as well as indicators about future trends. Local plans, such as comprehensive and smart growth plans, are valuable sources of information about growth and development

### CONSIDER THIS...

#### GROUNDWATER VERSUS SURFACE WATER: UNDERSTANDING THE BASICS

**Your community may receive its drinking water from a surface water intake, such as a river or reservoir. A reservoir may be fed by a variety of upstream water bodies, including rivers, streams, lakes, and wetlands. If the intake lies in your municipality, the upstream water bodies are most likely located in other communities. Alternatively, your drinking water may come from a source in another community, which, in turn, is influenced by waterways in your jurisdiction.**

**Groundwater, which flows beneath the land's surface and is pumped to the surface through wells, may also be an important source. Your municipality may again face multi-jurisdictional issues, as aquifers often span large geographic areas underground.**

**Ground and surface water are often interconnected depending on the season and watershed characteristics. Groundwater pollution, chemistry, and flow can directly impact surface water quality and vice versa. Because of this relationship, it is imperative that water suppliers understand the source of their waters in dry and wet seasons, and act to protect them.**

patterns. State and local maps of existing protected lands will help you determine what areas are not vulnerable to development and where future conservation efforts can build on existing protection. Other resources include:

- ◆ **Future development plans.** Zoning ordinances and development plans should be reviewed to determine whether any growth activities are slated to occur in areas near public water supply watersheds.
- ◆ **Buildout analysis.** Using Geographic Information Systems (GIS), local partners and states can evaluate the amount of buildable land and the impact of potential development based on current zoning. These analyses visually depict how projected growth will impact water quality and quantity.<sup>10</sup>
- ◆ **Parcel and zoning maps and subdivision regulations.** Use these resources to define the specific types of development allowed in a particular area. Overlay a map of the community's watershed lands and aquifer recharge areas with the municipal parcel map and a zoning map to see where future development could impact source areas. Maps can typically be found in the tax assessor's office or via the planning and zoning commission.

GIS can also be used to map man-made characteristics, such as ownership and land use. If a community does not have computerized parcel and zoning maps, the process of overlaying maps can be somewhat time-consuming.

#### MINI CASE STUDY

##### *Massachusetts Build-out Analysis*

In Massachusetts, the state Executive Office of Environmental Affairs has developed a set of build-out maps and analyses for all 351 cities and towns. The maps and analyses depict currently developed and protected land within a community and what a community would look like if remaining undeveloped land were completely developed in accordance with local zon-

ing. The information is designed to help communities project the potential impact of future growth and encourage cities and towns to work together to address cross-jurisdictional issues, such as water supply protection.

For more information, visit the Web at <http://comm-pres.env.state.ma.us/content/buildout.asp>.

### *STEP 3: Determine Ownership and Management*

Once you have evaluated the land and its growth patterns, try to determine land ownership within targeted areas, identifying the large parcels within the watershed and the predominant landowners. Who are the largest landowners or holders of significant source lands? Will you be working with farmers, timber owners, speculative developers, or others? Local realtors, the Farm Bureau, woodlot groups and other relevant organizations or associations may be able to help you answer these questions. This process will help you understand land uses, management issues, and potential protection approaches.

### *STEP 4: Assess Threats and Monitor Water Quality*

The next step is to understand the impacts on water quality from land uses, and create a baseline of water quality data for monitoring future changes. There are two components to the process:

- 1) compile and analyze existing sources of data, such as SWAPs, Watershed Studies, USGS Studies, Consumer Confidence Reports, and others;
- 2) implement a comprehensive monitoring program.

#### **Compile and analyze existing sources of data**

To begin, identify sources of information that can help you assess threats to water quality from land use, such as:

##### ◆ **Source Water Assessment Program (SWAP).**

Each state is required by federal law to complete an assessment that determines the location of source lands and threats to quality

#### **NATIONAL ESTUARY PROGRAM**

Where the river meets the sea, estuaries serve as critical buffers between land and ocean, filtering sediment and pollutants, and absorbing flood waters and storm surges. To protect estuaries of national importance, Congress created the National Estuaries Program (NEP) in 1987 through amendments to the Clean Water Act. Administered by EPA's Oceans and Coastal Protection Division, NEP is charged with developing Comprehensive Conservation and Management Plans (CCMP) for attaining or maintaining water quality in 28 targeted estuaries.

CCMPs address all aspects of environmental protection for an estuary, including water quality, habitat, living resources, and land use. The plans are based on a scientific characterization of the estuary, and developed and approved by a broad-based coalition of stakeholders—essentially creating a blueprint for future land-use and water quality decisions within the estuary.

Within each of the estuaries there exists a wealth of watershed information that may be useful in local source protection planning efforts, including monitoring data, characterization reports, and environmental indicators. In the process of designing its CCMP, Long Island's Peconic Estuary Program identified the need for an individual land protection plan—known as the Critical Lands Protection Plan. This plan is designed to evaluate and prioritize land for protection for water quality and habitat protection; drinking water, public access, and other issues also come into play. A diverse group of stakeholders is involved in the process and the plan is designed to build on and complement existing conservation activities. For instance, a GIS database was compiled of lands already identified for protection by various levels of government, and protection efforts are coordinated, to the extent possible, with special groundwater protection initiatives in the Pine Barrens.

For more information about NEP and its estuaries and resources, visit the Web at [www.epa.gov/nep/](http://www.epa.gov/nep/).



and quantity. Although unique in format and level of detail for each state, all assessments must delineate source water areas, inventory potential sources of contamination within these areas, and determine the relative susceptibility of each source to contamination. Municipalities and water suppliers are encouraged to use the information for local source protection activities, including land conservation, and expand upon the assessments whenever possible.

- ◆ **EPA Resources.** EPA has several resources that can help you assess the condition of your watershed: 1) EPA's Surf Your Watershed Web site ([www.epa.gov/surf/](http://www.epa.gov/surf/)) can help you locate, use, and share environmental information about your state and watershed. Included are tools to locate watersheds and a Watershed Atlas, which is a catalog of geo-spatial displays and analyses of information and data, including resources about watershed health, conditions, and vulnerability; 2) EPA's WATERS database (Watershed Assessment, Tracking and Environmental Results) unites water quality information that was previously available only from several independent and unconnected databases, including databases of water quality standards, nonpoint source pollution, and water quality inventories. Visit the Web at [www.epa.gov/waters](http://www.epa.gov/waters). 3) State 305(b) reports. This biennial report is prepared by state governments and submitted to EPA for review and analysis and transmission to Congress. Reports present a description of navigable water quality, protection of water life, elimination of pollutants, cost control, and other related records.
- ◆ **Existing Watershed Monitoring Data.** State or local entities may be currently monitoring watersheds in order to comply with Clean Water regulations. Non-governmental organizations, such as watershed associations, may also have monitoring stations set up, and universities and local land trusts are potential sources of data. Water suppliers should build on what is already available: assess the data, identify any gaps, and determine how monitoring efforts can be integrated and expanded to provide a complete picture of watershed's health.
- ◆ **Watershed studies.** Watershed studies by the United States Geological Survey (USGS), universities, watershed associations, and water

suppliers can provide valuable information about the health of a watershed. The USGS Web site ([www.usgs.gov](http://www.usgs.gov)) provides scientific information organized by watershed, coupled with observations and measurements made by watershed groups.

### Implement a comprehensive monitoring program

Although the information sources listed previously may provide a big picture of water quality within a certain watershed or source area, such as cumulative pollutant loads, there will likely be gaps in the data and a need for more targeted monitoring. Watershed monitoring can give you a baseline by which to fully understand

#### FEDERAL AND STATE MONITORING REQUIREMENTS

- ◆ **Clean Water Act (CWA).** The federal CWA establishes minimum monitoring requirements, although states can require more stringent monitoring of state-issued permits. Currently, 47 of the 50 states administer their own permit programs. States are required to produce an assessment of ambient water conditions (CWA 305b). There are also guidelines for "monitoring and reporting, enforcement, funding, personnel, and manpower;" (CWA 304i), and requirements for the development of water quality standards and the establishment of "designated uses," including the use of the water source as a drinking water supply (CWA 301, 510).<sup>14</sup>
- ◆ **National Pollutant Discharge Elimination System (NPDES):** As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources (including municipal wastewater treatment plants and industrial discharges). Phase I of the NPDES storm water program requires NPDES permit coverage for large or medium municipalities. Phase II extends coverage to certain regulated small municipal separate storm sewer systems and small construction activities. Phase II Stormwater Management Permits will likely require monitoring, but this will vary from state to state. Additional federal monitoring requirements may be established through NPDES permits to track point sources of pollution. There is some room for negotiating monitoring requirements of watershed-based permits—this can be done when developing NPDES permits for multiple point sources located within defined boundaries. For instance, some ambient monitoring may be required as a condition of the permit.
- ◆ **303(d) list:** Section 303(d) of the Clean Water Act requires that states identify waters that do not meet or are not expected to meet applicable water quality standards. These water bodies are compiled into a list known as the 303(d) list. Once a stream or lake is identified as 303(d), meaning that it is impaired, the Clean Water Act requires communities to monitor and track the contaminants of concern.

## FEDERAL FUNDING SOURCES

The EPA has a *Catalog of Federal Funding Sources for Watershed Protection* on its Web site, a searchable database of financial assistance sources (grants, loans, cost-sharing) available to fund a variety of watershed protection projects. Visit <http://cfpub.epa.gov/fedfund/> to search the database for funding sources that might be a match for your area.

your watershed and measure the success of future source protection and watershed management efforts.<sup>11</sup>

Tracking the health of a watershed is important throughout the source protection process, from the earliest information-gathering stage described here, through efforts to prioritize land for protection, and finally, as an on-going tool to manage protected land. Specifically, watershed monitoring can help you understand the health of your watershed (not necessarily finished water quality); identify sources and levels of pollution; meet regulatory standards; decide which lands are most critical to protect or restore; track conditions over time; and implement a comprehensive source water protection program. A monitoring program can also help you build public and political support for your program. Scientific data is critical for building a strong case for a comprehensive source protection strategy that may include land conservation, public funding, and regulatory and zoning changes.

As defined by EPA, “monitoring” is *“the collection of water quality or watershed data, either periodic or continuous, using measured parameters and consistent methods.”*<sup>12</sup> Depending on the objectives, monitoring may be limited to water quality, which is the sampling and analysis of chemical conditions of a water body.

Watershed monitoring, is a more comprehensive approach to data collection that includes monitoring chemical water quality and physical or biological watershed conditions throughout a source area. Comprehensive watershed monitoring helps you understand the fundamental health of your watershed, where land use is impacting water quality, and where conservation, restoration, or other efforts are effectively mitigating those impacts.

Unfortunately, monitoring can be complex, time-consuming, and costly; local partners sometimes lack the resources and expertise to implement a comprehensive monitoring program. Public and private partnerships and funding sources at the local, state, federal, and private levels are available. Many municipalities and water suppliers partner with the state, USGS, local universities, or volunteer watershed associations to implement monitoring programs. In fact, volunteer monitoring is often one of the primary purposes of local volunteer watershed associations.

Regardless of available resources and a chosen approach, it is important to understand the basic components of a comprehensive monitoring program. Outlined here are key considerations as developed by EPA. (More complete background is available on the EPA’s Watershed Academy Web at [www.epa.gov/water-train/monitoring/](http://www.epa.gov/water-train/monitoring/).)

Begin by determining the geographic boundaries and particular attributes of the watershed under examination. Define the objectives of your program and the scope of your study—its duration, any particular area of focus within a watershed, budget, and sources of funding.

With the scope defined, several steps are required to effectively implement a program: establish monitoring protocols; generate data; define quality assurance and quality control procedures; and conduct the assessment. The design of a sample must take into consideration the type, frequency, and amount of data to be collected and by whom. You should also consider up-front how the analysis will be conducted and how the data will be managed.

Regarding the collection and management of data, be sure to choose appropriate tools and indicators of quality, including measures of chemical, physical, biological, habitat, and toxicity, as well as the land-use plans, maps, and photos gathered in your watershed assessment thus far. A comprehensive monitoring program should include the following.

◆ **Probability-based and fixed-station sampling on all major tributaries throughout the watershed.** Fixed station samples are taken regularly (daily, weekly, monthly) at fixed locations in the watershed and are used to monitor changes over time, identifying trends at those specific locations. Probability-based sampling should be used in tandem with fixed-station sampling, as its results can

be used to make generalizations about the condition of the whole watershed instead of just the fixed sampling sites. In contrast to measuring at fixed locations, sampling sites within the watershed are chosen at random. Every location in the watershed has some known probability of being sampled. Because sampling is random and watershed wide, probability-based sampling results can be folded into statistical analyses that provide information (with a certain degree of confidence) about the entire watershed.

◆ **Physical, chemical and biological sampling methods.** Physical monitoring assesses the stability of a stream channel and a stream's vulnerability to erosion. Chemical sampling (testing for metals, nutrients, and other pollutants) provides a snapshot view of water quality—measuring the amount of a particular pollutant in the water when the sample is taken. Biological monitoring assesses how water quality is affecting the condition of the stream over time, by examining the biological (fish or macro invertebrate) community to assess the aggregate impact of all stressors potentially affecting the stream, including episodic water quality conditions that may not be present when chemical samples are collected.

◆ **Wet and dry-weather monitoring.** Most loading of pollutants to surface waters occurs during brief episodes of wet weather. Chemical monitoring that is limited to dry weather may not capture the most significant pollutant loads.

Monitoring data will give you the information you need to understand your watershed, design an effective source protection program, and assess its impact over time. Once initial assessments and analyses are complete, it's time to report the findings to the public and local leaders in an effort to influence watershed protection policies.

## CASE STUDY

### *Bull Run Watershed, Oregon*

The City of Portland, Oregon, through its Bureau of Water Works, provides drinking water to nearly one-fourth of the population of Oregon—roughly 787,000 people—across an area that includes Portland and 19 suburban cities and water districts. Water flows from two primary sources: the Bull Run watershed, 35 miles east of Portland in Mt. Hood National

## WATERSHED ASSESSMENT GUIDANCE

EPA's Elements of a State Water Monitoring and Assessment Program, outlines the components of a comprehensive monitoring program. Details can be found at: [www.epa.gov/owow/monitoring/repguid.html](http://www.epa.gov/owow/monitoring/repguid.html).<sup>13</sup>

The Center for Watershed Protection has designed a series of cost-effective rapid assessment methods, including vulnerability assessments and rapid stream assessment techniques. Details are available at [www.cwp.org/tools\\_assessment.htm](http://www.cwp.org/tools_assessment.htm).

The Chesapeake Bay Program published The Community Watershed Assessment Handbook to help community groups and local governments conduct comprehensive environmental assessments of their watersheds. The handbook outlines a basic process for assessing current and anticipated future watershed conditions and is available at [www.chesapeakebay.net/pubs/watershed\\_assess/index.htm](http://www.chesapeakebay.net/pubs/watershed_assess/index.htm).

Forest; and the Columbia South Shore Well Field, which largely serves as a supplemental source during summer months or times of emergency.

The story of Portland's drinking water dates back at least to 1892 when the city successfully lobbied President Benjamin Harrison to establish the Bull Run Reserve, a national forest reserve. Federal legislation, known as the Bull Run Act, now limits land management activities primarily to those needed to protect drinking water quality and to operate and maintain water supply facilities and hydroelectric facilities. No residential, commercial, or industrial activities are permitted within its boundaries. The legislation is unique because of its restrictions on federal land use and the requirements that federal and local partners cooperatively manage a large area of federal land for the purpose of protecting a municipal water supply.<sup>15</sup>

Because the watershed is closed to public entry and has stringent controls on logging, there are no land-use related sources of chemical or microbial contamination. The result of such prescient protection has been the availability of consistently high quality unfiltered drinking water to metro-Portland residents.

Monitoring water quality is an integral part of the Water Bureau's program to ensure clean supplies. The Water Bureau monitors for approximately 200 regulated and unregulated contaminants, including pesticides and radionuclides. Water samples are taken throughout the water system, including the

Bull Run watershed, Columbia Southshore Well Field, in-town reservoirs, distribution system, and customers' taps. Each year, roughly 75,000 water analyses are conducted on 9,900 water samples, and 32,000 quality control tests are performed to ensure compliance with state and federal drinking water standards and monitor water quality trends.<sup>16</sup>

Source water quality is routinely monitored at the mouths of major tributaries, the raw water intake, and immediately above and below some earth disturbing projects.<sup>17</sup> Source water monitoring responsibilities for the Bull Run watershed are shared among the Portland Water Bureau, the U.S. Geologic Survey (USGS), and the U.S. Forest Service. The team implements a comprehensive monitoring program with both fixed station and probability based monitoring to track such things as stream flow, turbidity, microbial risks, and other potential water quality problems. The USGS operates a monitoring program under contract with the Water Bureau and collects continuous data on flow, temperature, and specific conductance at stations located at the mouth of the four major tributaries. The

Water Bureau augments this program by collecting samples with automated pumping samplers and in-stream turbidity probes at the same set of stations. To monitor water quality during wet weather, the pumping samplers utilize a flow-weighted, probability-based method for determining when to trigger sample collection during storm events. The Water Bureau collects samples from the reservoirs every two weeks, and monitors for some variables daily at the raw water intake.

The Forest Service is involved in monitoring the impacts on water quality from road decommissioning projects. The road decommissioning program involves removing culverts and restoring stream channels on abandoned logging roads in order to minimize the long-term risk of erosion and sedimentation. Taken together, monitoring data gathered from the Water Bureau, USGS, and the U.S. Forest Service is used to inform land management decisions and gauge the effectiveness of best management practices.

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## WRAP-UP

### UNDERSTAND YOUR WATERSHED

#### Questions to Consider

- ◆ Does the community understand the scope of the watershed that supplies its drinking water? How will future demand be met?
- ◆ Which watershed lands are protected and which are vulnerable to development?
- ◆ How is your watershed changing? How will growth and land-use changes impact the watershed and steer source protection efforts?
- ◆ Who owns large parcels within the watershed? Are privately owned parcels strategically significant to the management of the watershed and the protection of drinking water?
- ◆ What are the threats to water quality from specific land uses in your watershed?
- ◆ What is the current condition of the watershed?
- ◆ What resources exist to implement a comprehensive watershed monitoring program?



## PRIORITIZE LAND FOR PROTECTION

In broad strokes, the most important lands requiring safeguarding for the purpose of maintaining water quality include:

- ◆ forestlands
- ◆ wetlands
- ◆ natural grasslands
- ◆ steep slopes
- ◆ land close to or encompassing small streams, and
- ◆ land with erodable soils, such as silts and clays.

Even with this information, difficult decisions must be made about where to spend limited resources and how to best prioritize properties. Improved knowledge about the impacts of land use on water quality and advances in computer-based decision support tools, notably geographic information systems (GIS), have made the decision-making process more efficient and effective. When integrated with other tools, such as field surveys, water quality monitoring, and professional judgment, GIS analysis is an increasingly effective and accessible way to identify and rank source lands.

### *Geographic Information Systems — The Basics*

GIS is a computer-based tool for mapping and analyzing land. It can be used throughout the source protection process, providing an invaluable resource for inventories, prioritization, and management. On a broad scale, a GIS can show permanently protected land, temporarily protected land, and land vulnerable to development. It can also provide overlays that demonstrate the interrelationship among natural resources, contaminant sources, and water resources.

More specifically, GIS can map natural features such as topography, vegetation, soils, wildlife and riparian areas, and cultural or man-made characteristics such as land use, growth patterns, protected areas, and property values. Decision makers can integrate and analyze these maps, design conservation strategies, and prioritize land accordingly.

Keep in mind that you cannot create an effective source protection plan unless you

consider the entire source area, and that usually means looking at maps of land in multiple jurisdictions. Too often, local partners fail to look outside their political boundaries even though the most critical source protection land could well be located in a neighboring jurisdiction. States are a key resource for cross-jurisdictional data and maps, and are usually a better source for data layers than municipalities, as they provide consistent data, watershed-wide. A list of potential data sources is included at the end of this chapter.

There are several components to GIS: computer hardware, software, and databases (geographic, demographic, topographic, and so on), a mapping methodology, and the people to manage the process. Support may be available from EPA, private consulting firms, state or regional government or planning agencies, watershed organizations, or water suppliers, among others. Municipalities and water suppliers without access to GIS can often contract mapping and technical services from other consultants or state/regional agencies.

How you use GIS to prioritize watershed land will depend on the availability and sophistication of your resources: simple analyses can help you identify existing conditions in the watershed; more sophisticated modeling can help you prioritize watershed and aquifer recharge lands. Potential methodologies include:

- ◆ **Locating specific sites on a map, such as parcels or contaminant sources** that have been identified through field surveys, monitoring, and existing data sources
- ◆ **Developing deterministic or quantitative models** that can predict potential impacts from land use on water quality
- ◆ **Creating operational or qualitative models** that rank parcels or areas based on a set of characteristics

The first and simplest use of GIS—*locating specific sites on a map*—can be very useful in integrating information on multiple sites into a single watershed map that can become a shared resource and guide for remediation or protection. For small municipalities and

### GIS SCENARIO BUILDING TOOLS

CommunityViz software is the leading provider in the market of scenario building tools, offering decision support software products optimized for ESRI ArcGIS. CommunityViz is located on the Web at [www.communityviz.com](http://www.communityviz.com).

ESRI is the world leader in GIS (geographic information system) software and technology. ArcGIS is an integrated collection of GIS software products for building a complete GIS. [www.esri.com](http://www.esri.com)

## USING GIS FOR SOURCE WATER ASSESSMENTS

The EPA's publication, *Source Water Assessment Using Geographic Information Systems*, is designed to help states, municipalities, and water suppliers use GIS to assess water supplies. The report provides detailed information about GIS concepts and components; data, software, and hardware; how to obtain data and build the GIS database, delineate source protection areas, and analyze the results. <http://www.epa.gov/ORD/NRMRL/wswrd/gis.htm>.

For more information on how to create such a tool, see *Using Technology to Conduct a Contaminant Source Inventory: A Primer for Small Communities*, a publication by The Groundwater Foundation, [www.groundwater.org](http://www.groundwater.org).

water suppliers with limited resources, this can be an excellent first step in understanding threats to drinking water and mapping out a strategy for protection.

More complex GIS applications involve *creating deterministic or quantitative models* that can predict potential impacts from land use (e.g. pesticide concentration, nutrient loading, or total suspended solids in stream water) on water quality. Quantitative models such as EPA's BASINS (Better Assessment Science Integrating Point and Nonpoint Sources) or Electric Power Research Institute's WARMF (Watershed Analysis Risk Management Framework) models are often used to develop Total Maximum Daily Loads for a water body. These models can be very useful and accurate, yet require significant resources, technical expertise, and historical data. Still, the approach is within reach for many local partners; consulting groups can be excellent resources in thinking through which quantitative models are the most appropriate tools for reaching your goals.

With deterministic or quantitative models, GIS can be used to create and compare different scenarios. For example, one scenario in a watershed may show "business as usual" development and how that impacts ground water reserves and quality. An alternative scenario might show a change in zoning to move high density development off of a critical aquifer recharge zone into another area. The impacts of this zoning shift on water reserves and quality can be displayed using charts, tables or 3D visuals.

Lastly, *operational models, also called ranking systems*, use data to generate indices or qualitative rankings—a widely used GIS tool for mapping out high priority sites for protection and restoration. Operational models integrate a diverse

array of data and information—topography, soil type, slope, and land use, for example—to produce data layers.<sup>18</sup> Digitized data layers are used to determine the areas of greatest interest, such as sites with steep slopes and natural land cover that incorporate small streams, and can efficiently generate land protection priority lists. When combined with local knowledge and field inspections, the resulting priority lists can be very effective decision-making tools. A comprehensive examination to this approach follows.

## GIS Ranking Systems

Ranking systems can help you understand the importance of a particular piece of property to the health of your watershed. By combining information on land characteristics such as topography, soil type, slope, land use, and zoning, you can efficiently generate land protection priority lists. For example, a large forested parcel that encompasses small streams, with steep slopes and highly erodible soils, would rank higher than a parcel that is level, with good soils and far from a water source. Where digitized parcel data is available, a numerical score can be given to each parcel indicating its value for conservation or restoration.

The University of Massachusetts (UMass), in partnership with TPL and the USDA Forest Service, with funding from EPA, developed one such ranking system that identifies high priority land in a source area and ranks individual parcels for conservation and restoration. The model is intended to be a practical and efficient tool for communities to identify land for protection, restoration, or storm water management, using available state and local data layers.

The following tables outline the GIS overlay process that is used to prioritize land for surface and groundwater protection.<sup>19</sup> The potential influence of land cover on surface water quality is represented by the total score generated by ranking and combining the GIS layers. If, for example, a site has forest cover, steep slopes, silty soils, and is located adjacent to a water body, it would receive high scores for all six layers and a total score of 18, making it a high priority for protection (Table 1). By contrast, a level, sandy site, far-removed from the stream network would have a total score of only 3. This method accounts for the many possible combinations of soil, landform, and location characteristics and amplifies the dif-

**TABLE 1 – Generalized GIS overlay process to develop a Surface Water Conservation Priority Index<sup>22</sup>**

	SCORE			
	3 (high)	2 (intermediate)	1 (low)	0 (n/a)
<b>GIS Layer</b>				
<b>Adjacency to water<sup>1</sup> (lakes, streams, wetlands)</b>	<30 meters	30 to 60 meters	60 to 90 meters	>90 meters
<b>Slope<sup>2</sup></b>	>15%	5 to 15%	<5%	–
<b>Flow accumulation<sup>3</sup></b>	>200 grid cells	150 to 200 grid cells	<150 cells	–
<b>Soil texture<sup>4</sup></b>	clays and silts	loams	sands	–
<b>Forest between roads and water features<sup>5</sup></b>	Intersection of 60 m buffers for roads and water features	–	–	
<b>Land Cover</b>	Forest, Wetland, Open land	–	–	All others
<b>Other layers<sup>6</sup></b>	To be determined	TBD	TBD	TBD

1. The 30 meter dimension is dictated by the digital elevation model (DEM) used to represent topography in the GIS. A 10 meter (33 ft.) resolution DEM is now available from the U.S. Geological Survey for many areas and could be used if smaller zones are more appropriate.

2. Appropriate thresholds for slope classes will vary in relation to local topography and site conditions. The slope classes used for mapping presented in Natural Resource Conservation Service (NRCS) soil surveys are a good source of site-specific data [county level].

3. Field data from headwater areas and flow accumulation calculated with the GIS are used to represent the land area associated with perennial, intermittent, and ephemeral streams, respectively. This high resolution map enhances the stream system shown as a blue line on US Geological Survey maps. The thresholds (>200, etc.) in this example are appropriate for southern New England. Different values would be suitable for watersheds in drier climates with deep residual soils (larger values), wet climates with mountainous terrain (smaller values), et cetera.

4. Soil texture is a useful surrogate for relative rate of water movement into and through soils. It represents the likelihood of overland flow, likelihood of soil erosion, and associated water quality degradation.

5. Because roads that are close to streams, lakes, and wetlands can have many adverse effects on water quality, the narrow strip of forestland between the two features is an especially important riparian buffer.

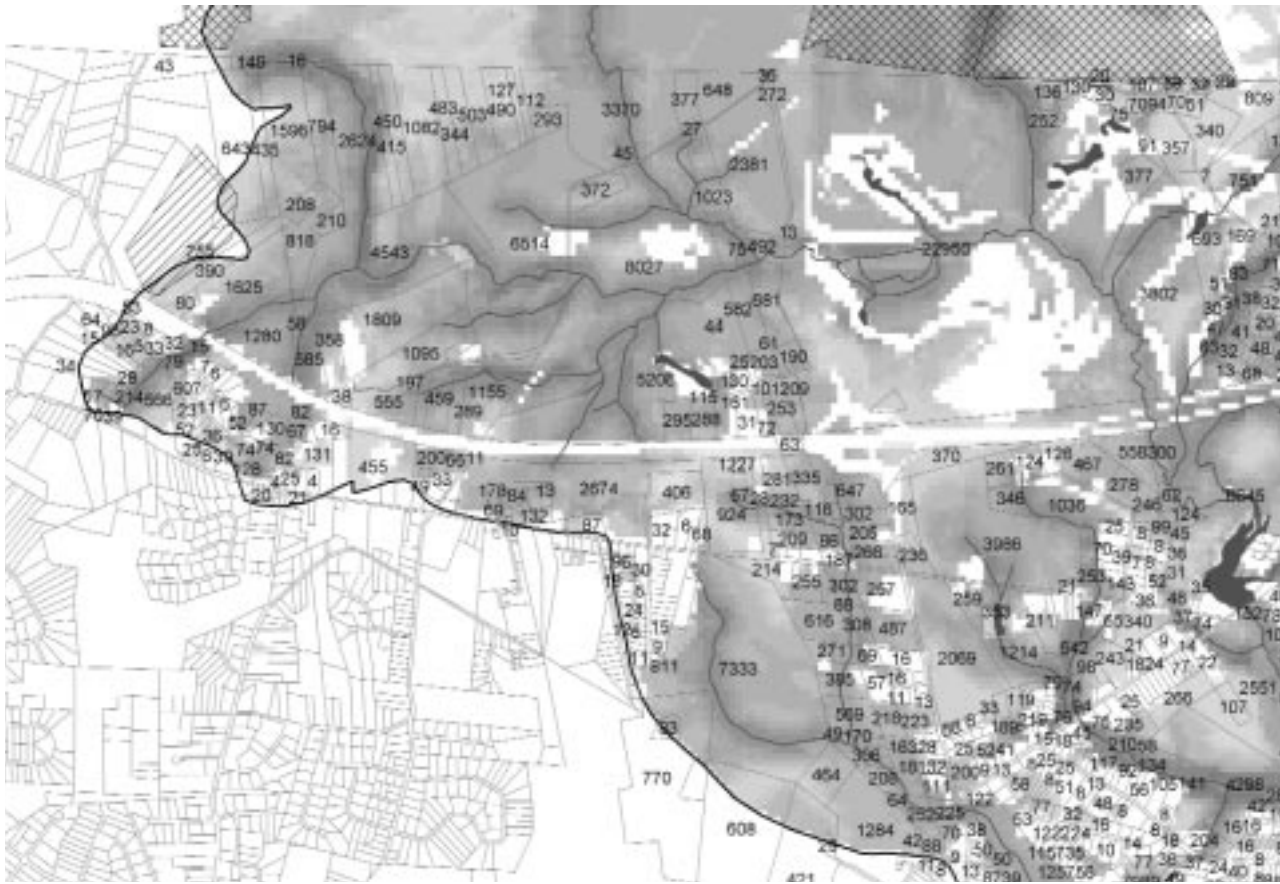
6. Other layers may include floodplain maps, historical and cultural resources, rare or endangered habitat, and high biodiversity sites that—along with water quality—would directly benefit from forest conservation.

ferences between the most important and the least important sites. An equivalent process can be developed for protecting groundwater supplies (Table 2).<sup>20</sup>

The University of Massachusetts has developed a guide for communities to use in replicating their modeling methodology, *Protecting the Source: A Guide to Database Compilation and GIS-Based Watershed Assessment Methods*, available through the University of Massachusetts-US Forest Service Watershed Exchange and Technology Partnership.<sup>21</sup> This publication is available at [www.wetpartnership.org](http://www.wetpartnership.org).

Some water utilities and government agencies use other characteristics to guide land con-

servation and watershed management decisions. The New York City Department of Environmental Protection considers differences in drainage density (miles of first-order stream per acre), estimated travel time to reservoirs, and proximity to reservoirs. Baltimore County, Maryland includes zoning and lot size information in watershed analyses. TPL includes a range of other measures, including zoning and parcel information, impervious areas and channel migration zones, flood plains, flood protection facilities, aquifer protection areas, and soil type by land use. TPL also looks at the fragmentation of land cover (i.e., forest, vegetation, or lack thereof) and its



**FIGURE 1 – An example of a surface water Conservation Priority Index for a watershed in central New Jersey.** <sup>23</sup>

**TABLE 2 – An example of a groundwater Conservation Priority Index for forests and wetlands in the Squannacook and Nissitissit River watersheds (Nashua River tributaries), Massachusetts and New Hampshire**<sup>24</sup>

	<b>SCORE</b>			
	3 (high)	2 (intermediate)	1 (low)	0 (n/a)
<b>GIS Layer</b>				
<b>Public water supply (wellhead protection area)*</b>	Yes	–	–	no
<b>Surficial geology</b>	Sand and gravel deposits		Floodplain alluvium	Till or bedrock
<b>Aquifer transmissivity (ft<sup>2</sup>/day)**</b>	>4,000	2,000 to 4,000	<2,000	No data
<b>Land use</b>	Forest, Wetland, Open land	–	–	All others

\* The spatial extent of the wellhead protection area is estimated with the maximum pumping rate of each well. A hydrogeologist can refine this delineation with core data collected during well drilling and drawdown observed in nearby monitoring and domestic wells.

\*\* The dimensions of transmissivity (depth-integrated hydraulic conductivity) are derived by multiplying saturated hydraulic conductivity [(Length<sup>3</sup>/Time)/Length<sup>2</sup>] x depth (Length).

impact on water quality.

Some ranking systems identify high priority parcels for restoration or storm water management based on the existence of potential point and nonpoint pollution sources—basically a risk assessment. Information on buffer disturbance, farms, residential or commercial development, impervious surface cover, contaminated sites, or storm water drainage pipes might be incorporated into such a ranking system to identify areas in the watershed where restoration or storm water management actions might be needed. As with any conservation ranking system, physical assessment of each site is needed to determine appropriate remediation strategies.

Ideally, restoration or storm water management ranking systems should incorporate water quality monitoring data that compares actual water quality data with information about potential pollution sources. A comprehensive monitoring program would provide water quality data for all major tributaries in the watershed and allow municipalities and water suppliers to link types of land use in a sub-basin to impact on water quality—more accurately targeting on-the-ground actions.

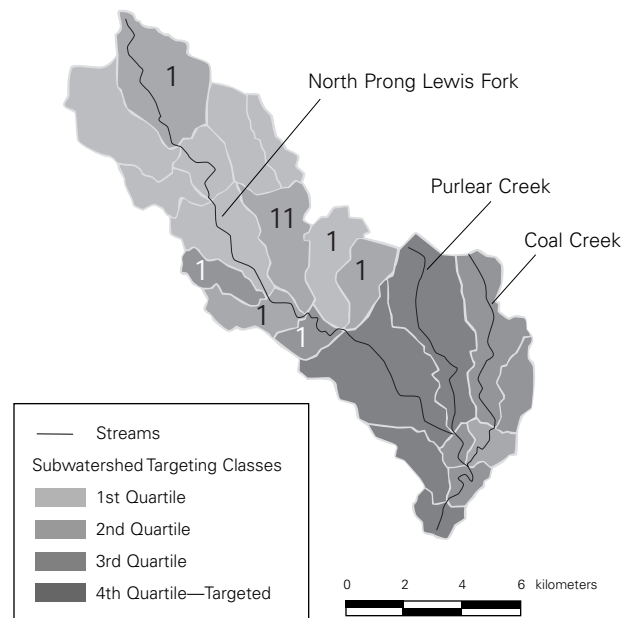
Tetra Tech, Inc. developed a restoration ranking system based on water quality data using sediment, phosphorous, and fecal coliform as their primary indicators (figure 2). By starting with annual pollutant loads for each indicator, they compare the degree of degradation in each subwatershed, targeting certain subwatersheds for more intensive restoration efforts. For example, experts identified the range of sediment loads coming from each subwatershed (i.e. 0.05 tons/hectare/year to 0.48 tons/hectare/year) and ranked each on a scale of 1 to 4 (1st quartile to 4th quartile), with 1 having lowest pollutant loads and 4 having highest pollutant loads. Similarly, they looked at the proportion of degraded stream length in each subwatershed (based on soil and land-use data) and ranked each subwatershed on a scale of one to four for overall stream stability. By aggregating the rankings for sediment, phosphorous, fecal coliform, and stream stability, they identified the subwatersheds with the greatest need for restoration.

Some municipalities and water suppliers have combined GIS-based ranking systems with other analyses, such as cost-benefit. Orange County Water and Sewer Authority, working in partnership with Tetra Tech, has developed an efficient and cost-effective way

**FIGURE 2: This map and table illustrate the approach of Tetra Tech, Inc. to ranking watershed lands.**

**SCORE BY SUBWATERSHED FOR NORTH PRONG LEWIS FORK RIVER**

Subwatershed	Sediment	Phosphorous	Fecal Coliform	Stream	Total
Purlear Creek #27	4	4	3	4	15
Coal Creek #24	3	4	2	4	13
N.P. Lewis Fork #9	1	1	2	2	6



to prioritize parcels for acquisition by using formulas to estimate potential phosphorous loads from future development at each site, then weighing phosphorous loads against the cost for either acquisition or easements. This strategy results in a comparative cost of dollars per unit of phosphorous reduction for each parcel. Simply put, the parcels with the greatest potential phosphorous load and the lowest cost are highest priority for protection.

### Data Sources

The success of any approach depends on the quality of the data within. There are a broad range of data sources available including.<sup>25</sup>

### General data sources

- ◆ Many state governments have made digital maps available for downloading on the Web. New Jersey's Department of Environmental Protection, MassGIS in Massachusetts, and Georgia's Spatial Data Infrastructure



(GSID) are good examples of well-organized, professional GIS data support.

- ◆ Universities may also be excellent sources of digital data.
- ◆ Elevation and soil data are available from the U.S. Geological Survey (USGS) <http://seamless.usgs.gov/> and the National Resources Conservation Service (NRCS) <http://www.nrcs.usda.gov/technical/dataresources/>.

### Primary data layers

- ◆ **Land use:** The Multi-Resolution Land Characteristics (MRLC) Consortium is developing a 2001 land cover data set that covers the 50 states and Puerto Rico. Mapped zone layers are posted on MRLC's website for public download as they become available. Coordinated by USGS, the Gap analysis program has also produced land-use layers on a state-by-state basis over time. In addition, layers may be available from specific universities as well as state and regional efforts.
- ◆ **Elevation or slope:** The Digital Elevation Model (DEM) is available from the USGS's National Elevation Dataset, <http://seamless.usgs.gov/>.
- ◆ **Soils:** The principal source for soils data is the NRCS SSURGO Web site at [http://www.ftw.nrcs.usda.gov/ssur\\_data.html](http://www.ftw.nrcs.usda.gov/ssur_data.html). SSURGO maps are the most detailed soil surveys available, however maps have not been completed for many areas of the country.
- ◆ **Hydrography:** Three separate map data layers are called for: 1) linear water features for streams and rivers; 2) polygon water features for lakes, ponds, reservoirs, and wetlands; and 3) the watershed boundary. Hydrographic data is often available from state and federal agencies, including USGS's National Hydrography Dataset (<http://nhd.usgs.gov/>). The National Wetlands Inventory may provide additional information, <http://wetlands.fws.gov/>.

### Other useful data layers

- ◆ **Roads: Digital road files are frequently available** from state GIS offices or from the state Departments of Transportation.
- ◆ **Political boundaries:** Sources may include state GIS offices (Department of Natural Resources, Department of Environmental Protection, and/or universities.)
- ◆ **Protected land:** State-level GIS programs are, again, the best sources for data. Other sources may include county and municipal

GIS offices or private conservation NGOs.

- ◆ **Surficial geology:** Check your state GIS office and/or universities.
- ◆ **Public water supplies (wells, wellhead protection areas):** State GIS office and/or universities may provide data. Much of this data has largely been withdrawn from Web sites by the U.S. EPA in response to homeland security issues.
- ◆ **Aquifers:** Sources may include state GIS offices and/or universities.
- ◆ **Tax parcel maps:** Maps are generally available from municipal government offices. They may occasionally be obtained through state GIS agencies.

## Pollutant Mitigation Potential by Ecosystem

In creating a ranking system for restoration and protection strategies, it is important to understand the role that different types of land cover and hydrologic systems play in removing pollutants. The pollutant mitigation chart here summarizes the most current scientific research on pollutant removal rates and the role different types of land plays in the ecology

### CONSIDER THIS...

#### NAMING TARGETED PROPERTIES

**In the course of conservation planning and prioritization, communities are likely to develop a list of high-priority privately held properties whose management is key for source protection. Determining when to share this information with the public is an important consideration. Releasing plans too early can have unintended consequences, such as increasing the potential purchase price of a property or straining relationships with landowners, such that even technical assistance to support continued private ownership is not welcome. At this stage, it is recommended that municipalities and water suppliers work at a broad scale until partnerships, strategies, and funding resources are in place, developing and making public the criteria that will be used to evaluate potential properties, rather than a list of targeted parcels.**

**TABLE 3 – Pollution Mitigation Potential by Ecosystem**

ZONE	POLLUTANT REMOVAL CAPABILITY	PROTECTION PRIORITY
<p><b>Small Streams</b></p> <p>Small streams constitute up to 85 percent of total stream length in a watershed and collect most of the water and pollutants from the land. Minimal ‘new’ water or pollutants enter the system over the banks of large rivers or reservoirs.</p>	<p>Small streams are critical to maintaining water quality in large drainages because of their large surface-to-volume ratio. Small streams have been shown to remove nitrogen at a rate of eight times that of large streams.<sup>26</sup> Nitrogen is removed in the stream within minutes to hours through the interaction between the water and the streambed (70–80 percent of nitrogen is taken up by the streambed). Headwater streams typically remove more than half of the nitrogen from their watersheds. The rate of removal declines as depth of water increases.<sup>27</sup></p>	<p>Because of their size, small streams are often ignored on planning maps and are most vulnerable to human disturbance, such as diversion, channelization, and elimination.<sup>28</sup> Restoration and preservation of small stream ecosystems should be a central focus of watershed management strategies.</p>
<p><b>Riparian Zones</b></p> <p>The riparian zone is where a stream interacts with the land—areas near the stream or river channel. A riparian buffer is the protected land directly along a waterway that buffers the impacts of agricultural and urban development. A buffer may or may not encompass the entire riparian zone. Riparian forests reduce the pollutant loads that reach streams, prevent erosion and flooding, support the vast majority of wildlife species, support most wooded areas, and protect water supplies. A river channel without a functioning riparian area no longer stores water and accumulates sediment, thus losing many of its ecological functions.<sup>29</sup></p>	<p>Depending on width, slope, soil type, and other factors, riparian buffers have been shown to remove 50–95 percent of nutrients and pesticides, 60–96 percent of pathogens, and 75–95 percent of sediment.<sup>30</sup> Depending on groundwater flowpaths and depth to water table, buffers less than 10 meters wide may not effectively filter soluble pollutants, such as nitrogen, because the groundwater can flow beneath the root zones and reach surface water before organic processes take place. However, they can be very effective at removing sediment and pathogens. More than 95 percent of <i>Cryptosporidium</i> spores have been shown to be removed by buffers as narrow as four meters with slopes up to 20 percent during moderate rainfall.<sup>31</sup></p>	<p>The National Academy of Sciences recommends making restoration and protection of riparian zones a national policy goal. The width of the riparian buffer that needs protection depends on its purpose and function. If the purpose is to trap sediment, it can be as narrow as seven meters. If the purpose is to remove soluble pollutants, such as nitrate and pesticides, it should be 30–50 meters wide. If the purpose is to protect habitat and provide recreational opportunities and flood control, the entire riparian area should be protected. For more information on how to create or restore riparian buffers for maximum pollutant removal, refer to “Buffer Strips: Common Sense Conservation,” <a href="http://www.nhq.nrcs.usda.gov/CCS/Buffers.html">www.nhq.nrcs.usda.gov/CCS/Buffers.html</a>.)</p>

continued next page

**TABLE 3 – Pollution Mitigation Potential by Ecosystem**

ZONE	POLLUTANT REMOVAL CAPABILITY	PROTECTION PRIORITY
<p><b>Forests</b></p> <p>About 66 percent of the Nation's precious fresh-water resources originate on forest lands, which cover about one-third of the U.S. land area.<sup>32</sup> Forests are critical to maintaining the integrity of ground and surface water systems.</p>	<p>Forested land absorbs rain, traps and filters pollutants, refills underground aquifers, slows storm runoff, sustains late season flows, reduces flooding, maintains watershed stability and resilience, and provides critical habitat for fish and wildlife.</p> <p>Studies show that the percentage of forested land in a source water area is one of the most important factors in determining water quality. The more forested land in a source area, the better the water quality and lower the treatment costs.<sup>33 34</sup> Watersheds with less forested land have higher water temperatures, and also higher levels of fecal coliform, turbidity, and nutrients.<sup>35</sup></p>	<p>Forests across the United States are increasingly being removed and fragmented by land-use changes, placing stress on watersheds and impacting water supplies. Forest protection and management, with selective cutting and management of species diversity, is critical to water quality. When forests are clear-cut, pollutant loads, particularly sediment, spike in the first few years after cutting. Even as forests are allowed to grow back, pollutant concentrations may return to normal after a few years under base flow conditions, but concentrations during storms can remain elevated for 5–10 years.<sup>36</sup></p>
<p><b>Wetlands<sup>37</sup></b></p> <p>Wetlands are some of the most productive ecosystems in the world, and provide food, shelter, and nesting sites for birds, fish, mammals, amphibians, and invertebrates. Almost 43 percent of threatened and endangered animal species, as well as many plant species, are dependent on wetlands for survival. Coastal wetlands provide 60–90 percent of commercial fisheries spawning grounds.<sup>38</sup></p>	<p>Wetlands act as living filters by removing pollution from waters flowing through them. Studies of 14 different man-made and restored wetlands around the country showed average removal rates of 82 percent of sediment, 61 percent of total nitrogen, 62 percent of phosphorous and 79 percent of metals (lead, zinc and iron).<sup>39</sup></p>	<p>Wetlands are the only type of natural land specifically protected under the Clean Water Act because of their critical role in filtering pollutants and supporting ecosystems. Between 1986 and 1997, a net of 644,000 acres of wetlands was lost. The estimated rate of loss is now 58,880 acres annually, representing an 80 percent reduction in U.S. wetlands from the previous decade. Wetland losses were primarily due to urban development (30 percent), agriculture (26 percent), silviculture (23 percent), and rural development (21 percent).<sup>40</sup></p>
<p><b>Floodplains</b></p> <p>Flooding of rivers is a natural process that happens two to three times a year on the average river. In watersheds affected by development, less water infiltrates the soil, resulting in faster, stronger, and more frequent floods that cover a wider range. It has not been shown that watershed development exacerbates periodic catastrophic floods (100 or 500 year floods), but development can significantly increase annual flooding.<sup>41</sup></p>	<p>Floodplains, with their saturated soils and ability to hold and absorb water, play a critical role in filtering pollutants, recharging groundwater and minimizing the damaging impact of floods. Floods are one of the greatest threats to water quality, as flood waters carry heavy loads of pollutants and organic matter to drinking water sources, making the consistent and effective treatment of drinking water more difficult.</p>	<p>The destructive potential of annual floods is exacerbated by development and urbanization of floodplains, forest clearing, loss of wetlands, and stream channeling. Development and paving of floodplains not only exacerbates the impact of floods downstream, but can also cause billions of dollars in flood damage to local communities.</p>



and hydrology of watersheds. Removal rates at any particular site will vary depending on the specific characteristics of the site and the amount of pollutants flowing through it. Usually the percentage of pollutants that any particular site can assimilate will decrease as the amount of pollutants increases.

#### CASE STUDY

##### *Upper Little Tallapoosa River Watershed, Georgia*

In the Upper Little Tallapoosa River (ULTR) watershed, a 95 square mile area in Carroll County about an hour west of Atlanta, land use is steadily moving from traditional farming, forestry, and low-density housing to residential and commercial development. Such development has resulted in on-site wastewater impacts in the northern half of the watershed, urban runoff from the cities of Villa Rica and Temple, loss of riparian vegetation along the main channel and tributaries, and fragmentation of forest habitat that threatens water quality.

Fortunately, county leaders had the foresight to tackle existing problems and threats head-on. Their efforts got a boost when the watershed was named a pilot for the national Source Water Stewardship Project, an EPA-funded program designed to demonstrate land-use conservation and forest management practices for source protection through four pilot project sites. The project combined technical expertise from national partners (The Trust for Public Land, the University of Massachusetts, and the USDA Forest Service) with a locally led and driven effort.<sup>43</sup>

Stewardship partners designed a multi-phase source protection strategy that included 1) a source water analysis to assess threats to drinking water, 2) a stewardship exchange to gather information from the community and use national professional experts to offer solutions to source water threats, and 3) an implementation plan with a set of specific recommendations to ensure the continued health of the watershed. Planners assessed threats to the watershed and, using a geographic information system, designed a geographic information system (GIS) model that clearly and consistently identifies high priority land for protection, restoration, or storm water management.

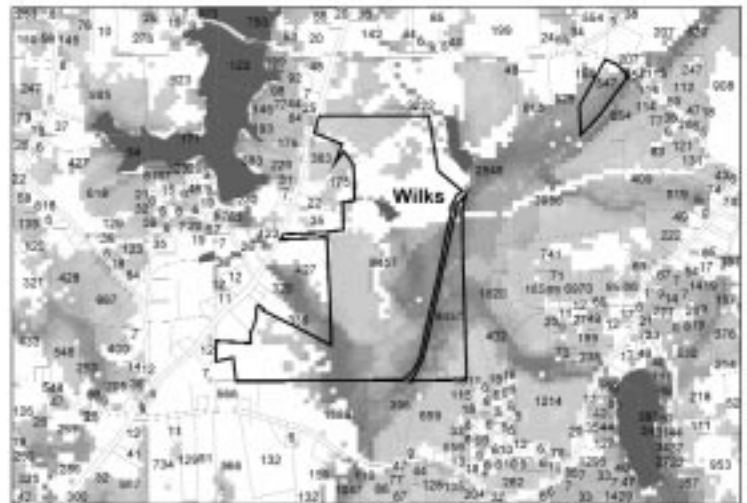
The GIS model for identifying high priority land is in use at all four national pilot project

sites. The model combines information on land characteristics such as topography, soil type, slope, land use, and zoning in order to rank properties according to their significance within the watershed. Where digitized parcel data is available, a numeric score can be given to each parcel indicating its value within a defined category—conservation, restoration, or storm water management. This objective methodology is then combined with first-hand understanding of the land—field inspections and local knowledge—to produce a comprehensive and effective prioritization tool.

The system can generate two types of maps—highest priority and scored maps—each with varying levels of detail and use. Highest priority maps provide a general overview of land prioritization within a watershed—which areas could have a disproportionate influence (positive or negative) on water quality.

Highest priority maps also utilize different

**FIGURE 3: Upper Little Tallapoosa Watershed**



priority indexes. For instance, a conservation priority index ranks high priority lands for conservation, such as forests wetlands, grasslands, and other lands still in natural cover, while a restoration priority index generally highlights agricultural lands or lands where the natural cover has been disturbed but not developed (power lines, highway corridors, and so on). Lastly, a storm water management priority index targets all developed lands, with priority given to sensitive parts of the watershed (close proximity to streams, on hydric soils, and so on).

More detailed scored maps provide numeric rankings for conservation, restoration, and

storm water management for every square kilometer in the watershed and for every parcel in the watershed. Accompanied by mapping reports, these management tools help decision-makers target individual parcels for protection.

The results of this partnership have been impressive. Citizens passed a special purpose local option sales tax by an overwhelming majority (67%), raising \$20 million to pay for land conservation that protects source water and an additional \$60 million for other projects, including improved wastewater management. With TPL's assistance, the county has begun identifying and acquiring priority properties, including purchasing a critically important 253-acre forested parcel that was slated for conversion to a large residential subdivision. The parcel protects 3,600 feet of the Little Tallapoosa River and a large wetland at the confluence of several smaller tributaries. In addition, funding has been secured through Section 319 of the Clean Water Act to hire a watershed inspector to enforce soil erosion and sediment control regulations.

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## BUILD STRONG PARTNERSHIPS

Water flows according to topography, not political borders. Most communities' source areas lie partially, if not entirely, outside of their jurisdictions, crossing multiple jurisdictions and even state lines. In a single watershed, there can be dozens of federal, state, regional, and local governing agencies; hundreds of nonprofit organizations, landowners, and businesses; and an array of overlapping policies, laws, and regulations.<sup>44</sup> This complexity demands communication and collaboration. Municipalities and water suppliers must plan and partner with other local jurisdictions and suppliers, nonprofit organizations, landowners, watershed associations, businesses and developers, citizens and volunteers, and others stakeholders who can directly influence land use and land management.

Partners can provide a variety of conservation and watershed protection perspectives and lend local governments much-needed manpower, technical expertise, and financial support. Partners can also be very helpful in

conveying a consistent and clear message about the threats to source water by reaching out to and communicating with their constituents, with whom they have the most credibility.

Individuals and organizations will often support and contribute to source protection efforts if it meets their goals and objectives, builds on initiatives they already have underway, and provides information they need to guide their actions. As a general rule, be certain to reach out to those individuals or groups who are interested, those who are impacted, and those who can help or hinder implementation.

It may be difficult to determine from the outset specifically which partners will be needed to design and implement your source protection plan, but it will be clear that:

- ◆ Local, state, federal, and possibly private funding and resources will be needed.
- ◆ Landowner groups, such as farmers, developers, and wood-lot owners, will be important if nonpoint source pollution is the primary threat.
- ◆ Neighboring jurisdictions that reside in the watershed or manage the local water supply will ultimately have to implement regulatory changes or fund acquisition.
- ◆ If water supplies are managed privately, suppliers can be involved in funding and implementing strategies to protect their source.
- ◆ Business and industry groups, which may contribute to water quality problems, need to be part of finding solutions. Their early involvement is critical to developing successful and broadly supported protection strategies.
- ◆ Local land trusts, watershed associations, and other nonprofits are key to public outreach and education, and support implementation with their constituent groups.

Planning and implementation partnerships can also be forged with other governmental entities—states, counties, cities, towns, and their various agencies—sometimes culminating in the joint management of land. Many water suppliers and local governments rely on other governmental agencies and planning commissions at the federal, state, and regional levels to provide technical support such as land-use planning, inventories, and mapping. EPA and private consulting firms can provide local partners with resources and support on such issues as source protection planning, nonpoint source pollution, and storm water management.

In some source areas, voluntary watershed associations, regional government associations, and other nongovernmental organizations are serving as coordinating entities for the watershed planning process. As independent third parties, they often bring together local municipalities and counties that may not have planned cooperatively in the past. These entities can offer unique skills and organizational flexibility that can leverage new resources and encourage new strategies. Included in this category are locally oriented, nonprofit watershed management councils that provide education or advocacy for river-basin protection, conservation, and natural resource protection. Membership is usually open to public agency personnel and private sector stakeholders, with technical, cultural, and conservation interest in the watershed.<sup>45</sup>

There has been a proliferation in watershed management councils in recent years because of increased public concern for and understanding of watershed and natural resource protection. Partnership opportunities also exist with regional or local watershed corporations. These are typically nonprofit organizations that guide the management of a watershed, their membership consisting of elected officials and regulatory and management agency staff from representative communities.

Local governments may also benefit from academic land-use expertise. Each state has designated land-grant and sea-grant colleges that receive federal funds for research and cooperative extension services. These programs have helped facilitate partnerships among education, nonprofits, industry, and government.

#### MINI CASE STUDY

##### *Illinois-Indiana Sea Grant College Program*

The Illinois-Indiana Sea Grant College Program, for example, is one of 29 programs in the National Sea Grant network. Sponsored by Purdue University, West Lafayette campus and the University of Illinois at Urbana-Champaign, the program serves 104 miles of heavily urbanized and industrialized shoreline along the Great Lakes where heavy development pressure is converting much land from agricultural use and open space to urban uses, impacting the area's watersheds and water quality (ten million people get their drinking water from

southern Lake Michigan). Through research, education, and outreach, program staff work to inform local leaders and the public about the economic benefits of these resources and the short- and long-term costs of local land-use decisions. The program provides cost-benefit assessments of local policy changes and their impact on water quality and estimates the value of coastal recreation resources and their contribution to local economies.

Finally, cultivating and maintaining relationships with landowners is an integral part of the source protection process. Their early support is needed to pass regulatory changes and can pave the way for successful land acquisition negotiations, as described on page 58.

#### CASE STUDY

##### *Portland Water Bureau, Oregon*

In the Portland Oregon metro area, a strong multi-jurisdictional public-private partnership was forged to protect regional groundwater supplies. The cities of Portland, Gresham, and Fairview led the initiative, bringing together a diverse coalition of business and industry, regulators, citizens, and other stakeholders. Their three-year, community-planning effort resulted in a unique wellhead protection program that significantly expanded regulatory protections for groundwater supplies in the City of Portland's Columbia South Shore Well Field (CSSW).

While Metro Portland residents get the majority of their drinking water from the Bull Run watershed, the CSSW is still the second largest water source in the state and serves as a critical backup during dry summer months and in times of emergency. The municipal partners recognized the need to protect groundwater sources that feed 25 wells on the south shore of the Columbia River.

The most significant elements of the plan expand the boundary of the protection area and change the requirements regarding use, transportation, loading, unloading, and storage of hazardous materials for affected businesses operating within the boundary.<sup>46</sup> To ensure compatibility and consistency, the plan was modeled on provisions of the Uniform Fire Code that govern handling and storage of such hazardous materials. Significantly, the new rules also now regulate previously exempt older

## NONPROFIT SOURCE PROTECTION PARTNERS

### American Rivers

The mission of American Rivers is to preserve and restore river systems and foster an ethic of river stewardship. Within its watershed protection program, the nonprofit works in the areas of water infrastructure, urban watersheds, riverfront revitalization, water scarcity, wild rivers, and floodplain reform. American Rivers also brings attention to threatened rivers through its annual report, *Most Endangered Rivers*, highlighting alternatives that can improve water quality. Information and technical resources are available at [www.americanrivers.org/riverconservation.html](http://www.americanrivers.org/riverconservation.html).

### Center for Watershed Protection

The Center for Watershed Protection is a nonprofit organization that provides local governments, activists, and watershed organizations with the technical tools for protecting watershed land. The Center has developed and disseminated a multi-disciplinary strategy to watershed protection that encompasses watershed planning, watershed restoration, storm water management, watershed research, better site design, education and outreach, and watershed training. The Center's Web site, [www.cwp.org](http://www.cwp.org), provides information about the approach as well as technical tools, publications, and case studies.

### Clean Water Fund

Clean Water Fund (CWF) is a national nonprofit research and educational organization, with locally staffed environmental and health protection programs serving communities in over 20 states. CWF's mission is to develop strong grassroots environmental leadership and to bring together diverse constituencies to work cooperatively for changes that improve their lives, including clean and safe drinking water. CWF's water protection programs build on and complement those of Clean Water Action, another national organization which has helped develop, pass, strengthen and defend the nation's major water laws such as the Clean Water Act and the Safe Drinking Water Act. CWF's Web site is located at [www.cleanwaterfund.org](http://www.cleanwaterfund.org).

### Environmental Finance Center Network

As the name suggests, EFCN is a network of Environmental Finance Centers. Each center is housed within a university and there are nine centers altogether, each in a separate EPA region. With multi-disciplinary teams, the network serves the public and private sector on discreet projects of varying scales, with an emphasis on addressing financial issues of environmental infrastructure and regulation. For the Unified Source Water Protection Project, the network helps stakeholders develop and implement source water protection plans for sources that cross jurisdictions and/or are shared by many water systems. More project details are available at <http://efc.unm.edu/sourcewater.htm>.

### Groundwater Foundation

A non-profit educational organization, the Groundwater Foundation strives to raise awareness about the value, threats and status of groundwater and related science among children and adults internationally by disseminating information through a quarterly journal, annual symposium, and various youth activities. The foundation's Groundwater Guardian Program arms individuals and communities who want to protect groundwater with a host of tools to raise awareness and take steps necessary to accomplish their goals at the local level. Besides serving as a clearinghouse of information for grassroots efforts, the foundation works directly with individuals, coordinates efforts between communities, and honors outstanding groundwater protection achievements. To join the Groundwater Guardian Program, please visit <http://www.groundwater.org/gg/gg.html>.

### National Rural Water Association

A trade association organized as a federation of state rural water associations, NRWA collectively serves over 24,500 rural and small community water and wastewater utilities across the country. They provide technical assistance to their members in formal classroom sessions, conferences, member-site training, and publications. As part of its Source Water Protection Initiative, NRWA has hired technicians to assist local governments in participating states to design and implement source water plans for high-priority watersheds. For more information on this initiative and other NRWA projects, visit [www.nrwa.org](http://www.nrwa.org).

### River Network

River Network is a national nonprofit organization that works to protect rivers and watersheds, by supporting grassroots river and watershed conservation groups. River Network acquires land, links activists with river information, resources and services, and makes small grants to help communities raise money, build organizations, and monitor and protect rivers and watersheds. Check [www.rivernetwork.org/index.cfm](http://www.rivernetwork.org/index.cfm) for more information.

businesses, providing a five year phased implementation time frame for these businesses to come into compliance.

The planning process was lauded for its diversity and support from business and industry, whose representatives formed a technical working group. This group worked to ensure that the regulatory program requirements are realistic and practical, maximize risk reduction for investments, and avoid duplication and conflict.<sup>47</sup> According to Rosemary Menard of the Portland Water Bureau, the agency that governs drinking water protection for the City of Portland, it was clear that the rules needed to make long-term sense for businesses, which face steep financial and legal problems if pollution reaches drinking water.<sup>48</sup>

The plan was approved by each of the municipalities in 2003. In addition to Portland's sources, the city of Fairview has existing municipal groundwater supply wells within the boundary. Gresham is currently in the process of investigating groundwater resources for municipal supply purposes; however, test drilling sites and proposed supply well locations are outside the boundary as currently drawn.

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## CASE STUDY

### *Raritan Basin, New Jersey*

Midway between New York City and Philadelphia lies the Raritan Basin, the largest river basin located entirely within the state of New Jersey. Spanning parts of 100 municipalities and seven counties, the basin is a collection of watersheds containing roughly 2,000 mapped miles of flowing streams and providing drinking water to 1.3 million people.

Throughout the latter half of the 20th century, the state of New Jersey experienced moderate growth rates accompanied by major shifts in population from urban to rural areas of the basin.<sup>49</sup> The resulting loss of farmland, wetland, and open space prompted a region-wide planning initiative to ensure long-term supplies of clean, plentiful drinking water.<sup>50</sup> The result was the 2003 Raritan Basin Watershed Management Plan, a comprehensive plan that addresses storm water management, nonpoint source pollutants, wastewater treatment plants, development approaches, and open space protection.<sup>51</sup>

The three-year planning process was launched by the New Jersey Department of Environmental Protection (DEP) and the New Jersey Water Supply Authority (NJWSA), a state-owned water supply utility. The initiative was paid for with state Watershed Protection Fund money, federal dollars, and water revenues from NJWSA.

A diverse group of Raritan Basin interests initially asked NJWSA to lead the effort. Once underway, the initiative was characterized by extensive stakeholder participation and strong public education. Phase 1 of the initiative, a preliminary characterization and assessment report, began with seven partners: New Jersey DEP, U.S. Geological Survey, USDA–Natural Resource Conservation Service, South Branch Watershed Association, Stony Brook–Millstone Watershed Association, Upper Raritan Watershed Association, Rutgers Center for Environmental Communication, and the North Jersey Resource Conservation and Development Council. These partners provided critical research and education and outreach services. The initiative was structured to include a project team, a basin-wide work group, an executive committee, and one technical committee.<sup>52</sup>

Public education and stakeholder involvement increased during Phase 2, the development of the plan. A public involvement process was designed to identify new stakeholders; encourage on-line participation; provide a series of workshops targeted to specific interest groups (farmers, developers, environmentalists, and municipalities); and increase forums for public input and education. Organizers recognized the need for two types of public education. The first is designed to educate the broader public about the watershed, the project, and opportunities for further involvement. The second type targeted those who wanted to become more actively involved in watershed management.

Included in the public outreach effort was a basin-wide public opinion survey. Results showed that central New Jersey residents rank the importance of water resource protection higher than reducing taxes, unemployment, and road congestion. According to the survey, residents are concerned about local rivers and lakes, development impacts, and the quality of their drinking water, and most support improved regulation and more open space protection to improve water quality by large margins.<sup>53</sup>



Now that the plan has been released, team leaders are proceeding with implementation work, focusing on turning the plan into projects. The team continues to reassess and revise their organizational structure to ensure ongoing stakeholder participation and public education. Great progress has been made in the area of protection and preservation thanks to strong partnerships among municipalities and the Stony Brook–Millstone Watershed Association (SBMWA) within the Millstone River region. SBMWA works individually with each municipality to understand their own source protection goals and vision, creating a partnership outlined in a formal agreement. The process involves a review of comprehensive master plans, environmental resource inventories, and local ordinances.<sup>54</sup> Daniel J. Van Abs, NJSWA's watershed protection programs manager, credits the individual municipal partnership model with the program's success. "Each municipality is addressed separately, rather than as a group," Van Abs notes, "and each municipality is compared to its own vision and goals, rather than to an outsider's view of what should be done."

A multi-jurisdictional partnership within

the Spruce Run watershed, the Spruce Run Initiative was created in 2001 through an agreement between the NJWSA and five municipal governments. Development threatens much of the watershed, of which more than 60 percent is neither developed nor dedicated to open space. The NJWSA has dedicated part of its income to land acquisition within the watershed and is acquiring purchased property in coalition with municipal, county, state, and nonprofit entities.

Watershed-wide, the Raritan Basin Watershed Management Plan received a huge boost in May 2003 when NJWSA and SBMWA were awarded a \$1 million Targeted Watershed Initiative grant—one of the largest ever. The grant is being matched by more than \$1 million from the recipients and their partners, NJDEP and the South Branch Watershed Association. The project calls for restoration, protection and preservation, and pollution prevention in urban, suburban, and rural/suburban watershed areas.

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## WRAP-UP

### BUILD STRONG PARTNERSHIPS

#### Questions to Consider:

- ◆ How do political and watershed boundaries overlap? What neighboring jurisdictions share your community's water sources?
- ◆ Are there regional planning organizations, watershed associations, and other nongovernmental entities that can help play a coordinating role?
- ◆ What local land trusts and national conservation organizations are available to help with conservation planning, acquisition, management, and technical support?
- ◆ Do funding resources and partnership opportunities with federal, state, and private entities exist?
- ◆ How can you cultivate strong relationships with landowners and keep the public involved and educated about the conservation process?

## DESIGN A COMPREHENSIVE SOURCE PROTECTION PLAN

Clean drinking water is only assured by erecting multiple barriers that balance remediation and treatment with prevention, weighing such factors as cost, effectiveness, types of contaminants and threats, and local resources. Yet the cost of cleaning up contamination often exceeds the cost of prevention, making the creation of a comprehensive source protection plan fundamental.<sup>55</sup> Such a plan should focus on preventing contamination from nonpoint source pollution by managing and protecting land that supplies drinking water.

Now is the time to turn the information you've gathered thus far—analyzing watersheds, assessing threats to drinking water, mapping high priority land for protection, and developing partnerships—into a comprehensive, workable source water protection plan. It's an opportunity to use what you know (the scientific and technical findings) and who you know (public-private partners) to design a viable plan of action. This section presents the various components of a source protection plan—focusing on prevention through land conservation—and discusses how to mix the range of tools, techniques, and strategies in a way that works for the community.

Throughout the process, always remember to think watershed-wide and develop the plan with other partners from your source area. Also keep in mind the importance of public education in the planning process; building community support during this phase will be critical when it comes time to fund and implement the plan.

Carefully consider the following framework when creating your plan to protect source water.

- 1) **Prevention:** Identifying and protecting highly sensitive lands that are vulnerable to development allows municipalities and water suppliers to be proactive about protection and avoid costly mitigation or restoration action. Source protection includes land conservation, land-use controls, regulations, and best management practices.
- 2) **Remediation.** In most drinking water watersheds there exist contaminants and/or threats to water quality from septic systems, agricultural operations, lawn maintenance, underground storage tanks, and other point

### CONSIDER THIS...

#### EMERGENCY RESPONSE PLANNING

**Emergency response planning is key to mitigating the harmful impacts of disaster or system failure. Potential problems range from routine operating emergencies, such as pipe breakage and power outages to natural disasters, chemical spills, or even sabotage.**

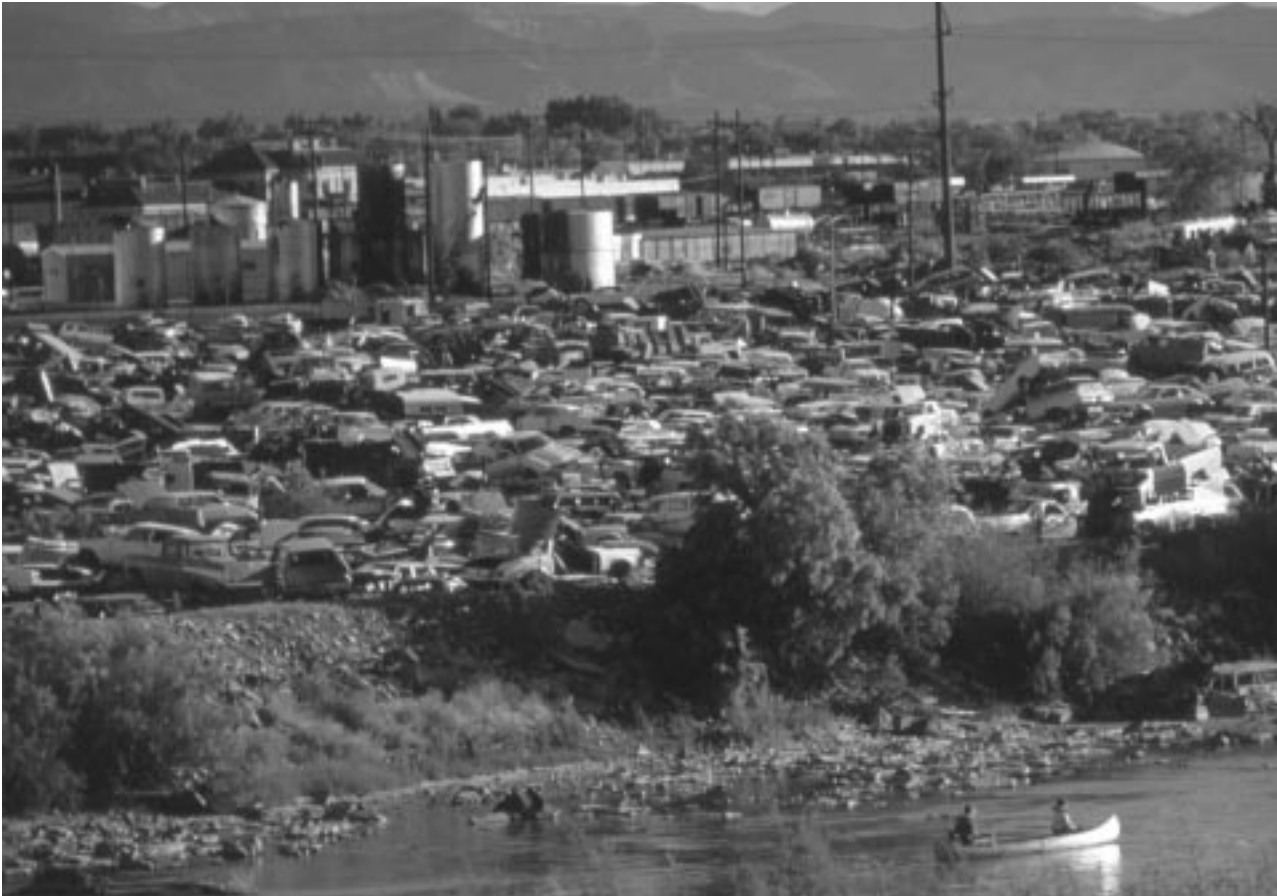
**Emergency response planning is a process by which water system managers explore vulnerabilities, make improvements, and establish procedures to follow in an emergency. It requires a comprehensive exploration of "what ifs" and the contingency plans to address them. As outlined by EPA, elements of municipal emergency response plans should include information about the water system, potential contamination sources and their locations, fire-fighting plans, necessary equipment and supplies, surface spill reporting forms, names and phone numbers of emergency response contacts, and short- and long-term water supply options. Written plans should be provided to responding parties, such as police and fire departments, health officials, public water suppliers, and contractors.**

and nonpoint sources of pollution. Source protection plans should identify the greatest contaminants and outline a plan to clean up existing pollution, using such tools as agricultural and residential best management practices, and riparian restoration.

- 3) **Preparation.** Preparation means knowing and being ready to deal with potential pollution. Tools include emergency spill response and mapping potential contaminants such as underground storage tanks and dry cleaners.

A variety of factors will inform your decisions about prevention, remediation, and preparation strategies. As outlined by EPA, considerations include the physical properties of the watershed (annual precipitation, soil and drainage, ground water and surface water hydrology, and space limitations), land uses and potential contaminants, types of contamination problems, public acceptance of measures, cost, maintenance needs, and aesthetics.<sup>56</sup> Keep these in mind throughout the planning process and carefully weigh future drinking water needs and long-term benefits of each approach. Such an assessment of each option will help you determine which tools are most appropriate for protecting existing resources or mitigating pollution problems throughout your watershed.

This report focuses on the prevention of contamination through the conservation of



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source lands, which is one critical component of a source protection plan. It also outlines various regulatory and design tools and best management practices, some of which help prevent contamination while others are designed to remediate land that is already contaminated.

The tools available to protect targeted watershed and aquifer recharge lands fall into three distinct categories:

- 1) **Voluntary, incentives-based land protection methods** can be used when landowners willingly sell their land or easements and contractually agree to the approach.
- 2) **Regulation and zoning** can help prevent development in sensitive areas, control patterns of development and pollution, and prevent flooding and other costly disasters.
- 3) **Best management practices**, which may be voluntary or regulatory, are useful to change the behavior of landowners and the community within a watershed.

Given the size and complexity of some watersheds, a combination of approaches is necessary to protect public and private lands identified as important to maintain drinking water quality. Some of the issues that need to be considered when designing a comprehensive source protection plan are outlined in the following Decision-Support Matrix.



**TABLE 4 – DECISION-SUPPORT MATRIX**

**Characterize the source area.**

**Ground or surface water.** If it's ground water, is it shallow and under the influence of surface water? Or is it deep and fed by a recharge area that's not in the immediate vicinity?

For surface water and shallow ground water, protection is necessary throughout the contributing area; headwater streams need to be protected as well as the area immediately around the intake or wellhead.

For deep aquifers, protection is necessary in the wellhead area, as well as the recharge area. Depending on the size of the recharge area or time of travel to the well, protection of the recharge area can be very important for maintaining water quality and quantity.

**Source Area Size.** How large is your contributing watershed or recharge area? Is it in the tens of thousands or hundreds of thousands of acres?

If the source area is below 300,000 acres, particularly if it's smaller than 100,000 acres, implementing protection and restoration with local partners is most feasible and will more likely result in measurable improvements within a five year timeframe.

If the source area is greater than 300,000 acres, source protection will require extensive partnering and greater involvement of the state(s) with a longer timeframe for measurable results.

Regardless of the size of the total contributing area, implementation of protection and restoration strategies should be focused at the subwatershed level (usually below 50,000 acres) whenever possible.

**Land use.** What are the predominant land uses—urban, agricultural, forest, or other natural cover and how are those land uses changing?

In high growth areas where development is replacing agricultural or forested lands, there is likely to be greater support for protection measures, either more restrictive zoning or acquisition financed with public dollars.

In predominantly agricultural areas, conservation easements in high priority riparian areas and cost-share programs for BMP implementation will be most feasible.

In areas with extensive forest or other natural cover where the goal is to maintain high quality water, it may be necessary to find other, more pressing motivations and incentives for protecting water resources.

**Jurisdictions.** Does the source area cross municipal, county, or state boundaries? If so, who has jurisdiction over land use? How does each jurisdiction's approach to water use and protection vary?

If the source area is contained entirely in one jurisdiction with authority to regulate land use, zoning or other regulatory approaches to protection can be very successful, as can some un-funded voluntary approaches.

If the source area crosses multiple jurisdictions, each with its own land use controls and varied approaches to water resource protection, or where there are no regulatory land use controls, publicly-funded voluntary strategies, such as land acquisition or BMP cost-share programs will likely be necessary for long-term protection.

**Identify current and future threats to water resources.**

**Point Sources.** What are the point sources of pollution that need to be closely controlled or reduced? Are there potential point sources of pollution that need to be monitored or removed?

If point sources of pollution are the primary threat to source water, regulatory approaches to monitoring, controlling, or removing them will be necessary, as well as ensuring that additional point sources are not created. Planning and funding enforcement of the regulations is equally as important as creating them.

**Nonpoint Sources.** What are the primary NPS of pollution? Have they been clearly identified? How are those sources changing, based on changing land use, and what are the likely future sources?

If nonpoint sources of pollution are the primary threat, a wider variety of strategies will be required to protect or improve water resources. Regulatory strategies, such as zoning or land-use restrictions, will need to be blended with voluntary strategies, such as acquisition and BMP implementation. Because land use changes constantly, as does its impact on water quality and quantity, it will need to be monitored and tracked over time to ensure the primary sources of pollution are prevented or remediated.

continued next page

## DECISION-SUPPORT MATRIX CONTINUED

### Identify potential partners and stakeholders.

<b>Resources.</b> Who has the technical, financial, or political resources that you will need to implement protection or restoration?	Identifying and engaging the stakeholders in the watershed greatly increases the likelihood of successful implementation and improves the efficiency of the planning process. Stakeholders with access to technical, financial and political resources should be involved in the earliest phases of planning.
<b>Audience.</b> Who needs to be informed of and encouraged to use best practices and approaches to protect water resources?	Identifying and educating the land and business owners, residents, and other stakeholders whose actions impact water quality will be necessary to ensure long-term protection, as these are the individuals that must support regulatory changes and public funding, and who ultimately must change their behavior to protect water resources. If residents and landowners in the source area do not receive drinking water from the sources in question, you need to understand their interests and motivations for protecting local water resources.
<b>Existing Initiatives.</b> Are there other existing initiatives underway to protect land or water resources? How can you build on these efforts?	If partnerships and momentum exist around other land and water protection efforts, such as habitat, recreation, or meeting clean water regulations, find ways to build source protection goals into these initiatives. The more you can build on existing efforts, the easier it will be to attract partners and resources.

### *Emphasize Land Conservation Approaches*

The most fundamental and failsafe way to protect drinking water supplies is by preventing the development of watershed and aquifer recharge lands. Land conservation approaches include the sale or gift of private real estate for permanent public use and management. Since these particular techniques are voluntary and incentive-based, they generally enjoy stronger public support than regulations. Although the price tag is often higher, they also provide more permanent protection and are faster to implement.

Because it involves real estate, the conservation of land is inherently complex and variable; properties come and go for a variety of reasons without regard to a community's source protection goals, and funding may be unpredictable. The uncertainty of the process demands flexibility. That said, it is important to map out appropriate strategies to reach long-term conservation goals and prevent the most immediate threats to water quality. Strategies for each subwatershed as well as individual properties should be developed in accordance with the type of conservation land, landownership, and available resources.

**Own and manage.** The most straightforward approach is outright acquisition and management of the land. Acquisition provides full ownership of the land and the most permanent protection, giving the buyer full rights to the property and the title. It is also the most costly, making it an unlikely option to protect all the sensitive land within large watersheds.

**Own and others manage.** This involves acquiring title to the property and simultaneously developing a management agreement with an appropriate third party, such as a non-profit land trust. This approach helps the acquiring entity save on long-term management responsibilities and costs.

**Resell to third party.** Some properties can be protected by acquiring and reselling to a suitable third-party owner and manager. Sometimes the third-party buyer is found after the land is purchased, and often the buyer is involved from the start. A land trust can act as an intermediary, negotiating with both the landowner and buyer. Examples include a farmer willing to purchase land restricted to agricultural use, or a nonprofit interested in running an ecological preserve for public education and research. Generally, however, it is

not easy to find such buyers, nor are they always legally obligated to restrict the land.

**Allow limited development.** Sometimes portions of a property can be developed without sacrificing the overall protection goal. Such limited developments usually entail developing less environmentally sensitive portions of a land parcel and selling these to a private buyer. The portion of the property with the most valued resources may be retained by the acquiring entity or sold to a third party with conservation restrictions. While the developer may subsidize protection of part of the land, such a process is complex, time-consuming, and risky. Similarly, it may make sense to consider selling existing buildings on the property, such as those outside a watershed boundary, while protecting targeted parcels.

**Acquire partial interest.** Owning real estate may be thought of as owning a “bundle of rights” that may be divided or shared in almost limitless ways. There is a range of opportunities to protect land by acquiring, through purchase or donation, only a few of the rights. Acquisition of a partial interest is usually less expensive than buying the land, and it can be acceptable to a landowner who is unwilling to part with the land. There are several options in this category:

- ◆ **Conservation easement.** The most well known means of conveying a partial interest is through a conservation easement. The acquisition or donation of a conservation easement either entirely eliminates or greatly restricts the type and amount of development that may occur on the property, and can also include provisions for management and public access. The buyer, in turn, accepts responsibility for monitoring the property to ensure the landowner complies with the terms of the easement. The purchase of conservation easements are complicated, sometimes more so than outright acquisition. That’s because the landowner and buyer must carefully negotiate a unique set of rights and restrictions over the property. Easements are generally less expensive than outright fee purchases.
- ◆ **Other partial interests.** There are other forms of partial interests that can be acquired to protect a property. These include *use rights* for minerals, timber, or water (as well as

rights conveyed through conservation easements), *deferred interests*, which usually involve the landowner selling or donating land while retaining rights to live on it, and *partial undivided interests* in which rights are acquired from a partial owner, such as a tenant in common.

**Transfer development rights (TDR).** In some parts of the country it is possible to acquire development rights through government TDR programs. This is a complex mechanism that is not widely used. Put simply, city or county planning bodies can establish areas designated for additional development and areas designated for no development. Someone wanting to build in the area designated for new development must purchase development rights from a landowner owning land in an area where development is restricted. When development rights are sold from a property, permanent restrictions are imposed.

**Leasing land.** Leasing conservation land typically provides the lessee with exclusive use or access rights to a property for a set period of time. This arrangement can be attractive because it offers a trial period to manage the property, build public support for long-term protection, and cultivate a relationship with the

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landowner. With a purchase leaseback arrangement, the buyer agrees to lease land back to the seller, subject to restrictions.

**Donations of land.** Donating land for conservation purposes typically provides the landowner with significant tax benefits. A landowner can make an outright donation, allowing for immediate protection, or defer the donation through a bequest or reserved life estate. In the case of a bequest, the landowner retains ownership until death and does not benefit from income tax deductions. In the case of a life estate, the landowner donating the property retains it for lifetime use.

### Consider Regulatory and Design Tools

Land-use controls such as zoning and subdivision requirements are the most powerful regulatory tools for protecting source lands, giving local governments the legal authority to control activities that threaten drinking water supplies.<sup>57</sup> Such techniques offer an important vehicle to address nonpoint source pollution on privately owned land, which makes up a majority of most source areas.

Like voluntary approaches, regulation can evolve from a smart growth or conservation visioning process and enjoy public acceptance and support. Often, however, regulations are seen as unfair and burdensome, subject to legal challenge, and impractical for communities whose source area lies outside its jurisdiction. In addition, many communities have relied too heavily on regulatory strategies in the past, which have been subject to change over time. Land-use regulations should thus be balanced with voluntary acquisition and cost-share programs in order to be politically viable and

#### GUIDE TO REGULATORY TOOLS

For more information about alternative zoning tools and other regulatory land use controls, refer to *Source Water Protection: A Guidebook for Local Governments*, a publication of the National Association of Counties, [www.naco.org](http://www.naco.org).

effective over the long-term.

**Zoning Controls.** Zoning regulations can be used to control the types of development allowed in a particular area. Special zoning options that may be appropriate for use in high priority water supply areas include:

- 1) cluster zoning and incentive zoning: Cluster zoning provides for a higher concentration of development on a smaller portion of land; only a portion of the parcel is developed while the remaining open space is permanently protected through conservation easement. Incentive zoning allows developers to expand the number of lots in exchange for dedicating additional open space. Incentives are offered to developers for clustering new houses in the least environmentally sensitive areas while permanently preserving as open space the more vulnerable areas (e.g., riparian zones, wetlands, and buffers);
- 2) watershed/aquifer overlay zoning techniques identify and limit by ordinance or regulation certain harmful activities in environmentally sensitive watershed or aquifer areas (e.g., prohibiting land uses not compatible with source protection or limiting the density of residential housing in the overlay district);
- 3) open space dedications require developers to dedicate a certain amount of land as permanently protected open space when building a new development, or they can be required to pay a cash fee which can be used to purchase land elsewhere in the town for open space purposes.

**Subdivision Controls.** Subdivision regulations establish general site design standards, which can greatly reduce harmful impacts on sensitive land and receiving waters. Examples of protective subdivision controls include:

- 1) ensuring that septic systems and storm water infiltration structures do not contaminate groundwater;
- 2) implementing erosion and sedimentation controls in areas undergoing development; and
- 3) requiring certain site design measures, such as aquatic buffers, on-site storm water management, and preservation of certain trees. Towns can also adopt separate road and drainage standards as part of their subdivi-



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sion regulations and make other site proposal changes to limit the impact of development on water supplies.

**Sediment and Erosion Control Measures.**

Sediment and erosion control measures address runoff from agricultural operations and construction sites. Proposed development plans may contain provisions to control accelerated erosion and sedimentation and reduce the danger from storm water runoff at a proposed site.

**Storm Water Management Measures.** Storm water discharges are generated by rain or snowmelt runoff from land and impervious areas such as paved streets, parking lots, and building rooftops, and often contain pollutants that impact water quality. Most urban storm water discharges are considered point sources and require permitting through the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES).<sup>58</sup> Storm water management measures are designed to delay, capture, store, and treat rain runoff from impervious surfaces and other types of disturbed areas (e.g., housing subdivisions, municipal storm sewer systems, construction sites) in order to mitigate flood-

ing and reduce pollution in receiving waters. Techniques include bio-retention, rain gardens, wet and dry swales, constructed wetlands, and infiltration basins.

**Non-Storm Water Management Measures.**

Communities can also address polluted runoff from non-storm water sources, such as septic systems, sanitary sewers, car washing, residential pesticide use, and road maintenance. Regulations may include land-use controls such as proper placement and design of septic systems, and mandatory sanitary setbacks, as well as best management practices such as public outreach and education and spill prevention programs.

**Eminent Domain.** Finally, if land is needed for a public purpose such as a school or road, the government may take possession of the land via *eminent domain*. Eminent domain may be an appropriate option for securing extremely critical and threatened watershed lands. The owner is compensated for the value of the property, and the approach provides government with a tool to acquire targeted properties when other acquisition techniques are unworkable. Yet the method is rarely the first option to pursue due to high costs of acquisition, litigation, and necessary public relations.



## Incorporate Best Management Practices

**Best Management Practices (BMPs)** are actions you can take to reduce human impact on land and water resources. Regulatory or voluntary, these procedures help mitigate contamination from homes, businesses, agricultural and forestry operations, or industry, and can be applied to specifically manage publicly or privately owned lands within subwatersheds.

**Non-structural BMPs** specify procedures to reduce runoff and pollutants and emphasize educational activities to change individual behavior. Structural BMPs are constructed systems or devices designed to filter pollutants.<sup>59</sup>

These tools should be integrated with a community's other source protection efforts; alone they cannot adequately address all source protection challenges. Along with public education, BMPs can help change behavior over time.

A summary of BMPs that relate to the management of conservation lands follows. This is by no means an exhaustive list, but is intended as an overview of land protection and management practices.

- ◆ Protect wetlands and create natural buffer strips around streams and lakes that can help filter pollutants; wooded buffers offer the greatest protection
- ◆ Design buffers to meet unique needs, varying width based on such ecological factors as stream-bank slope, vegetation, and stream size<sup>60</sup>
- ◆ Install natural storm water management techniques for all new development

### GUIDE TO BEST MANAGEMENT PRACTICES

For more information on BMPs, see *Source Water Protection: Best Management Practices and Other Measures for Protecting Drinking Water Supplies*, produced by the USEPA Drinking Water Academy, [www.epa.gov/watertrain/pdf/swpbmp.pdf](http://www.epa.gov/watertrain/pdf/swpbmp.pdf). EPA's *Source Water Protection Practice Bulletins* are also useful.

### Forestry related BMPs:

- ◆ Use trees, shrub roots, duff, and grasses to slow the flow of runoff, hold buffers in place, and prevent erosion
- ◆ Provide the best possible forest cover throughout the watershed; forest cover can help manage sediment runoff and help control nonpoint source pollution<sup>61</sup>
- ◆ Where practical, replace deciduous trees with conifers in order to reduce tannins and humics that give rise to disinfection byproduct precursors
- ◆ Use BMPs in forestry operations: practices such as removing trees without disturbing ground cover and maintaining buffer zones of standing trees and undisturbed soils along streams will mitigate impacts to water resources<sup>62</sup>

### Agricultural BMPs:

- ◆ Use conservation tillage to help reduce erosion and runoff from agricultural fields
- ◆ Employ planting methods such as contouring and strip cropping
- ◆ Use established irrigation practices to prevent salinization of the soil water
- ◆ Use buffer zones which prevent pesticide drift
- ◆ Develop a program of integrated pest management
- ◆ Develop and implement nutrient management plans
- ◆ Fence livestock out of streams

## Implement a Plan that Creates Real Change

Whatever mix of source protection strategies you incorporate into your plan, keep in mind that the ultimate goal is the implementation of on-the-ground action steps that meet the following objectives:

- ◆ protecting or restoring natural lands and hydrologic processes in order to maintain a healthy watershed and buffer water resources from pollution;
- ◆ successful containment, mitigation, or elimination of existing sources of contamination; and
- ◆ transforming the behavior of residents, landowners, businesses, and governments to minimize the impact of their activities on water quality.



Your plan should combine strategies in a way that meets these objectives and addresses local source protection challenges.

#### CASE STUDY

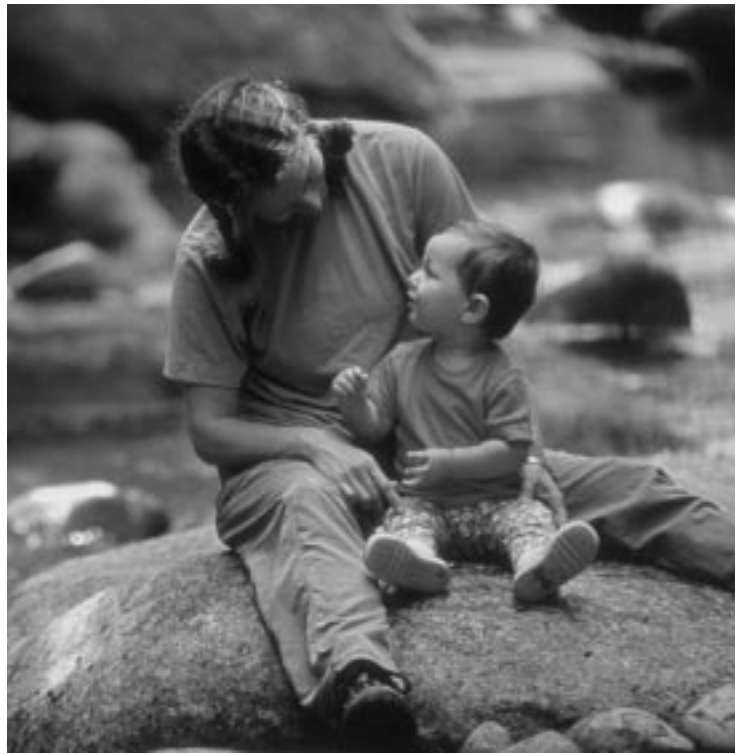
#### *Merrimack Village District Water Works, New Hampshire*

The town of Merrimack, New Hampshire, is a perfect example of a community that has used a multiple barrier approach to safeguard its drinking water. Strategically located between the state's two largest cities and about an hour each from Boston, the seacoast, and the mountains, the town of Merrimack, with a population of 27,000, combines a traditional rural flavor with newer suburban-style residential enclaves and light industry. Bordered on the east by the Merrimack River, the south by the Naticook Lake, and split down the middle by the Souhegan River, the town's drinking water is drawn from underground sources. The groundwater is pumped from six wells located throughout the town of Merrimack as well as well-sites in nearby Hollis.

The delivery of clean drinking water is the purview of the Merrimack Village District (MVD), a municipally managed, independent corporation.

The MVD's success is the result of years of comprehensive and community-wide planning, culminating in the adoption of a Source Water Protection Program (SWPP). For five years running, Merrimack has been awarded official Groundwater Guardian status from the Groundwater Foundation, a national organization that recognizes communities that are dedicated and committed to local groundwater protection, ensuring a safe water supply. Merrimack is the only town in New Hampshire awarded this status.

The impetus for the Source Water Protection Program was trichloroethylene (TCE) contamination discovered in the town's groundwater in 1995, an occasion that prompted the MVD to establish a Wellhead Protection Committee. Among its members were the town planner, the wastewater treatment officer, a state representative, a town selectman, a Zoning Board official, a Conservation Commission member, and a community leader. Working with MVD staff, the committee conducted extensive research and public outreach; using what it learned to design the SWPP; the program is now managed by the committee



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and the MVD. A surcharge on customer water rates helps fund implementation. Their efforts entailed:

- ◆ **Regulatory protection.** The committee defined its source area (the town's six wells) and drafted a town ordinance to protect them as a Wellfield Protection Area District and an Aquifer District. These areas were determined by wellhead delineation, one of the four components of an EPA Source Water Assessment Program (SWAP). Development regulations were then instituted within the defined areas.<sup>63</sup>
- ◆ **Land conservation.** The committee created a Land Acquisition Program that has, thus far, protected 150 acres of land within recharge areas, using fee-simple acquisition, transfer of development rights, and conservation easements.
- ◆ **Promoting best management practices through public education.** An education coordinator from the District has implemented a series of lessons to show school pupils how water is a vital part of daily life. School workshops are designed to teach students about water distribution systems, water usage, and conservation. This innovative education strategy is teaching town residents how to change behavior through actual hands-on instruction.

- ◆ **Alternative landscape project.** Through a demonstration landscape project, the MVD offers homeowners practical solutions to preserving water quality, such as planting drought-resistant, hardy native vegetation and utilizing rainwater for irrigation.
  - ◆ **Contingency planning:** An extensive contingency plan for emergency response was developed in conjunction with the local fire and police departments.
- Overall, the town followed a tried-and-true formula for groundwater: establishing a committee, defining the wellhead and aquifer recharge areas, identifying current and future threats to supplies, protecting and managing

priority areas, and conducting ongoing public education and outreach.<sup>64</sup> According to EPA, the plan's success is measured in a number of ways. First, the local planning board is incorporating water protection into its decision making process, whether or not the proposed development lies within an aquifer district. In addition, existing threats to the town's drinking water from household hazardous waste and septic tanks has been reduced as a result of the public education program.<sup>65</sup>

Contact: Bob Kelley, Water Quality Testing and Operational Data, Merrimack Village District, 603-424-9241, rnkmd1@inr.net

## WRAP-UP

### DESIGN A COMPREHENSIVE SOURCE PROTECTION PLAN

#### Questions to Consider:

- ◆ Define the community's long-term vision for conservation, growth, and source protection—how will you protect water supplies over 30, 50, or 100 years?
- ◆ How can you best balance source protection strategies—prevention, remediation, and preparation—to address contamination?
- ◆ What are the most appropriate considerations for mixing tools and techniques? Such an assessment will help you determine where to protect existing resources or mitigate pollution problems in the watershed.
- ◆ What tools are available to protect source lands?
- ◆ What areas within the watershed demand permanent protection?
- ◆ Are funds available in your municipalities or in partnership with others that can help secure properties in targeted areas?
- ◆ How can best management practices and public education change behavior of landowners within your watershed?
- ◆ How can you educate the public about the importance of source protection and the planning that is underway?

## FINANCE LAND CONSERVATION

A municipality or water supplier can benefit from conserving source lands—preserving clean water, avoiding costly treatment and filtration, and protecting open space and quality of life. Yet land conservation is also a big investment that requires significant, predictable, and steady funding.

Fortunately, most communities have a variety of potential fiscal options and financing techniques available to them, from federal and state grants to local taxes and bonds. Water suppliers also have funding options available so as to protect land within their watersheds. By tapping into every option, local partners can create a *funding quilt* that increases overall dollars and avoids too great a reliance on a single, potentially unpredictable funding source.

For any specific project, there may be a wide range of funding sources, including: a state grant matched by local funding; local funding that is supplemented by a private fundraising campaign; a private conservation effort that leverages a federal grant; and others. (Using one funding source to leverage others is essential.

When funding any type of conservation program to protect local water supplies, the primary responsibility rests with local governments and water suppliers; they must raise funds via legislative or voter approval of a conservation tax or bond, or utility fees. Federal, state, and private funds are limited and in high demand and should serve only as incentives or supplements to locally generated conservation dollars.

This section outlines several different funding strategies:

- ◆ Create and maintain dedicated local public funding sources
- ◆ Identify and secure state and federal funding federal sources
- ◆ Explore private funding sources

### *Create and maintain dedicated local public funding sources*

Local funds mean local control and local commitment, which in turn make it easier to generate federal, state, and private matching grants. The process of securing local public funds requires research (to identify financing

options) and a strategy to secure the money (either legislatively or through the passage of a voter approved conservation measure.) Water suppliers have unique funding options and considerations, and may have more flexibility to raise funds without voter approval.

A summary of local financing options for both local government and water suppliers is provided here, followed by strategic considerations. The process of winning a voter approved conservation funding measure is also outlined briefly. For complete information, refer to TPL's *Conservation Finance Handbook* at [www.tpl.org](http://www.tpl.org).

### Identify Local Financing Options

The tools local governments may use to raise funds for land conservation are diverse and continually expanding. In many cases, money comes from traditional revenue sources, such as sales and property taxes. In other places, unusual options such as the local income tax and cell phone tax are being tapped. Water suppliers have unique options, such as a water utility or storm water fee, which can help fund land conservation.

The availability of financing options depends on state enabling legislation and local regulations, and takes the form of “pay-as-you-go,” long-term borrowing, or a combination of the two.

### “Pay-as-you-go” approaches and non-taxing tools

With “pay-as-you-go,” a government spends revenues from general appropriations or a dedicated funding source. These funding sources can include property taxes, sales-taxes, set-asides, real-estate transfer taxes, and even one-time environmental fines and budget surpluses. Such channels can be attractive to debt-resistant voters and public officials.<sup>66</sup> Pay-as-you-go means year-by-year accountability and no borrowing costs. It also means relatively small annual revenues that may be too small to pay for large capital projects. Pay-as-you-go can be difficult to sustain as the politics and leadership of a community change.

- ◆ **Water utility rates or storm water utility fees.** In order to increase available funds for watershed land conservation, utilities may incorporate dedicated *water utility fees* as a supplement to their rate structure. Alternatively, a *storm water utility* is a type of a special assessment district created to generate funding

## UTILITIES USE SURCHARGE FEES TO ACQUIRE THREATENED WATERSHED LAND

Numerous water sources and differences in service elevations make Salt Lake City's water system one of the most complex in the world. Adding to these structural challenges are unprecedented rate of growth, several years of drought, and the 185-square mile Wasatch Front canyon watershed, one of the city's primary sources of drinking water that is also heavily used for recreational activities.<sup>72</sup>

The city and its utilities have taken significant steps to protect water supplies through its watershed preservation fund, which gets its revenues from a 50-cent surcharge on residents' monthly water bills. In addition to expanding public education and outreach, creating alliances among valley stakeholders, and implementing land-use measures, the city has acquired watershed lands threatened by development. In 2001, the city and state worked together, placing a conservation easement on 154 acres of watershed land in Big Cottonwood Canyon that was scheduled for development. In recent years, the city has spent \$4.1 million on about 1,250 canyon acres that were threatened by development.<sup>73</sup> Salt Lake City now protects more than 24,000 acres.

Water utility surcharges can generate sizable funds for land conservation. The San Antonio Water System (SAWS), a public utility owned by the City of San Antonio, levies a surcharge on water rates/usage (a water supply fee) to help fund the Sensitive Land Acquisition Program (LAP). Since 2000, SAWS and its partners have preserved more than 10,000 acres of land at a cost of roughly \$5.6 million. Of this amount, SAWS contributed \$1.8 million from its water supply fee and effectively leveraged additional city, state, and private dollars. Voters also agreed to foot part of the bill, approving a one-eighth cent sales tax for land acquisition within the Edwards Aquifer that has generated about \$65 million.

The Portland Water District in Maine also uses utility revenues to acquire land or conservation easements around its drinking water source, Sebago Lake. In 1993, legislation was passed allowing water utilities to set aside up to 5 percent of the prior year's revenues for drinking water source protection. The District has since used \$1.06 million to acquire twelve properties surrounding the shoreline or tributaries. Approximately \$200,000 has also been used for demolishing buildings and replanting vegetation on the lots.

The city of Lenexa, Kansas is levying a storm water utility charge at a rate of \$30 per year per household in order to create a series of natural, park-like detention basins that are designed to lessen the impact of flooding. The innovative Rain into Recreation program relies on natural features of the land to move water along the system, improving water quality in the process. Connected by greenway corridors, the basins will collect trash and silt after heavy rains and double as sites for ball fields and other recreational uses when dry. Over ten years, planners expect cost-savings of millions from the new program, offsetting the price tag for flood damage and repairs to the old system. In addition to the storm water utility charge, voters approved a 1/8-cent sales tax for storm water/recreation improvements to fund the investment. Other potential financing sources include a capital fee for new development, and revenue from existing sources such as the mill levy and funds from the county storm water management program.

specifically for storm water management, including maintenance, drainage systems, flood control measures, and water quality programs. Fees are imposed on property owners to pay for storm water management. Methods of determining storm water utility charges vary considerably around the country. Typically, charges are based on the amount of runoff generated from the property, the amount of impervious areas on the property, or the assessed value of the property. Unlike general fund tax revenues, storm water utility taxes are imposed only on those who directly benefit from the improvements.<sup>67</sup>

- ◆ **Budget appropriation.** A budget appropriation, as approved by the governing body, involves either a reallocation of existing resources or a legislatively approved tax levy.
- ◆ **Property tax levy.** Voters across the country have been willing to increase their property taxes, particularly when revenues are earmarked for park and open-space protection and spending accountability is guaranteed.
- ◆ **Sales tax.** Levied on the sale of goods or services, sales tax can generate large sums, even at small taxing increments, and can tap into tourism profits generated by open-space amenities. On the downside, tax revenues can drop when the economy slows, and the tax is often criticized as regressive, falling disproportionately on lower-income people.
- ◆ **Real estate transfer tax.** Real-estate transfer tax is levied on the sale of property, increasing with the value of the property being sold. The tax can create substantial funds for park and open-space acquisition, particularly in fast-growing communities. Yet revenues can plummet in a soft real-estate market. Winning approval for the tax in the face of opposition from real-estate interests has proven to be a tough challenge for many communities.
- ◆ **Impact fee.** Development impact fees are a special kind of user fee that charge new development to fund capital projects and services necessitated by new growth. Like user fees, beneficiaries should be charged for government services and goods based on their consumption. The fees can legally be assessed when 1) there is a reasonable connection between the need for additional public facilities and the growth spawned by a new development, 2) the fee represent the development's proportionate share of the costs of public facilities, 3) the fees benefit



the development, though not exclusively, and 4) the fees are earmarked for the purposes for which they were imposed. Impact fees have been used to help fund the acquisition, construction, and maintenance of parks and recreational facilities near new development, and more and more states are adopting impact fee enabling legislation.

- ◆ **Mitigation land bank.** A mitigation land bank is a parcel of land that is paid for, or restored by, developers who are compensating for the adverse impacts of development—often the degradation of wetlands. This land can be adjacent to development or in a location other than the development site. Mitigation is often the best option when development violations have already occurred on-site or when key natural areas are targeted for protection. The approach also offers local governments flexibility in their land use decisions and gives communities the ability to protect a single, larger area rather than smaller, scattered tracts of land.
- ◆ **Tax incentives.** Many state and local governments offer tax incentives that encourage the donation of land.
- ◆ **Special districts.** Special assessment districts are separate units of government that manage specific resources within defined boundaries. Districts vary in size, encompassing a single community or several counties. They can be established by the local government or by voter initiative, depending on state laws and regulations. As self-financing legal entities, these districts have the ability to raise a predictable stream of money (through taxes, user fees, or bonds) directly from the people who benefit from the services—often parks and recreation.
- ◆ **Benefit assessment district.** A benefit assessment district may assess a defined constituency and provide benefits to those residents, from water and roads to parks and recreational facilities. Unlike special assessment districts, benefit assessment districts lack a partnership, structure, or separate governmental body with management responsibilities.

## Borrowing

Borrowing presents its own set of opportunities and obstacles. On the one hand, borrowing in the form of bonds can provide a community with the revenue and flexibility it needs up-front to fund land conservation projects, the



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cost of which is presumably less today than it will be tomorrow. On the other hand, many bonds require voter approval, and convincing voters of the merits of incurring debt and paying financing costs can be challenging. Two types of bonds commonly used in conservation measures include:

- ◆ **General obligation (g.o.) bonds.** A g.o. bond is secured by a pledge of the issuer's limited or unlimited taxing powers. G.O. bonds of local governments are often paid from ad valorem property taxes and other general revenues. In some cases open space bond money can be included in a general capital funding measure or paired with related environmental programs such as agricultural land preservation, soil conservation, or storm water management. General obligation bonds are a popular open space financing tool at the state and local levels—they allow for the immediate purchase of land that is often quickly rising in value. On the downside, G.O. bonds typically require voter or legislative approval, or both. Interest charges also add costs, debt ceilings limit the amount of bonds a community can issue, and there is generally stiff competition for the bonds among the many local programs in need of financing.
- ◆ **Revenue bonds.** Revenue bonds are usually easier to approve and costlier to repay than G.O. bonds. Voter approval is not typically

required since the government is not obligated to repay the debt if the revenue stream does not flow as expected. The revenue stream could be user fees, utility rates, or other project revenues, or a tax levied specifically to fund the project. Unlike G.O. bonds, revenue bonds are not constrained by debt ceilings.

- ◆ **Short-term debt instruments.** Short-term debt instruments, such as promissory notes and bond and tax anticipation warrants, can also provide communities with park and open space financing options. Although more costly to the borrower, these mechanisms can help local governments with sufficient income to cover the debt service of a loan, but that have limited long-term bonding capacity.

### Alternative Financing Techniques

- ◆ **Lease/purchase contracts** can be used when a decision has been made to buy a property but up-front funds are unavailable. Under such an arrangement, an acquisition can be paid for in installments that include principal, interest, and associated costs. The contract can grant possession or use for a specific or indeterminate period, until purchase funds are in hand. The nature of the transaction, however, may be complicated and the transaction costs high. Land trusts, such as TPL, often play a middle-man role between landowners and public agencies, paying landowners and contracting directly with agencies so as to provide the agency with time to raise funds and acquire the property.
- ◆ **Certificates of participation (COPs)** are a variation on the leasing theme. Structured to allow for investment in lease/purchase agreements, COPs allow a government to pay for a leased property over time; the transaction is not formally considered debt and therefore neither requires a referendum nor impacts a community's debt limit. Although fairly new, COPs are becoming an increasingly important tool for protecting open space at the local level.

### Design a Strategy to Secure Local Funds

Local or regional conservation funding can take the form of a budget appropriation, tax increase, dedicated fee, or debt issuance by the legislative body. Carefully assess the political and fiscal landscape, as well as the potential support of local elected officials, to determine the most viable course. Often, local leaders find that the price tag, the politics, and the legal options demand approval by the voters.

Ballot measures may be referred by the legislative body (termed a referendum) or placed on the ballot by citizen petition (termed an initiative). Some measures are advisory in nature, others create statutory obligations, and yet others may amend government charters.

Voter approval for conservation is reaching record levels. Despite a weak economy, American voters displayed overwhelming support for conservation-related ballot measures in 2003, approving 99 measures in 23 states generating \$1.8 billion in new conservation-related funding. In 2002, state and local conservation measures created roughly \$5.7 billion in new public funding for parks and open space.<sup>68</sup> More than 70 percent of all measures were approved each year since 1998, when TPL began tracking conservation finance data. Furthermore, results from a national public opinion poll conducted by TPL in 2004 showed overwhelming support for the conservation of land that protects drinking water. Voters consistently cite drinking water quality as a valid reason for purchasing and protecting land; a strong majority of voters support tax increases in order to protect their water supply through land conservation.<sup>69</sup>

Successful measures are the result of careful planning, hard work, and an understanding of public priorities. The process involves assessing public opinion about conservation and taxation and designing a measure that is compelling, affordable, and accountable.<sup>70</sup>

#### CONSERVATION FINANCE HANDBOOK

For more detailed information on how to design a strategy to secure local funds, refer to TPL's *Conservation Finance Handbook*, available at [www.tpl.org/publications](http://www.tpl.org/publications).





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- ◆ Land preservation benefits must be viewed by voters as a *compelling need*. Whether addressing water quality protection, farmland preservation, or urban parks and playgrounds, proponents must understand voters' priorities.
- ◆ The tax must be *affordable*. Voters have a specific taxing threshold, even to support benefits they find compelling. Find out how much voters are willing to spend (not what the ideal program would cost) and design your measure accordingly.
- ◆ Voters must have confidence that those in charge of spending the money will be accountable and responsible. Fiscal safeguards written into a measure can assure anxious voters that their tax dollars are being spent wisely. Safeguards include fiscal audits, administrative cost caps, citizen advisory committee reviews, and sunset clauses.

Once such a measure is designed, a campaign must be conducted that builds broad support from community leaders and organizations and *communicates the key benefits* of the measure to undecided voters. "If a campaign does its work well," notes TPL consultant Steven Glazer, "the measure should have minimal opposi-

tion, and the focus of the public debate will be on the measure's benefits and accountability."<sup>71</sup>

So how do you design a compelling, affordable, and accountable measure and communicate its benefits to voters? The answer lies in careful research and polling, intelligent measure design, and sound campaign strategy. Research will inform you about local funding options, potential funding levels, costs to taxpayers, election trends, and any legal constraints that may impede the measure en route to the ballot. Research will also help guide the design of a public opinion poll that accurately assesses attitudes about public funding for open space and conservation of source lands.

If research and polling indicate sufficient support, the next step is to design a measure that reflects voters' priorities and spending tolerance. It is important to solicit advice from local leaders, advisory board members, and other conservation stakeholders.

Once on the ballot, supporters should launch a campaign to help secure its passage. County officials and community activists can work together to support the measure by forming a campaign committee outside the auspices of local government. By following these steps, a community can secure the local support needed to protect watershed lands and other targeted open space lands.

## Identify and secure state and federal funding sources

There is no single formula for securing conservation grants and matching funds from federal, state, and private sources. A variety of factors come into play, including programmatic objectives, competing applicants, and available resources.

Yet there are some fundamental considerations. First and foremost, a local government should have its source protection plan completed and local funding resources committed. A plan, a budget, and local funding will either be required by the agency contributing the funds or will significantly increase the likelihood of securing grants or matching funds from outside sources. In some cases, however, state and private funding precedes local dollars.

In addition, local leaders should research potential funding sources to determine where there is geographical or programmatic convergence. What programs exist that could help fund local open space and watershed protection goals? What grants have been awarded to neighboring counties, cities and towns, or communities with similar objectives? Are there new legislative developments that impact potential funding? EPA, state and local government associations such as the National Association of Counties, TPL, and others can help answer these questions.

The availability of most federal and state conservation funds fluctuates annually with the political and economic climates and budget allocations. In the arena of conservation funding, states provide local governments with two important tools: direct funding (grants and incentives), and the authority to raise local funds. Local water utilities may also be able to purchase land through grants from a regular state program. For example, Rhode Island's Water Supply Board, through its Watershed Land Acquisition Program, provides grants to public water suppliers to protect watershed supply lands. The so-called "penny per hundred" program, named for its levy of about 1 cent per hundred gallons, was enacted by the Rhode Island State Legislature in 1989 and generates approximately \$2.2 million annually statewide for the purpose of acquiring land and protecting raw water supply.

Common characteristics of states with successful conservation funding programs include:

- ◆ a clear vision for source protection and clean drinking water
- ◆ a skill for leveraging federal funding and using funds creatively and effectively
- ◆ constant support for integrating source protection programs at all levels.

The state of New Jersey, for example, has maintained a long-term commitment to the protection of open space, including a steady funding stream, incentives and financing options for local conservation, and the use of federal dollars to protect watershed land. New Jersey's Department of Environmental Protection has used the state's Green Acres Program to leverage federal Clean Water State Revolving Funds—typically a source of money for storm water, waste water, and nonpoint source pollution management—to help local governments protect watershed land. The Green Acres Program, which funds land preservation throughout the state, gives financing priority to those projects that protect source waters.

At the federal level, appropriations, grants, and incentives are made available to state and local governments, water utilities, or nonprofit organizations. Many federal programs require matching funds, underscoring the need to secure state, local, and private dollars. There are three distinct types of federal funding for land conservation and watershed management:

1. **State-directed programs**, in which states receive grants from the federal government, but are given broad discretion to allocate funds (Clean Water and Drinking Water State Revolving Funds);
2. **Direct federal programs**, in which the federal government makes direct grants in partnership with states to local recipients, usually local governments (Forest Legacy Program); and
3. **Direct federal acquisition**, such as Forest Service or National Park Service acquisition).

### State directed federal programs

include the Clean Water State Revolving Fund (CWSRF), the Nonpoint Source Grant Program (Section 319), and the Drinking Water State Revolving Fund (DWSRF). The revolving funds, which have traditionally funded infrastructure improvements, provide water

quality improvement grants to states, which then make loans to local governments, and in some cases nonprofits, private citizens, and others. States are given a great deal of flexibility in the allocation and management of state-directed federal funds and are strongly encouraged to use their share to address threats from nonpoint sources of pollution at the local level. Local stakeholders can also impact how state-directed federal program dollars are spent by communicating with state program administrators, generating applications for projects that address nonpoint source pollution and source water, and encouraging states to implement innovative grant and loan program that leverage other local and state dollars.

One such state is Ohio, where in 2000 the state EPA created the Water Resource Restoration Sponsor Program. The program addresses nonpoint source pollution threats by offering drastically reduced loan rates to utilities and local governments for traditional wastewater treatment work if the loan recipient either implements or “sponsors” a watershed protection or restoration project. The savings they receive through the reduced interest rate is then granted to the watershed protection project. This results in new grant dollars for watershed protection projects and a lower overall total repayment cost for loan recipients.

**Direct federal programs**, in addition to state-directed programs, provide state governments, local governments, and nonprofit organizations with appropriations, grants, and incentives. Although none of these funding sources are directed specifically at source protection activities, many may be used for land protection strategies targeting source waters. You should think creatively about how funds from the following direct federal programs can be leveraged to support local source protection goals.

#### **North American Wetlands Conservation Act (NAWCA)**

This program promotes voluntary public-private partnerships to conserve wetland ecosystems for waterfowl and other migratory birds. Administered by the U.S. Fish and Wildlife Service, NAWCA and matching funds may be used only for wetlands acquisition, creation, enhancement, and/or restoration. The maxi-

imum grant size is \$50,000 for the small grants program and \$1 million for the large grants program.

#### **Farm and Ranchland Protection Program (FRPP)**

Administered by the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS), this program provides federal matching funds of up to 50 percent to states, municipalities, and nonprofit organizations acquiring conservation easements over active agricultural properties. The cooperating entity acquires, manages, and enforces the easement. Proposals are selected based on agricultural importance. Interested municipalities should contact the state NRCS office or district conservationist.

#### **Forest Legacy Program**

Administered by the U.S. Forest Service, this program provides federal matching funds of up to 75 percent to states for the purchase of conservation easements, or in some cases outright acquisition, of high-priority forestland. The 25 percent of nonfederal monies can include state, municipal, and private funds. Municipalities and land trusts can work with private landowners to submit applications to their state Divisions of Forestry. Projects are ranked based on a set of criteria including the degree of threat, property size, and proximity to protected land. Congress directly earmarks funding for specific projects, based on the priorities of each state and the comments of the U.S. Forest Service. Applications should be submitted approximately two years in advance, if possible.

#### **Transportation Efficiency Act for the 21st Century (TEA-21)**

Administered by the U.S. Department of Transportation, TEA-21 is a six-year transportation funding bill, which in addition to traditional road building includes money for land acquisition and infrastructure development of pedestrian and bike trails, historic site preservation, conversion of railway corridors to trails, scenic or historic highway programs, and water pollution mitigation. The program is administered through each state’s Department of Transportation (DOT). Municipalities work with their regional planning organization to submit applications to DOT, which selects projects based on local and regional priorities.

## USING STATE REVOLVING FUNDS TO PROTECT SOURCE LANDS

Federal rules allow for state revolving funds and nonpoint source grant funds to be used for a wide variety of water quality projects, including land conservation. Through the Drinking Water State Revolving Fund, states can provide loans to water systems to acquire critical lands and implement protection measures. The Clean Water Act State Revolving Fund (CWSRF) program provides assistance to communities, water systems, and other organizations—including land conservation organizations—for projects that protect source water and enhance water quality.<sup>74</sup> The Clean Water Act also provides for the Nonpoint Source Grant Program and the Estuary Program.

Revolving fund programs operate like banks, making no- or low-interest loans to finance water quality projects. States have wide discretion over the programs funded, and must approve a source of loan repayment as part of the application process (developer fees, recreational fees, drinking water fees, dedicated local tax revenues, and nonprofit donations, among others). Some states have been innovative in their funding strategies, using state revolving fund dollars to maximize the protection of local source lands and minimize the impact of nonpoint pollution sources. Techniques include:

- ◆ Allowing for private borrowing and maximizing protection dollars. Nonprofit land trusts, for example, can leverage additional private resources for water quality improvement.
- ◆ Providing flexible interest rates and establishing linked deposit plans. Maryland's linked deposit program allows the state to enter into partnerships with community lending institutions, providing a simple and convenient way for borrowers to access nonpoint source capital improvement dollars.
- ◆ Creating an integrated priority ranking system. By integrating CWSRF, NPS, and Estuary Programs and prioritizing funding decisions based on identified water quality problems or threats, states can fund a wider variety of projects.
- ◆ Establishing incentives for nonpoint source protection programs. Ohio's EPA offers greatly reduced loan rates to utilities and local governments for traditional wastewater treatment work if they implement or "sponsor" a watershed protection or restoration project. Sponsored projects may include partnerships, land trusts, park districts, and others.

Through the CWSRF, states have the flexibility to target resources to their particular environmental needs, including source protection and brownfield remediation—two issues closely linked when brownfield sites are abandoned, thus contaminating drinking water supplies. The state of Wisconsin has a strong history of support for local brownfield remediation, including using CWSRF dollars to help municipalities clean up brownfield sites. Wisconsin's efforts began in the early 1990's when the state adopted a legislation package that provides incentives and regulatory flexibility for local clean-up efforts. Funding came a few years later when a special committee identified the Clean Water State Revolving Funds (CWSRF) money as a potential source.<sup>75</sup>

In 1997 the Land Recycling Loan Program (LRLP) was created, earmarking \$20 million from the federal CWSRF for municipalities to clean up properties. The loan program combines the federal dollars with state funds generated through state-issued revenue bonds. The LRLP now provides no-interest loans of up to 20 years for cleanup of sites where environmental contamination affects surface water or groundwater. Counties, municipalities, and redevelopment and housing authorities are eligible. A set of criteria determines project eligibility based on environmental and human health impacts. Highest scores are awarded to projects with impacted drinking water supplies. Points are also awarded to sites with contaminated soil, sediment, or groundwater.<sup>76</sup>

For more information about protecting drinking water with state revolving funds, contact the Clean Water State Revolving Fund at [www.epa.gov/owm/finan.htm](http://www.epa.gov/owm/finan.htm) and the Drinking Water State Revolving Fund at [www.epa.gov/safewater/dwsrf.html](http://www.epa.gov/safewater/dwsrf.html).

### **Coastal and Estuarine Land Conservation Program**

Created in 2002 and administered by the National Oceanic and Atmospheric Administration (NOAA), this program funds grants to states and local governments for the cost of land acquisition and restoration in a state's coastal zone. Federal funds must be matched by nonfederal funds, including cash, in-kind contributions, or other acquisitions. This is a

relatively new program, and although NOAA recently drafted guidelines, to date, grants have been appropriated by Congress through federal earmarks. To pursue a grant, municipalities should contact their congressional delegation or state coastal zone manager.

For current and detailed information on federal funding sources for land acquisition search TPL's Federal Programs at [www.tpl.org](http://www.tpl.org). For detailed information on federal funds for

all watershed protection activities use the EPA's online searchable *Catalog of Federal Funding Sources for Watershed Protection* at [www.epa.gov/safewater/dwsrf.html](http://www.epa.gov/safewater/dwsrf.html).

### Explore private funding sources

Private funds from foundations, corporations, and individuals can provide an important boost to local or regional open space protection efforts. These funds can leverage public monies while building local support and enthusiasm for land conservation projects. Like federal and state funds, however, private dollars are best relied on as supplements to municipal funding. Keep in mind as well that although foundations can make capital grants for land acquisition, they are more likely to give funding for planning, GIS work, and citizen outreach and education.

Partnerships are incredibly important in attracting private funds. Local leaders should develop relationships early on with organizations and individuals that can assess the potential for raising private contributions. These partners may include corporate leaders, experienced community volunteers, local land trusts, or regional and national nonprofits.

Nonprofit conservation partners can be particularly instrumental in helping to raise funds from private foundations, corporations, and individuals. The tax status of these organizations allows donors to make tax-deductible donations, and many foundations and corporations prefer to make grants to nonprofits rather than to government entities. Nonprofit partners also often have the staff, expertise, and infrastructure to plan and execute effective fundraising campaigns.

Municipalities do have the ability, however, to create special foundations to support conservation efforts, entities that can be a useful vehicle for raising private donations. Developing such a foundation should be considered if the community is embarking on a series of projects without a nonprofit partner.

What follows is a brief summary of guidelines for raising private funds for land acquisition. Each project and community is unique, and it is difficult to make broad recommendations. If you are planning a campaign of significant size, it may be well worth the cost to engage a private fundraising consultant to help prepare and execute your campaign.

### Foundations

The most promising foundation sources for local efforts will be community based, since large national foundations do not generally give to local projects, unless there is a special connection between the foundation and the community.

To identify potential foundation prospects, helpful resources include the Foundation Center and Environmental Grantmakers. Next, look carefully at the annual reports and press coverage of local nonprofits and projects to identify those who support initiatives in your area. Finally, determine specifics such as grant application procedures and timing, and proceed accordingly. It is important to keep in mind that most small foundations should be treated similarly to individuals, with personal contact and cultivation strategies.

### Corporations

The best corporate prospects will also be locally based or have large local operations. As with foundations, it is essential to develop a case for why a particular company should support your project. It is valuable to identify and secure one corporation that will commit to the project early, as it is often easier to convert subsequent potential donors by saying, "Company X is committed to supporting this at the \$5,000 level. Can you do the same?"

Try to make contact at the highest corporate level possible, ideally through a board member or the chief operating officer. Before your meeting, find out how many employees

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are locally based and how close the project is to their facilities. It is also important to develop a strategy to acknowledge the company's support, as it will likely want to receive press coverage and other public relations benefits based on its contribution.

### Individuals

When it comes to securing individual donations, a fundraising committee is key. This group of influential community members must be willing to identify and solicit donations from friends, family, neighbors, business associates, and others. The committee may also recruit others to raise money.

The committee should cast a wide net and determine the best strategy for soliciting specific donations from each contact. If you are part of a fundraising committee, ask the following questions when creating a list of potential supporters:

- ◆ Who will benefit the most from this project?
- ◆ Who are the closest neighboring property owners?
- ◆ Who are the most committed conservationists in the community?

- ◆ Are there families with long histories in the community who would be motivated to support this project?
- ◆ Are there any individuals who are not full-time residents who might be interested in supporting the campaign?

Major gifts should be solicited in face-to-face meetings. Save the mail campaign for last, when only a small fundraising gap remains. Before launching the campaign, provide committee members and potential donors with a case statement that explains why the project is important and the difference private donations will make. Likewise, formal training for committee members and volunteers working the front lines will prove invaluable.

### CASE STUDY

#### *Suffolk County and its Towns, New York*

Located at the eastern end of Long Island, an area rich in ecological importance and scenic beauty, Suffolk County and its towns have pioneered local land conservation for more than 25



years. These efforts have included programs for the protection of farmland, open space, and drinking water.

County residents get all of their drinking water from groundwater, particularly from the vast supplies underlying the Pine Barrens, a federally designated sole source aquifer. Heavy development in past decades threatened supplies and led to the creation of the Suffolk County Drinking Water Protection Program. The program to acquire critical recharge land is funded with one-quarter cent of the sales tax, first approved in 1987 and extended by voters in 2000. The tax generates about \$8 million annually and has funded the acquisition of about 13,000 acres. Additional funds are leveraged through the State.

Despite the success of the County's program, development still threatened critical source lands. This led to the Long Island Pine Barrens Protection Act, a national model for groundwater protection that created a 100,000-acre preserve above the recharge area, effectively eliminating development in the core half and setting aside the other half for limited use. Various land-use and zoning tools are used to accomplish the preservation goals of the Act, including transfer of development rights, cluster zoning, and conservation easements.

Local leaders and voters throughout the county have long recognized the value of land

conservation as a tool to protect natural resources and quality of life, and the importance of working together to fund source protection projects. The County has fostered multi-jurisdictional partnerships in many of its programs, including a Land Preservation Partnership Program that splits costs between the County and its towns to pay for various land acquisition projects, including the protection of drinking water supplies. The County's Drinking Water Protection Program also has a revenue sharing component based on population and is set aside by the town.

Voters in many towns have also approved local measures to protect open space and source lands. In 2002, for instance, the Town of Brookhaven passed a bond measure that provides \$20 million for preservation of open space and environmentally important lands that protect drinking water. In addition, five towns in eastern Suffolk County have enacted a local real estate transfer tax (2 percent of sales above \$150,000) that has raised an impressive \$200 million in the past 5 years. The program will be in effect until 2025. Finally, there are also several bond issues proposed for the November 2004 election to further fund land acquisitions, including \$100 million in Brookhaven, \$75 million in Suffolk, and \$50 million in Nassau.

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## WRAP-UP

### FINANCE LAND CONSERVATION

#### Questions to Consider:

- ◆ What options are available at the local level to fund conservation? How can you secure political and public support for local funding, either through budget appropriation or the passage of a voter-approved conservation funding measure? What role can a water supplier play?
- ◆ What is your plan to secure local funds and how can it be used to attract support from federal, state, and private sources?
- ◆ What conservation funding support is provided by your state? Does your state have a dedicated funding source? How creatively does your state use federal funds to protect water quality? How can you impact the allocation of state-directed federal funds to benefit local source protection?
- ◆ What federal funds are available for local source protection? What is the focus of the program, and how are funds administered?
- ◆ Are there private funding sources, including foundations, corporations, individuals, and water supplies that can help fund source protection?

## PROTECT PRIORITY LANDS

The world of real estate is often complex, time-consuming, and risky; large sums of money are at stake, legal issues are complicated, and the value of a given piece of property can be quite subjective. That's why it's critical to understand the acquisition process and partner with experts whenever possible. This section is designed to familiarize readers with the fundamentals of land acquisition. Keep in mind that this is merely a summary; for more detailed information see *Doing Deals: A Guide to Buying Land for Conservation*, a detailed look at the land acquisition process created by TPL and the Land Trust Alliance.

A key initial step is to develop a prioritized list of specific land parcels, and use it as a guide to approach landowners about doing deals. Consider this step a compilation and assessment of the information gathered thus far: GIS mapping and conservation ranking systems help you understand the importance of a particular piece of property to the health of the watershed; source protection planning helps you decide which protection approach is most appropriate for a given parcel. Once a piece of property is on a priority list, additional information about the parcel and the needs of the landowner are essential. This process is described in the “doing deals” section to follow.

### Doing Deals

The section “Doing Deals” was adapted from the following sources: *Doing Deals: A Guide to Buying Land for Conservation*, written by the Trust for Public Land and published by the Land Trust Alliance and the Trust for Public Land, 1995; “Community Open Space: New Techniques for Acquisition and Financing,” developed by the Trust for Public Land and published in the MIS Report by the International City/County Management Association; co-editors are TPL's D. Ernest Cook and urban consultant William P. Ryan.

Buying land or conservation easements requires a fundamental understanding of real estate—its unique terminology, accepted practices, and legal risks. While it is not necessary to be a real estate expert, it is essential to work knowledgeably and comfortably with conservation partners and other experts throughout the process. While local governments will likely be

the predominant land buyer and landowner, public water authorities and private utilities are increasingly acquiring source lands. For the purposes of this discussion, the terms public agency and local government are most often used to describe the parties in the land acquisition process. Yet whether a transaction is ultimately facilitated by a land trust partner, local government, or water supplier, the steps involved remain the same: information gathering, negotiations, and due diligence

### Information Gathering

Once you've decided to pursue a property, it's time to begin a process of information gathering and analysis—about the land, the landowner, potential partners, and sources of funding. You'll probably follow these lines of inquiry simultaneously, exploring each to the degree demanded by the projects and reacting to opportunities and roadblocks as they arise. Fact-finding begins with the land and landowners and includes:

- ◆ **History of the land and its geographic features and resources.** Understand the land's size and physical characteristics by visiting the property, talking with the landowners and neighbors, and examining existing public documents and maps.
- ◆ **Landowners.** Investigate ownership constraints and motivations for selling the land. The landowner's character, background, social and professional affiliations, financial status, and relationship to the land can all influence negotiations and decisions about the deal.
- ◆ **Development capacity.** Explore the practical and legally allowed uses of the land—its development potential. This will help you determine desirable and allowable protection strategies, estimate the market value of the land, assess the feasibility of limited development, and predict the development of adjacent land that might adversely affect your protection efforts.
- ◆ **Likely cost of owning and managing land.** Short- and long-term costs may include site stabilization and improvements, insurance premiums, building maintenance and repairs, utilities, inventories, fencing, weed management, easement monitoring, and staffing.
- ◆ **Current and projected land value.** The value of a piece of property is estimated through a

subjective analysis of size, shape, and terrain; access to roads and facilities; applicable land-use regulations; development and land value trends in the area; restrictive easements or covenants; and improvements on the land. Professional appraisers are essential.

◆ **Level of community support.** The community can help with a range of tasks, including information-gathering, fundraising, gaining political approvals, and managing the technical aspects of a transaction. With enough public support almost every project can be a success.

The sources for information are extremely varied: human resources include landowners, neighbors, community leaders, professional realtors, assessors, and so on; public documents include property tax records, title reports, existing appraisals, recorded surveys, existing inventories, local general plans and watershed planning studies, environmental impact reports, land-use regulations, and more. How exhaustive your research needs to be will depend on the circumstances of the projects, available time, and financial restraints.

## Planning and negotiations

Careful information-gathering and analysis can pave the way for successful negotiations—the most sensitive and critical step in any acquisition. Ultimately, a successful negotiation with the landowner will result with you obtaining site control, adequate legal safeguards, and enough time to secure funding.

There are typically two phases to the negotiation process, *preliminary* and *final*. Phase one, *preliminary negotiations*, should be used to establish a relationship with the landowner and reach common ground on the basic framework of the deal. In the *final negotiations* stage, conceptual agreements are formalized in a legal document, including details of the financing arrangements.

During preliminary negotiations, focus your efforts on finding common ground with the landowner. Work to get the landowner on your side, develop a personal rapport, explore shared goals for the land, and help the landowner understand the value of his/her property for water quality protection. You and

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the landowner should also establish areas of agreement and disagreement—exploring purchase options, price, restrictions, deposits, and timing. Keep in mind that everything you learned to date—about the land and the landowner—is drawn upon and synthesized as you develop your negotiation strategy.

It is also essential to acquire *site control* at the earliest time possible. Site control is the legally binding right to acquire the land on terms established in a legal agreement. There are a variety of forms of site control agreements; the most secure is an acquisition agreement that specifies the full range of circumstances that will govern the transfer of the property:

- ◆ **Purchase-and-sale agreement.** The most common acquisition agreement, the purchase-and-sale contract obligates the seller to sell and the buyer to buy, subject to specified conditions and basic terms, such as the time frame for closing, price, legal description of the property, and required condition of sale.
- ◆ **Option.** An option is essentially a purchase-and-sale agreement under which the owner of the land gives the other party, in exchange for some form of consideration, the *right* (but

not the *obligation*) to buy the land within a certain period. An option provides the option holder time to consider the merits of the project and to put together a feasible deal.

- ◆ **Earnest money contracts.** A variation of a purchase-and-sale agreement, an earnest money agreement is a deposit made by a buyer of real estate (typically of a house) as a sign of good faith. Unlike an option, this is a contract to buy the property.
- ◆ **Donation agreement.** A donation agreement formalizes the transfer of donated property.

There are also many arrangements short of formal site control that are good halfway measures to secure a property in the interim. So-called site influence agreements may be formal or informal, yet all require the continuing goodwill of the landowner.

- ◆ **Letter of intent.** Letters of intent anticipate future relationships and are often used to document an agreement, whether expressing the parties' intention to enter into a fully drafted agreement or detailing the understanding of how the property will be managed.



- ◆ **Right of first refusal/right of first offer.** A right of first refusal requires a landowner to sell the property for the same price and terms that he/she is willing to accept from a third party. A right of first offer guarantees a designated buyer the right to make an offer to purchase the property before a landowner can sell it to a third party, and also prevents the landowner from selling to a third party at a lower price than was offered.
- ◆ **Lease.** A lease typically provides exclusive use or access rights to a property for a set period of time. This arrangement can be attractive because it offers a trial period to manage the property, build public support for long-term protection, and cultivate a relationship with the landowner. A “lease-option” gives the lessee the option of purchasing the land at the end of the lease.
- ◆ **Will and bequests.** If the landowner puts your organization or agency in his/her will, you retain complete control of the land at the time of the owner’s death. Until that time, however, the landowner is free to change the will.
- ◆ **Management agreement.** Less formal than a lease, a management agreement specifies a plan under which the property will be managed, either by the landowner or by the acquiring entity.
- ◆ **Registration program.** Some land trusts operate programs to “register” significant conservation properties. This regulation involves drafting a nonbonding agreement stating that the landowner will not develop the land, or at least certain parts of it, and will provide notification of any threats to the property or plans to sell the property.

Once site control or site influence has been established, it’s time to develop an acquisition action plan that details the work ahead, the timing, and the resources available. Think backwards from your protection goal to identify all the steps you need to take, including acquisition (option, appraisal, title report, etc.), financing arrangements and due dates, fundraising activities, political endorsements or approvals, and preparation for stewardship (baseline data collection, and management). Work with others to develop the plan, brainstorming alternatives and considering worst-case scenarios. Call upon experts to double-check your budgets and timelines. Look at each and every aspect of the project: determine major constraints, set milestones, identify

and order tasks, anticipate delays, monitor and track progress, and develop a comprehensive budget.

During *final negotiations*, conceptual agreements are made formal and the fine points of the deal are hammered out—the estate to be acquired, the consideration/deposit, the terms of seller financing, title, environmental liability, and defaults and remedies. Move as quickly as possible to a preliminary draft of the acquisition agreement as circumstances change constantly; competing offers may be made, the landowner’s financial situation may change, or the landowner may die. The culmination of this process is the closing, the point at which ownership of the land is transferred. Be advised, however, that it is time-consuming to generate a sound legal document and the process can be prolonged by any number of factors.

## Due Diligence

It is important to minimize any risk associated with land ownership by performing a survey, appraisal, environmental assessment, and title search—referred to as *due diligence*. For land known to be rich in archaeological resources, an archaeological or cultural resources study may also be important. Be certain to follow due diligence steps carefully during final planning and negotiations. The following is a description of each step and some points to keep in mind when retaining professional consultants to perform the work.

- ◆ **The survey.** A survey is a map showing the measurements, area, boundaries, and contours of a property. Just as a title report provides information about the land’s ownership, a survey provides information about the land’s physical features—information that can be extraordinarily useful in your negotiations, in your evaluation of the property for your intended uses, or as baseline data. If developing a portion of the property is part of the protection strategy, a survey is critical.
- ◆ **The appraisal.** Appraisals are tools for evaluating the market value of a piece of property. They are a qualified professional’s opinion of value, expressed in a formal document called an appraisal report. Appraising is *not* an exact science. The industry is governed by guidelines, not rules; there is not one standard or format for reports, and the qualifications of

an appraiser are difficult to define. Appraisals should always be held open to critical scrutiny, analysis, and challenge.

- ◆ **Environmental Assessment.** Contamination can result from agricultural operations, industrial or commercial operations, mining and timber operations, or the construction of residential buildings, particularly those that contain asbestos or lead-based paint. Under many federal and state environmental liability laws, local governments are liable for cleanup of contaminated sites that come into their possession. That's why assessing the environmental hazards of a site *before acquisition* is essential.

The purpose of the assessment is to determine the possible presence of a contamination problem, and the nature and cost of cleaning it up. Whether or not there is a known problem, officials must negotiate an acquisition agreement that gives the acquiring entity the greatest possible protection from liability. It is important to work closely with an attorney at all stages of assessing the environmental health of a property and drafting an agreement.

- ◆ **Title Report and Title Insurance.** The term "title" means evidence of ownership—that is, the legal documentation of an owner's right to the property. There are a variety of ways in which title can be secured, as outlined by the table on page 63. A *title report* is a document indicating the current state of title for a property, including the owner of record; easements, covenants, or liens affecting the property; and any clouds on the title. The search is performed either by a title insurance company, or in some states by attorneys or title "abstractors." From this investigation, the title insurance company creates the title report, or abstract of title. The title report is usually accompanied by a "title commitment," a statement by the title company that says it is willing to insure the existing state of title to the property, excluding any defects or clouds specifically listed in the report. Title insurance, which is available for both land and conservation easements, protects the holder from any loss sustained due to defects in the state of title other than those stated in the policy. Local governments like private landowners, are vulnerable to title problems and usually need title insurance.

## Forge Partnerships for Doing Deals

The section was adapted from *Preserving Urban and Suburban Gardens and Parks: The Trust for Public Land and Its Partners*, by William Poole, in *Land Conservation through Public/Private Partnerships*, edited by Eve Endicott and published by the Lincoln Institute of Land Policy (Washington, D.C.: Island Press, 1993).

Many local partners lack the resources or expertise to execute land transactions effectively, especially in volatile urban markets. This is particularly true of complicated transactions, which may involve delicate timing, the splitting or combining of land parcels, or complex tax or legal circumstances.

Moreover, public agencies are constrained by political considerations and by mandated procedures and regulations. Appropriated monies may fail to cover a land transaction or may not be available when a desired parcel comes on the market. Some landowners distrust government, making negotiations difficult. And rarely does exactly the right piece of land come on the market at exactly the right price and exactly the right time.

For all these reasons, private, third party partners can play an important role in local land acquisition, ownership, and management. Much of the work of a third party involves adjusting such variables as time, price, and land configuration to meet the needs of both the landowner and the acquiring agency. An understanding of potential partnership opportunities is essential before launching into a deal.

### Timing Transactions

Local governments and other public agencies frequently face hurdles in timing public funding when desired properties are for sale. A local partner may anticipate authorization of funds, the passage of a bond act, or the sale of bonds at a future date, but meanwhile it needs to make sure a targeted property remains available for purchase. There are two basic strategies for providing interim protection. The first is to negotiate an option on the property. If an option is unavailable, a fall-back strategy is to get assistance from a "friendly" third party—often a land trust—who is willing to take the risk of buying the property and holding it until the government is able to proceed with the acquisition.

An *option* gives the purchaser the right—but



**TABLE 5: Acquiring Title**

TECHNIQUE	EXPLANATION	ADVANTAGES	DISADVANTAGES
Fair market value sale	Land is sold at its value at highest and best use.*	◆ Highest sales income (cash inflow) to seller.	◆ Can be expensive.
Bargain sale	Part donation/part sale—property is sold at less than fair market value.*	◆ Often the landowner is eligible for a tax deduction for the difference between the sale price and the fair market value.	◆ Seller must be willing to sell at less than fair market value. Can be expensive.
Outright donation	A donation by landowner of all interest in property.*	◆ Allows for permanent protection without direct public expenditure. ◆ Tax benefits to seller since property's fair market value is considered a charitable contribution.	◆ Very few landowners willing to consider.
Bequest	Landowner retains ownership until death.*	◆ Management responsibility usually deferred until donor's death.	◆ Date of acquisition is uncertain. ◆ Donor does not benefit from income tax deductions. ◆ Landowner can change will.
Donation with reserved life estate	Landowner donates during lifetime but has lifetime use.	◆ Landowner retains use but receives tax benefits from donation.	◆ Date of acquisition is uncertain.
Land exchange	Exchange of developable land for land with high conservation value.	◆ Little or no government funds required. ◆ Landowner may defer capital gain recognition.	◆ Properties must be of comparable value. ◆ Complicated and time-consuming.
Eminent domain	The right of the government to take private property for public purposes upon payment of just compensation.*	◆ Provides government with a tool to acquire desired properties if other acquisition techniques are not workable.	◆ Landowner and public opposition. ◆ Can result in speculation on targeted properties. ◆ Potentially expensive and time-consuming litigation.
Tax foreclosure	Government acquires land by tax payment default.	◆ Limited expenditure. ◆ Land might not be appropriate for public open space, but can be sold to provide funds for open space acquisition.	◆ Cumbersome process.
Agency transfer	Certain government agencies may have surplus property inappropriate for their needs that could be transferred to a parks agency for public use.	◆ Limited expenditure.	◆ Surplus property available may not be appropriate for park use or the owning agency may want to sell to a private party to generate revenues.

\*Conservation easements can also be acquired by these means.

This table was adapted from *Tools and Strategies: Protecting the Landscape and Shaping Growth*, 1990, the Regional Plan Association, New York. The information was also published in "Doing Deals: A Guide to Buying Land for Conservation," written by the Trust for Public Land and published by TPL and the Land Trust Alliance; 1995.

not the obligation—to buy the property at some time in the future. Because an option binds the landowner to hold the property off the market without any assurance that the sale will be concluded, most owners insist that the prospective purchasers pay for the option, providing as consideration some amount between one dollar and ten percent (or even more) of the purchase price. Many landowners prefer a *purchase-and-sale agreement* to an option. A purchase-and-sale agreement generally requires both buyer and seller to proceed with the transaction, but the agreement can be loaded with various conditions (e.g., “subject to available public funds”) and escape clauses that make it essentially equivalent to an option. The services of qualified counsel are essential to prepare or review either form of agreement.

Many local governments and most land trusts use options. Options are powerful tools for facilitating public park and open space acquisition, often enabling the holder of the option to leverage millions of dollars or potential acquisitions through relatively small option payments. However, many public agencies are prohibited from entering into such agreements, and others may not have the funds needed—or be willing to place public funds at risk—to purchase option rights. A private partner or land trust may be the best solution.

In addition to providing interim protection, an option may serve the public agency by highlighting a desirable opportunity and stimulating voter or legislative support to provide the necessary funding. Optioning the land creates an atmosphere for acquisition and allows planners and advocacy groups to say, “This land is available if we want it.”

Not all landowners are willing to consider an option or any form of agreement that does not require a firm commitment to buy in the immediate future. In these cases, help from a nonprofit conservation group that is willing to purchase the property outright may be the only means for a local government to preserve the chance to create new parkland. Many land trusts have accumulated revolving funds from donations, earnings, and loans that can “bridge” financing until a public agency is able to acquire a parcel. Once the land has been conveyed to protective ownership, the funds are returned to the revolving account to be used again.

### **Assembling and Splitting Parcels**

Sometimes a local government or public agency can afford only a portion of an offered parcel.

Or it may need to acquire multiple parcels from different owners to accomplish a single project. Governments are often forbidden by statute or regulation from assuming the risks of holding, splitting, combining, and reselling parcels on the open market. Private partners, on the other hand, can do this work—often in multiple transactions—and can then transfer the land to the acquiring agency in the precise configuration required.

### **Helping with Negotiations**

A land trust may be asked to step in as an independent third party if negotiations between a landowner and a public agency reach an impasse. In other instances, a local government may enjoin negotiations by procedural, legal, or regulatory encumbrances. For their part, some landowners do not trust government agencies. This is often the case when a local government is in the awkward position of regulating the use of a property while simultaneously seeking to buy it. Negotiations are most successful when they are confidential, especially regarding the landowner’s financial circumstances. Many owners fear that direct negotiations with the local government will expose their personal affairs to public scrutiny.

In all of these situations, a private partner who represents neither the local government nor the landowner is often in the best position to negotiate.

Often, the key to placing land in public ownership is finding a solution sensitive to the financial and legal needs of landowners. A land trust or other private partner may be in a better position than a government representative to counsel landowners confidentially on the tax benefits of bargain sales, showing them how deductions based on charitable donations of land can offset in some measure a lower selling price.

### **Finding and Maximizing Funds**

Frequently, a financial issue prompts a local government to call on a nonprofit partner for assistance. A private partner can promote a tax-deductible bargain sale to bring down the price of a project. By acquiring or optioning a high-profile property, nonprofits can also help generate funds from individual, corporate, or philanthropic sources, and help educate voters about a conservation finance measure. With their inherent flexibility, nonprofit partners can often combine funds for an acquisition from two or more public or private sources. They



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may, for instance, combine local government money with foundation grants, development mitigation funds, low-interest loans, or private gifts. Sometimes, a nonprofit partner can schedule payments on a transaction to fit the budget or timing of an acquiring agency. And finally, in some instances, funds can be generated through a partial development transaction. This is done by splitting the parcel, selling a minor portion for development and using the proceeds to help secure the major portion for public use.

### Owning and Managing Land

Third party partners, such as land trusts, can often manage lands with greater efficiency at reduced costs. Ownership can also be simplified by having a land trust hold a piece of property for a determined amount of time. There are a variety of options, as described in detail in the section on land conservation approaches, on pages 40 and 41.

#### CASE STUDY

#### *Waynesville, North Carolina*

At the western end of North Carolina, near the foothills of the Great Smoky Mountains, lies the small but growing community of Waynesville, population 10,000. While neighbor-

ing towns struggle to protect their water supplies in the face of new development, Waynesville has the unique distinction of owning its entire watershed—every parcel between its drinking water reservoir and the hundreds of surface streams and underground springs that feed it.<sup>77</sup> Still, final decisions and public debate about long-term land ownership and management continue into 2004.

The protection of the community's watershed, known as Allen's Creek, began 100 years ago with the town's first acquisition of key land. By 1997, the town supplemented its own funds with grant money from the state's Clean Water Management Trust Fund (CWMTF), the Environmental Protection Agency and the state's Division of Water Resources, to acquire the final 690-acres. The grant from the CWMTF required the town to place a conservation easement on that land, the easement was then conveyed to the state to ensure permanent protection.<sup>78</sup>

Town funds later matched additional CWMTF funds to pay for a survey of 6,000 acres of protected watershed land. The town also then agreed to donate a conservation easement on the watershed, to be conveyed to the Conservation Trust for North Carolina.<sup>79</sup> Countless drafts of the easement document have been written, reviewed, and rewritten since 1997 and a number of partner organiza-

tions have been added to the project to bolster community support.

The broad-based coalition of state, non-profit, and local partners formed to design and monitor the easement, includes CWMTF, the Conservation Trust for North Carolina, the Southern Appalachian Highlands Conservancy, Land Trust for the Little Tennessee, Haywood Waterways Association and Western Carolina University. Town officials solicited public input at town meetings, which were attended by residents and participating members of the conservation community. Residents expressed support for the conservation easement, as there is currently no mechanism for protection of the watershed. There was some concern about the town's desire to retain the right to manage the forests in the watershed, but the primary concern was a lack of public forums as this project evolved over the last eight years. The town's Board of Alderman now has plans for continued public involvement in the decision-

making process.

The proposed conservation easement contains numerous requirements and restrictions based on scientifically driven decision-making, regular water quality testing, and the oversight of two experienced conservation organizations and the State of North Carolina. Any forest management activities would be done in accordance with a protective forest management plan and would be strictly governed and monitored. Management activities could be halted at any step, and all must comply with the primary objective of protecting high quality water.

Proponents of the easement, which is more restrictive than the state's Best Management Practices, hail it as a model for sustainable forest management for source water protection. Final decisions about the conservation easement are expected in 2004.

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## WRAP - UP

### PROTECT PRIORITY LANDS

#### Questions to Consider:

- ◆ What is the most appropriate and effective conservation tool available to protect a parcel of watershed property?
- ◆ What do you know about the piece of property, its history, landowners, and contaminant threats?
- ◆ What are the common techniques, accepted practices, and legal risks of doing a deal?
- ◆ What is your plan for protecting a piece of property, including timing, budget, negotiations, acquisition options, and preparation for stewardship?
- ◆ How can experts help you facilitate the negotiations and secure the deal?

## MANAGE PROTECTED LANDS

Whether source lands are developed or undeveloped, privately owned or publicly protected, proper land stewardship can have a tremendous impact on water quality.

Perhaps surprisingly, land protection does not automatically equal improved water quality. How conserved land is managed—from restoration to maintenance to public access—can affect water quality. Source lands that are permanently protected by a local government, water supplier, local land trust, or other partner have their own, albeit sometimes overlapping, set of management tools and challenges. It is important to consider management and public access before property is purchased, and take into account issues that influence who you partner with and which entity will own the land. This chapter touches on stewardship of private lands, but the primary focus is on stewardship of publicly protected lands.

### *Stewardship of Private Lands*

Promoting good land stewardship depends on the voluntary actions of private landowners and requires outreach, education, technical assistance, and sometimes financial incentives. The goal is to improve how individuals manage their land by building their understanding of the watershed they live or work in and how their actions can impact water quality. As noted by EPA in its comprehensive report on watershed management, “environmentally responsi-

ble land management does not mean that people must cease certain activities or make drastic changes to their business, rather that they rethink the way they go about their activities.”<sup>80</sup>

The nonprofit Center for Watershed Protection has developed a six-point program, as outlined below, to promote effective watershed stewardship.<sup>81</sup> Consider these points when designing a program to facilitate proper stewardship of private lands. For more details, see [www.cwp.org/stewardship.htm](http://www.cwp.org/stewardship.htm).

- ◆ **Watershed advocacy.** Advocacy lays the foundation for public support and more effective watershed stewardship. Grassroots watershed management organizations and local governments have important roles to play in an advocacy effort.
- ◆ **Watershed education.** Education programs can raise awareness (signs, storm drain stenciling, maps), encourage personal stewardship, provide professional training to the development community, and engage the public in protection and restoration activities.
- ◆ **Watershed maintenance.** Most watershed protection tools require ongoing maintenance, including maintenance of septic systems and sewer networks, as well as managing storm water practices. Maintenance may also require some replanting of natural vegetative cover.
- ◆ **Pollution prevention.** Some businesses may need special training on how to manage their operations to prevent pollution and protect the watershed.
- ◆ **Monitoring.** Public agencies, as well as private

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corporations, citizen groups, and even landowners should seriously consider monitoring to provide appropriate data that will answer their own questions and allow them to design and target management strategies.

- ◆ **Restoration.** An urban restoration process should include storm water retrofitting, source control through pollution prevention, and stream enhancement.<sup>82</sup>

There are a variety of specific tools and techniques for proper stewardship of developed land within this framework, from the proper disposal of waste to the appropriate use of vegetation cover. For example, landowners should be encouraged to develop environmentally sensitive landscapes that rely on native plants with dense root systems and apply proper lawn maintenance techniques, such as aerating soils and planting climate-appropriate species of grasses that need the least chemical assistance. Farmers should use conservation tillage, crop rotations, contour strip farming, and animal grazing management that reduce loss of pesticides and nutrients to the environment and sediment.<sup>83</sup>

## NATURAL RESOURCES CONSERVATION SERVICE

In the Dust Bowl days of the late 1920s, when America's prime farmland was suffering from depletion and erosion, Congress appropriated its first dollars to the study of soil conservation. By the mid-1930s, President Roosevelt established the Soil Conservation Service in the U.S. Department of Agriculture, which later became the Natural Resource Conservation Service (NRCS).

Today, the NRCS supports the conservation of soil, water, and other natural resources on America's private land. Through its 22 programs, the NRCS provides a range of services, helping farmers, ranchers, and other private landowners address issues such as erosion control, energy efficiency, water conservation, sustainable grazing management, water quality, and wetlands restoration. The NRCS support services include technical assistance, cost shares, and financial incentives, while fostering partnerships with local, state and federal agencies, and policymakers.

The Farmland and Ranchland Protection Program, which provides matching funds to help purchase development rights and keep productive farmland in agricultural uses, is also administered through the NRCS. The NRCS Web site is located at [www.nrcs.usda.gov/](http://www.nrcs.usda.gov/).

## Stewardship of Public Lands

Once a municipality or water supplier acquires a tract of watershed land, it faces the significant task of owning and managing it. To guarantee the adequate protection and enhancement of water resources, the creation of a well-planned and well-funded land management program is essential. Such a program should balance the protection of water and other natural resources with the recreational and usage needs of the public—while ensuring public safety.

A management plan guides the protection and enhancement of acquired land over the short- and long-term. Your plan should include strategies for immediately protecting acquired property, balancing competing land-use demands, and addressing long-term costs and management issues. For properties with significant natural and biological resources, such as water supplies, it is also important to consider a specific resource stewardship plan as part of a more general management plan. In fact, a number of different yet overlapping management approaches may be needed for a piece of property, depending on the type of land and natural resources protected. These may include forest management, ecosystem management, species management, trails and resource management, agricultural production, and grazing management. This section discusses the steps involved in the creation of a management plan and the special considerations for developing a specific resource stewardship plan to protect watershed supplies.

Keep in mind that the acquisition of conservation easements requires its own distinctive planning and management. The easement holder is responsible for monitoring and enforcement—essentially making sure that the terms of the easement are being followed. Such management requires a good relationship with the property owner, an easement document with clear and enforceable restrictions, and a program of regular, systematic, and well-documented monitoring. Ongoing funding is essential to ensure the program is viable over the long-term.

### Creating a management program— a summary of action steps

Once a piece of property is acquired, planners must *stabilize the site*. This entails determining what types of public access are permitted, and what immediate improvements and/or



enforcements are necessary. When new property is acquired, public access is often restricted until a management plan is in place and short-term improvements are made, including the construction of trails and signage, visitor management and safety guidelines, permitting-process procedures, and resources and facilities-management strategies.

Short-term site stabilization is followed by longer-term assessments of goals for the property: the property should be studied, public input solicited, and most appropriate uses determined. This information forms the basis for the management plan—the document that guides the protection and enhancement of acquired land.

Long-term land-management planning requires an *inventory* and *evaluation* of the land. An inventory involves a close accounting of the land, its natural resources, plant and animal species, and infrastructure. This process helps land managers gain an understanding of the land, its physical setting, and social context. The type of evaluation depends on the type of resources found on the property. For instance, an environmental-resource evaluation will examine soils, plants, wetlands, birds, butterflies and other insects, and small and large mammals. Cultural evaluations may include reviews by archeologists and interviews with local residents and knowledgeable professionals. *Mapping* the resources identified through a geographic information system (GIS) then provides a clear picture of the land's natural and cultural resources, with overlays that demonstrate appropriate management techniques and recreational uses. Keep in mind that some of this information may have been gathered earlier in the information-gathering process. At this point, however, a more exhaustive evaluation may be needed.

Budgeting and human resource planning is essential. This step calls for determining staffing needs, the management role of partners, and short- and long-term management costs. Consider what will be necessary to administer the program (record keeping, budgeting, insurance, and community relations), how public programs will be managed (recreational programs, public education, and so on), and what monitoring and enforcement provisions will need implementing (trespassing, overuse, vandalism, safety hazards such as fire and flooding, and other potential problems). Determine your overall budget and evaluate potential revenues that could offset manage-

## CONSERVATION EASEMENT HANDBOOK

The *Conservation Easement Handbook*, updated and republished by the Trust for Public Land and the Land Trust Alliance in winter 2005, provides comprehensive information about the monitoring and enforcement of conservation easements. For more information, visit the Web at [www.tpl.org](http://www.tpl.org).

ment costs, such as park entrance fees, harvesting contracts, or agricultural leases. Flexibility is important: management plans and projections may continue to evolve with changes in the natural systems of the property, available resources, or the recreational needs of the public.

### SPECIAL WATER SUPPLY LAND STEWARDSHIP CONCERNS

Lands in public water supply watersheds and aquifer protection areas may need to be managed differently than other open space lands in order to protect the drinking water supply. An effective resource stewardship plan will consider major threats and how to address them, compatible uses for the land, and restoration and maintenance.

**Consider compatible uses.** Watershed lands can help a community meet a range of conservation goals, including resource protection, research and education, historic preservation, and wildlife habitat protection. In many cases a piece of land can help a community meet multiple conservation objectives. The preservation of significant cultural or archaeological resources, for example, may be important to the community and compatible with other watershed protection goals.

In fact, incorporating water quality protection with other local priorities can help secure the political and public support to successfully implement a plan. Communities in the arid west, for instance, are often underserved by parks and water-based recreation; building public awareness of the compatible uses of water supply lands can increase support for land protection and financing.

The potential benefits of providing for



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appropriate public access to source land are considerable; the process itself can open the door to a wide array of potential partners and funding sources. Think carefully about land management, public access issues, and potential partnerships. State, local, or federal park or land management agencies and local land trusts can facilitate land management and help balance public uses with resource protection.

When considering compatible uses, begin by asking yourself and your partners whether a piece of property can adequately protect water supplies while offering recreational opportunities or even allowing public access.

In general, any human use will have an impact on the land, and there is evidence that certain types of recreation can adversely affect the quality of surface drinking water supplies. Yet the impacts of dispersed, or more passive, recreation may be manageable, so long as the water supply is well buffered from potential impacts, in particular the transport of pathogens through poorly controlled sanitation. The challenge is to carefully weigh the public demand for access with the potential impact to water quality, determine what is acceptable, and mitigate impacts. The Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection (DCR/DWSP)—formerly the Metropoli-

tan District Commission—is the state agency that oversees the management of watershed lands in Massachusetts. The agency considers the following factors when evaluating the compatibility of recreational activities and water supply management:

- ◆ Type and intensity of proposed public access and use
- ◆ Physical features of the area being considered for public activities
- ◆ Potential for impacts to water quality from the activities of visitors
- ◆ Resources needed to properly manage any particular use on its properties

The DCR evaluates each potential activity in accordance with its goals, guiding legislation, and regulations. It also considers the environmental impacts to land resources and water quality, costs in terms of staffing and administration, legal issues, public access points, and public safety and education.<sup>84</sup>

Each watershed is unique and public access should be considered on an individual basis. The designation or prohibition of public access may also vary within a watershed, depending on size, scope, and characteristics of the land within. That said, it's important to consider best practices and qualitative guidelines

throughout the development of your management plan.

In its publication entitled *Drinking Water from Forests and Grasslands, a Synthesis of the Scientific Literature*, the USDA Forest Service examines the effects of concentrated high-impact recreation and dispersed recreation.<sup>85</sup> The impacts from activities will depend on such unique factors as soil conditions, the presence of vegetation, and existing infrastructure. The following is a summary of key findings about recreational impacts on source lands, primarily from the USDA report. Keep in mind, however, that the field of recreation ecology is relatively new and there is limited research on the quantitative impacts of recreation on drinking water supplies.<sup>86</sup>

#### **Concentrated recreation**

Like urbanization, concentrated recreation impacts water quality through wastewater treatment and urban runoff. Pollutants from concentrated recreation include fuel residues from moving vehicles (cars, boats, snow mobiles, and other gas-powered vehicles), wastewater flow from service facilities, such as toilets, showers, restaurants, laundries, and soil and construction materials carried to surface waters with runoff during construction.

- ◆ The impacts of concentrated *camping* on drinking water quality are similar to those found in dispersed recreation, such as hiking and horseback riding, but more severe. Carefully assess the need for wastewater facilities and understand that camping tends to generate significant amounts of trash that can impact water supply management.
- ◆ The use of gasoline with methyl tertiary butyl ester (MTBE) in *motorboats*, contaminates surface water.
- ◆ The effects of *swimmers* on drinking water supplies are an emerging problem that has prompted some utilities to limit or ban recreation on drinking water reservoirs. Concentrated swimming may cause microbial contamination of drinking water supplies. In fact, the link between water contact activities, such as swimming and wading, and the spread of water-borne disease is well-documented.<sup>87</sup>
- ◆ *Vehicular traffic* in forests and grasslands may impact drinking water quality through the deposit of MTBE and nitrogen.

#### **Dispersed recreation**

The impact of non-motorized recreation activities on source waters is generally less significant than motorized recreation. Proper management of non-motorized, dispersed recreation can go a long way toward preventing contamination. Every affordable effort should be made to provide appropriate facilities to visitors and educate them on how to dispose of human waste appropriately.

- ◆ Shoreline *fishing* may be acceptable along reservoirs and streams.
- ◆ *Horseback riding, and dogs and other pets*, if allowed access to drinking water supply lands, may cause contamination and erosion.
- ◆ *Hiking, nature study, bird watching, cross-country skiing, snow shoeing, hunting*, and other types of passive recreation may be suitable within a watershed.
- ◆ *Bicycle riding* may be acceptable in designated areas.

Keep in mind that conflicts may arise over the best uses of open space land and how much public access and recreational use should be allowed. Classifying the property and publicly clarifying why the land was acquired may help mitigate conflicts and guide management decisions.

#### **UNDERSTAND THE IMPACT OF AGRICULTURE**

Farmland and agricultural operations can pose unique challenges and opportunities. By purchasing a permanent conservation easement, a community may be able to meet multiple conservation goals of protecting its farming heritage, preventing development, and preserving water supply lands. Yet agricultural operations may generate unsafe levels of runoff from pesticides and animal waste. When considering a conservation easement, you should assess whether the resource can be sufficiently protected by an easement or if a fee interest is necessary. You should also encourage best management practices and public education to protect water supplies.

Through its voluntary Watershed Agricultural Program, the New York City Department of Environmental Protection (DEP) promotes best management practices to be used on agricultural land within its watersheds. The program is administered by the nonprofit farmer-led Watershed Agricultural Council, whose mission is to help farming and forestry

communities adopt best management practices for water quality protection and economic viability. This includes whole farm planning, forest management planning, executing conservation easement programs, and implementing forestry best management practices. For more information, refer to the Web at [www.nycwatershed.org](http://www.nycwatershed.org).

#### **RESTORE CONTAMINATED LAND**

Contamination can come from a variety of sources: agricultural waste, fertilizer and pesticide run-off, public usage, walking trails and motorized vehicle roadways, and other point and nonpoint sources of pollution. The majority of pollutant loads typically come from a few specific sub-basins or stream reaches where land management policies are impairing water quality. In urban watersheds, impervious surfaces increase runoff and can change the boundaries, shape, and sediment load of a stream; the restoration of streams degraded by past development and contamination may be essential. Depending on the body of water, this process may involve any of the following three types of stream restoration projects: storm water retrofitting, source control through pollution prevention, and stream enhancement. Costs associated with remedial activities can include infrastructure repair and replacement, flood control improvements, storm water management, and erosion control.<sup>88</sup> For a complete overview of watershed restoration techniques, refer to the CWP's article, "Assessing the Potential for Urban Watershed Restoration," [www.cwp.org](http://www.cwp.org).

#### **MONITOR AND MAINTAIN PROTECTED LAND**

Continuous monitoring of watershed lands is essential to the management of protected land. Data collected in earlier planning stages will allow you to understand the health of the land and assess the impact of your management practices over time. Such monitoring should be conducted on all major stream networks, allowing you to assess and target management efforts within subwatersheds. Monitoring may also be important to future land conservation efforts, giving you the information you need to maintain public and political support for the program. Refer to page 20 and 21 for more background on watershed monitoring.

## *Forge Land Management Partnerships*

Careful planning, budgeting, and funding, as well as strong technical expertise, are required to implement a plan for the long-term stewardship of lands surrounding drinking water sources. Federal and state agencies, neighboring municipalities, nonprofit land trusts, community groups, water utilities, and professional contractors can all help improve and manage watershed lands—often with impressive efficiency at a reasonable price. Connecticut's Department of Environmental Protection, Division of Forestry, for example, provides free technical advice and assistance to owners of forestland, including individuals, municipalities, and conservation groups. And their Cooperative Extension System has experts available in such areas as forestry stewardship, wildlife habitat management, and wetlands and water quality management. As mentioned earlier, if you are willing to consider public recreation, you can open the door to a much wider array of potential partners and funding sources.

Some of the most important partnerships are those that involve other governmental agencies—state, counties, cities and towns, and their various agencies. These partnerships may involve land-management agreements that protect jointly-owned county/town land. For example, in New Jersey, when property is jointly acquired, counties and townships often become partners—tenants-in-common. Both jurisdictions are listed on the deed and a management agreement or similar document is created that outlines management responsibilities.

Local land trusts can be particularly helpful with land management. Consider these benefits:

- ◆ Nonprofits can hire new management staff and contractors more quickly than a government agency
- ◆ Nonprofits are not governed by regulations that can slow the bidding process.
- ◆ The use of land trusts frees up a public agency's staff and funds
- ◆ Land trusts may be able to use their own land management staff and volunteers for new projects
- ◆ In some cases, the commitment to manage the land enables the trust to get it protected

Volunteers can also assist local governments with the management of the watershed land, helping with a variety of tasks that include watershed monitoring.

## *Fund Land Management*

Public ownership of watershed lands requires careful budgeting and planning. Many factors must be considered depending on the condition of the property, compatible uses, endangered species habitat, the type of protection (owned or under easement), local prices, and so on.

To come up with a land-management price tag, planners must understand the initial costs of stabilizing and improving a site, the day-to-day costs of managing the land, and the potential risks involved in owning a piece of property. Potential costs include surveying, resource evaluation, fencing (a potentially significant cost that may be shared with adjacent property owners), watershed monitoring, trash removal and equipment (more potentially costly items), building removal, and weed management. Public access presents a host of additional issues, such as installing and maintaining facilities and liability costs. Keep in mind that some costs may be optional or deferred, particularly if public access is not immediately planned.

The national nonprofit Center for Natural Lands Management has developed a computer program that analyzes the natural resource characteristics and stewardship needs of a property. The program determines management tasks and estimates costs of managing a piece of property. The software also considers issues such as potential liabilities, administrative costs, inflation, and contingency funds, while helping land managers carefully assess the purposes for which the land will be managed. The CNLM Web site is [www.cnlm.org](http://www.cnlm.org). Complete information about funding conservation easements can be found in the *Conservation Easement Handbook*, a publication of the Trust for Public Land and the Land Trust Alliance.

So how do you pay for land management, restoration, monitoring, liability, and other ongoing costs? Many communities dedicate management or maintenance funds, setting aside a percentage of the acquisition costs or establishing a permanent funding source. Typically, general obligation bonds, a common acquisition-funding source, may not be used to pay for ongoing maintenance and management costs. As a result, communities must make use of federal and state grants, local budget appropriations, or private funds for land management. Organizations and agencies also set aside

funds solely for monitoring and defending conservation easements. There are a variety of funding options: soliciting a cash contribution from the donor, raising money from other sources, and dedicating a percentage of each year's budget to a monitoring fund.

### CASE STUDY

#### *Manchester, New Hampshire*

The picturesque Lake Massabesic watershed provides drinking water to about 140,000 people in the Manchester area of southern New Hampshire. Supplementing the lake supply is an upland man-made impoundment known as Tower Hill Pond, which is located in the towns of Auburn and Candia. The flow of tap water and the management of watershed land is the primary responsibility of the Manchester Water Works, the state of New Hampshire's largest water utility, which has developed a land management plan that protects supplies while allowing for sustainable public access and recreation.

Of the 42-square mile watershed area, the Manchester Water Works owns about 13 square miles. Certain recreational activities have historically been permitted on this land, which is located just three miles from downtown Manchester. Balancing public access with stronger land stewardship controls was addressed in a public management planning process that began in 1999 when Manchester Water Works contracted a private consulting firm to conduct a watershed-wide assessment of Lake Massabesic. Manchester Water Works put forth a draft of the plan for public review and encouraged dialogue among local interested groups and community organizations, including the Audubon Society of New Hampshire and recreation groups representing the interests of horseback riders, mountain bikers, snow mobilers, and boaters. The result of the community-based planning process is a strong, balanced management plan that allows for regulated outdoor recreational activities (hiking, boating, biking, and fishing) within defined areas while ensuring a stable, high quality drinking water supply.

The input of the public and community groups did not end with the completion of the plan. Local groups have voluntarily supported the upkeep of natural areas—trails and bridges—and have offered innovative ideas to



## LAND MANAGEMENT PLANS

There are often multiple goals for the management of a piece of land—habitat protection, forest management, agricultural and grazing management—that must be balanced along with the protection of drinking supplies. Background information and a few links to water utilities that own and manage source land are provided here.

### **Massachusetts Department of Conservation and Recreation/Division of Water Supply Protection**

In Massachusetts, the Department of Conservation and Recreation Division of Water Supply Protection (DCR/DWSP) manages and protects the drinking water supply watersheds for nearly 2.2 million residents of Massachusetts, primarily in the greater Boston area. The Massachusetts Water Resources Authority handles distribution. Source waters include the Quabbin Reservoir, Ware River, and Wachusett Reservoir and their contributing watersheds. The DWSP also manages and protects the Sudbury Reservoir system, which is greater Boston's reserve drinking water supply.

DCR/DWSP continuously updates its comprehensive plans and monitors their implementation to maintain the quality of its drinking water. Printed copies of complete plans are available for review at libraries in the watershed region or Department of Conservation field offices. The Web site, [www.mass.gov/mdc/dwmpplans.htm](http://www.mass.gov/mdc/dwmpplans.htm), includes the following plans, along with those most recently updated:

- ◆ Wachusett Reservoir Watershed Protection Plan Update (2003)
- ◆ Ware River Land Management Plan (2003)
- ◆ Wachusett Reservoir Watershed Public Access Plan Update (2003)
- ◆ Sudbury Reservoir Watershed System Public Access Plan Update (2002)
- ◆ Wachusett Reservoir Land Management Plan (2001)
- ◆ Quabbin Reservoir and Ware River Watershed Protection Plan Update Executive Summary (2000)
- ◆ Ware River Watershed Access Plan Update (1999)

### **Seattle Public Utilities**

The Cedar River Watershed is a large natural area in the Cascade Mountains that drains the Cedar River. The watershed is used by the City of Seattle to provide two-thirds of the drinking water (municipal and industrial water) for about 1.3 million people in the Seattle metro area, and provides a system of locks and habitat for the spawning, hatching, and rearing of salmon.

The City of Seattle through Seattle Public Utilities owns all but a few acres of the 90,546-acre watershed. Over the years, the watershed has been used for a variety of “secondary” purposes, including public education, scientific research, limited recreation in some areas, and commercial timber harvest by former private landowners, the U.S. Forest Service, and the City.

To address the declining populations of salmon, steelhead, and other species of fish and wildlife, Seattle developed a Habitat Conservation Plan, as required by the Endangered Species Act. Included are provisions to establish an ecological reserve on about 64 percent of the land and manage the commercial harvest of timber on lands outside the preserve. For health, safety, and security reasons, the municipal watershed is closed to unsupervised public access.

The *Cedar River Watershed Habitat Conservation Plan* is available at [www.cityofseattle.net/util/CedarRiverHCP/](http://www.cityofseattle.net/util/CedarRiverHCP/).

### **Los Angeles Department of Water and Power**

The complex drinking water supply and delivery system for the city of Los Angeles is managed by the Los Angeles Department of Water and Power (LADWP), the nation's largest municipal utility. Of the 2.2 million acres of Eastern Sierra watershed land that supplies drinking water, the LADWP manages roughly 314,000 acres, primarily in the Owens Valley floor. (The rest is controlled by the U.S. Forest Service and the U.S. Bureau of Land Management).

The vast majority of these lands are undeveloped watershed with recreation and grazing comprising the main land uses. Nearly 80 percent of LADWP land is leased to cattle ranchers that use a combination of irrigated pastures and upland dry grazing for forage. Cultivated crops, mainly alfalfa, are also present but to a lesser extent. LADWP works with individual ranchers to develop ranch management plans that protect drinking water supplies and other natural resources while providing for sustainable agriculture. Best Management Practices are implemented to insure the existing land uses are compatible with maintaining a healthy watershed. Lease policies are set forth in *Range Management Guidelines for DWP Leased Lands*. LADWP's Web site is located at [www.ladwp.com](http://www.ladwp.com).

simultaneously protect water supplies and improve recreational opportunities. Watershed patrol officers employed by Manchester Water Works monitor the water department's watershed land, while educating the public and enforcing regulations. The water department also sponsors an annual science fair for fourth grade students in Manchester and surrounding communities. The event further educates today's generation about the importance of watershed protection and drinking water purity.

Management of the watershed also includes an active forestry program. Under the direction of a professional forester the Manchester Water Works annually harvests about 500,000 board feet of timber. The program is designed to ensure effective tree cover and root systems for the forest environment and promote controlled water retention and runoff, while generating a source of local income and timber supply.

To help pay for some of its ongoing source protection efforts, Manchester Water Works has received funds from the Drinking Water State Revolving Fund. Administered through NHDES, the funds have been used to help pay for the construction of a storm water retention pond, erosion and sediment controls, and for studies on urbanized areas of the watershed.

Contact: David Paris, Water Supply Administrator, Manchester Water Works, 603-624-6482

## CASE STUDY

### *Contra Costa Water District, California*

The Contra Costa Water District (CCWD), a county water district in San Francisco's East Bay Area, serves roughly 450,000 people and several major industries in central and eastern Contra Costa County and is one of the largest urban districts in California. Pulling drinking water from the Central Valley's Sacramento-San Joaquin Delta that lies to the east, CCWD has experienced challenges with water quality and quantity for years: high salinity levels caused by tidal influences of the Bay and the export of freshwater to the San Joaquin Valley and Southern California; reduced flows caused by upstream agricultural water uses; water quality degradation resulting from drainage and discharges from upstream agricultural lands and urban areas; and the demands of population growth and agricultural uses that have taxed supplies.

CCWD took an important step in improving drinking water quality by initiating a major reservoir project in the 1980's, thereby creating a system to store supplies and better regulate the quality of water delivered to its customers. Voters backed them up by approving a ballot measure in 1988 authorizing CCWD to issue revenue bonds to construct the Los Vaqueros Reservoir. CCWD subsequently acquired more than 19,000 acres of watershed land and completed the \$450 million project. The Project, including the land, is owned entirely by the CCWD.

The Contra Costa Water District has worked to balance the high demand for public recreation, grazing uses, and source water protection on its watershed land surrounding the Los Vaqueros Reservoir. CCWD adopted a comprehensive public recreation plan in 1998, following a seven-year planning and public outreach process. The watershed offers hiking and multi-use trails, picnic facilities, fishing, an interpretive center, and boating. The 55-mile regional trail system was constructed and made available to the public in December 1999. Public access is well organized and activities are strictly controlled, allowing, for instance, only electric-powered boats owned and maintained by CCWD. CCWD has placed 10 professional staff on-site on the watershed to protect and care for these resources. A law enforcement contract with the County Sheriff assures compliance with rules and regulations and recreational fees established to protect water quality and the natural and cultural resources on the watershed.

CCWD's investment in safe and responsible public recreation extends beyond the Los Vaqueros Reservoir to a Central Valley Project (CVP) facility operated by CCWD. The district invested \$2.2 million into a swimming lagoon at Contra Loma Reservoir to protect the water supply from fecal coliform contamination resulting from body-contact recreation while still meeting the recreational needs of the public—and made the water safer to swim in at the same time.

In 1999, soon after the completion of the recreation plan, a comprehensive Resources Management Plan for Los Vaqueros became final, outlining watershed management policies for recreation, biological resources, cultural resources, fire management, and water quality monitoring. One important element of the plan is that it requires continuation of historically allowed agricultural grazing in the water-

shed but in a manner that meets strict resource management guidelines to protect water quality and endangered species habitat. For instance, the reservoir and all wetlands and major riparian corridors have been outfenced to provide important habitat buffers for several species such as red-legged frogs, tiger salamanders and western pond turtles. In total, there are close to a thousand acres of out-fenced buffer to exclude grazing animals at times and to allow their short-term use within the buffer when necessary to conserve riparian and associated upland habitats. In compliance with state and federal Endangered Species Acts, critical habitats are provided for the California Kit Fox, Alameda Striped Racer, Red-Legged Frog, Tiger Salamander, Vernal Pool Species, various Raptors, Alkali Plants and other candidate and locally rare species of concern. CCWD conducts long-term monitoring and reporting for all of these species on a quarterly and annual basis. The environmental compliance program also includes Integrated Pest Management of noxious animals and plants and a predator control program for species that prey on protected animals.

In all, CCWD grazes 65 percent of the rangelands on the watershed utilizing cattle on 10,000 acres and sheep on 1,570 acres. Approximately 50 percent of the lease revenue is used to support rangeland improvements in ways that optimize agricultural production while enhancing the habitat for protected and unprotected animals and plants. Grazing these 11,570 acres is necessary to meet federal requirements for kit fox, tiger salamanders, burrowing owls and golden eagles and it is also necessary to meet fire hazard reduction requirements. Sheep are used in cultural resource areas of significance, along roadsides to eliminate the use of herbicides and in areas where fencing is not desirable. Sheep are carefully controlled by on-site herders using temporary electric fences and sheep dogs. Routine water quality monitoring of the reservoir and its key tributaries indicates that all contaminants of concern at Los Vaqueros have been eliminated or reduced to trace amounts that are of no concern to drinking water quality.<sup>89</sup>

Contact: Robert Nuzum, Watershed and Lands Department, Contra Costa Water District, 925-688-8028, nuzum@ccwater.com

## WRAP-UP

### MANAGE PROTECTED LANDS

#### Questions to Consider:

- ◆ What tools can you use to promote responsible land stewardship on privately owned source lands? Can you combine outreach, education, and technical assistance with financial incentives?
- ◆ What are the goals and appropriate uses of publicly protected property, and how can defined objectives best be reached?
- ◆ How can you evaluate and manage competing demands for the land?
- ◆ What steps must you take to immediately protect acquired property?
- ◆ What are the long-term considerations, costs, and management issues for the property? Is restoration of contaminated land part of the picture?
- ◆ How will you pay for land management, restoration, monitoring, liability, and other ongoing costs?







## CONCLUSION: MOVING TOWARD SUCCESS

Assuring drinking water quality in the long term will depend in great measure on the quality of land in the watershed. Conservation of watersheds and aquifers will increasingly be used as a tool for water managers to reduce treatment costs and control land-use activities for water quality protection. This is particularly critical in areas of high growth, where development of source lands—nature’s water filters—threatens the quality and quantity of clean, fresh drinking water.

The conservation of source lands must become an integral part of a multiple-barrier approach to protecting drinking water supplies that includes filtration, treatment, and distribution system integrity. The potential benefits are considerable: the protection of watershed and aquifer recharge lands can protect public health, lower treatment costs, ensure consumer confidence, and maintain community character and quality of life.

Successful source protection initiatives require the coordination and cooperation of public agencies at the federal, state, regional, and local levels, as well as nonprofit organizations and private stakeholders. Partnerships are flourishing in many areas, as renewed federal emphasis on source protection is being met with increasingly integrated state and local initiatives. The completion of state assessments required through the federal Source Water Assessment Program (SWAP) marks a pivotal point in these efforts: though not federally mandated or funded, states such as Washington, Georgia, and Connecticut are demonstrating continued commitment to their source protection programs, while others, like Massachusetts and New Jersey, have proposed new funding for implementation. At the organization level, groups such as the American Association of Drinking Water Suppliers (AADWS) and the American Water Works Association (AWWA) provide valuable technical support and training. The AWWA Source Water Protection Symposium, for instance, brings

together experts in the field to address the latest developments, learn new strategies, and build partnerships.

Still, it is ultimately a local responsibility to provide drinking water that meets federal and state standards; comprehensive and sustained planning, funding, and acquisition efforts at the local level are essential. The process is multi-faceted: success requires intensive planning, strong local leadership, public-private partnerships, and considerable resources. Municipalities and water suppliers are increasingly taking a leadership role in promoting watershed planning, advocating source protection, and showing the benefits of a multiple barrier approach. It’s an involved and evolving undertaking, but an important step for source water protection. The good news is that land conservation organizations and planners are becoming partners and further exploring why and how to use land conservation as a fundamental source protection tool.

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# Glossary

**Aquifer**

An underground layer of rock, gravel, or sediment containing water. An aquifer may be confined between two impervious surfaces, or it may be unconfined.

**Ballot Measure**

When voters are presented with a piece of legislation to approve that will create funding for public initiatives, such as land conservation. The vast majority of ballot measures are so-called "referenda," which are referred by a legislature (county commission, city council, town meeting, etc.). There are a handful of "initiatives" that are initiated by ballot measure proponents, bypassing the legislature.

**Best Management Practices (BMPs)**

Regulatory or voluntary procedures that can reduce the threat to water supplies posed by normal activities in homes, businesses, or farms.

**Emerging Contaminants**

Diseases or chemicals that either are new to the environment or have been recently identified as potential health threats.

**Fee Simple Ownership**

The acquisition or donation of full title to land and all rights associated with land.

**GIS Mapping and Modeling**

Tools that enhance geography-related decision making. Maps and models are created from spatial and attribute data, and they are housed in a computerized Geographic Information System (GIS)

**Nonpoint Source Pollution**

Pollution that occurs when surface water runoff from rainfall or snowmelt moves

across or into the ground, picking up pollutants and carrying them into streams, lakes, wetlands, or groundwater.

**Pathogen**

Any microbiological agent capable of producing disease in healthy peoples, plants or animals.

**Physical, Chemical and Biological Monitoring**

Three measurable components of water quality monitoring: Physical measurements may include temperature, flow, water color, and the condition of streambanks and lakeshores. Dissolved oxygen, suspended sediments, nutrients, metals, oils, and pesticides are examples of chemical measurements. The abundance and variety of aquatic plant and animal life are biological measurements.

**Point Source Pollution**

Pollution from a distinct, identifiable source, such as a feedlot or factory.

**Purchase of Development Rights (PDR) and Conservation Easements**

Agreement in which the residential, commercial, or industrial development rights of a particular parcel are transferred from landowner(s) to a different party, usually a nonprofit or governmental entity. In most cases, PDR and conservation easement are interchangeable terms.

**Riparian Zones**

Vegetated areas abutting lakes, rivers, and streams that function as filters for polluted runoff, stabilize banks and channels, and provide habitat for fish and wildlife.

**Source Water Assessment Program**

A 1996 amendment to the Safe Drinking Water Act requiring every state to examine



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existing and potential threats to the quality of all public water supplies by delineating source areas, inventorying potential contamination sources, determining the susceptibility of the water supply to contamination, and making the results public.

**Total Maximum Daily Load (TMDL)**

The amount of a particular pollutant that a stream, lake, estuary, or other body of water can contain without violating state water quality standards.

**Zoning**

Land use regulations that can be used to control the types of development allowed in a particular area.

# Resources

This listing is a compilation of the resources and Web links highlighted throughout the report.

## Making the Case

**Protecting the Source: Land Conservation and the Future of America's Drinking Water.** Published by the Trust for Public Land, this report provides the economic, public health, and environmental justifications for using land conservation as a source protection strategy, and provides a set of best practices and case studies to guide implementation in the field. Protecting the Source is the companion publication to the Source Protection Handbook and is available for free download or to order on TPL's Web site at [www.tpl.org/publications](http://www.tpl.org/publications).

## Understand Your Watershed

**Source Protection Contact** information for state source water and EPA's regional source water representatives is available at [www.epa.gov/safewater/protect/contacts.html](http://www.epa.gov/safewater/protect/contacts.html).

**EPA's Watershed Academy** Web site offers a variety of self-paced training modules that represent a basic and broad introduction to the watershed management field. [www.epa.gov/watertrain/monitoring/](http://www.epa.gov/watertrain/monitoring/)

**EPA's Surf Your Watershed** Web site helps you locate, use, and share environmental information about your state and watershed. The site includes a database containing hundreds of links to environmental resources that can help you assess the condition of your watershed. [www.epa.gov/surf/](http://www.epa.gov/surf/)

**EPA's WATERS** (Watershed Assessment, Tracking, and Environmental Results) database unites previously unavailable water quality information in the form of maps and reports. [www.epa.gov/waters/](http://www.epa.gov/waters/)

**Elements of a State Water Monitoring and Assessment Program** is an EPA guide that recommends ten basic elements of a holistic, comprehensive water quality management and monitoring program. [www.epa.gov/owow/monitoring/repguid.html](http://www.epa.gov/owow/monitoring/repguid.html)

**Community Watershed Assessment Handbook**, by the Chesapeake Bay Program, is designed to help Chesapeake Bay community groups and local governments conduct comprehensive environmental assessments of their watersheds. [www.chesapeakebay.net/pubs/watershed.assess/index.htm](http://www.chesapeakebay.net/pubs/watershed.assess/index.htm)

**EPA's State Source Water Assessment Program** description is available on the Web, along with links to individual state SWAP Web pages, state source water contacts, and potential federal funding sources. [www.epa.gov/safewater/protect/swap.html](http://www.epa.gov/safewater/protect/swap.html)

## Prioritize Land for Protection

**Using Technology to Conduct a Contaminant Source Inventory: A Primer for Small Communities.** Published by The Groundwater Foundation, the report outlines the use of Geographic Information Systems as a means to map threats to source water. [www.groundwater.org](http://www.groundwater.org)



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**Source Water Assessment Using Geographic Information Systems** is an EPA publication designed to help states, municipalities, and water suppliers use GIS to assess water supplies. The report covers GIS concepts and components, data software and hardware, and how to obtain data, build the GIS database, delineate source protection areas, and analyze the results. The publication can be ordered at [www.epa.gov/ORD/NRMRL/wswrd/gis.htm](http://www.epa.gov/ORD/NRMRL/wswrd/gis.htm).

**ESRI** is the leading provider of GIS (geographic information system) software and technology. ArcGIS is an integrated collection of GIS software products for building a complete GIS. [www.esri.com](http://www.esri.com)

**CommunityViz** is the leading software provider in the market of scenario building tools, offering decision support software products optimized for ESRI ArcGIS. ArcGIS is an integrated collection of GIS software products for building a complete GIS. [www.communityviz.com](http://www.communityviz.com)

## Design a Comprehensive Source Protection Plan

**Source Water Protection: Best Management Practices and Other Measures for Protecting Drinking Water Supplies.** Developed through EPA's Drinking Water Academy, this training manual provides information on source water contamination prevention measures to technical assistance providers. [www.epa.gov/watertrain/pdf/swpbmp.pdf](http://www.epa.gov/watertrain/pdf/swpbmp.pdf)

**Source Protection: A Guidance Manual for Small Surface Water Supplies in New England.** Published by EPA in partnership with the New England Interstate Water Pollution Control Commission, the report includes descriptions of new SDWA programs, source protection case studies, information on pollutants and their sources, funding and implementation assistance, and source protection planning. [www.epa.gov/safewater/protect/watersys.html](http://www.epa.gov/safewater/protect/watersys.html)



**Source Water Protection: A Guidebook for Local Governments**, by the National Association of Counties, helps local governments ascertain how to protect surface and ground water sources for drinking water supplies, with information on federal source protection requirements, why source protection is important, what the threats are to source waters, and the actions that can be taken to prevent or minimize threats. [www.naco.org](http://www.naco.org)

**Leadership in Watershed Management: The County Role**. Distributed by the National Association of Counties, this publication describes how counties can take a leadership role in watershed management. The report offers extensive case studies to guide implementation. [www.naco.org](http://www.naco.org)

### Finance Land Protection

**EPA's Catalog of Federal Funding Sources for Watershed Protection** is a searchable database with details on all federal funding sources that can be used for any aspect of watershed protection or management. <http://cfpub.epa.gov/fed-fund/>

**EPA's Clean Water State Revolving Fund** ([www.epa.gov/owm/cwfinance/index.htm](http://www.epa.gov/owm/cwfinance/index.htm)) and **Drinking Water State Revolving Fund** ([www.epa.gov/safewater/dwsrf.html](http://www.epa.gov/safewater/dwsrf.html)) Web sites provide detailed information on how to protect drinking water sources with state revolving funds.

**Conservation Finance Handbook**, by the Trust for Public Land's conservation finance experts, is a handbook for communities seeking to raise conservation funds at the ballot box—from initial demographic research to post election analysis. [www.tpl.org/publications](http://www.tpl.org/publications)

**TPL's Federal Programs Web page** provides detailed information on federal funding sources for land acquisition. [www.tpl.org](http://www.tpl.org)

**TPL's Conservation Finance Web page** provides detailed information on state funding sources for land acquisition. [www.tpl.org](http://www.tpl.org)

### Protect Priority Lands

**Doing Deals: A Guide to Buying Land for Conservation**. Published by the Trust for Public Land and Land Trust Alliance, this book is a detailed guide to land protection techniques and strategies, including information on working with landowners, surveys, appraisals, working with government agencies and negotiating. [www.lta.org](http://www.lta.org)

### Manage Protected Lands

**Conservation Easement Handbook**, an update of the 1988 original, will be published by the Trust for Public Land and the Land Trust Alliance in 2005. This new edition is the definitive practical and technical resource on conservation easements and best practices for their use. The use of conservation easements has evolved to address a wide array of landscapes, and this handbook will assist conservation professionals with navigating the legal complexities of their protection efforts. This publication will be available at [www.tpl.org/publications](http://www.tpl.org/publications)

**The Center for Watershed Protection's Stewardship Web site** outlines a six-point program to promote effective watershed stewardship, providing local governments, activists, and watershed groups with technical tools and support. [www.cwp.org/stewardship.htm](http://www.cwp.org/stewardship.htm)

- <sup>1</sup> *Source Water 2000: Drinking Water Protection Strategies for Small Towns and Rural Communities*, National Association of Towns and Townships, [www.natat.org/ncsc/Pubs/Source%20Water/source\\_water\\_2000.htm](http://www.natat.org/ncsc/Pubs/Source%20Water/source_water_2000.htm), p. 20.
- <sup>2</sup> *Action Guide for Source Water Funding: Small Town and Rural County Strategies for Protecting Critical Water Supplies*, National Association of Towns and Townships, [www.natat.org/ncsc/Pubs/Source%20Water/Action\\_Guide\\_intro.htm](http://www.natat.org/ncsc/Pubs/Source%20Water/Action_Guide_intro.htm), p. 6.
- <sup>3</sup> U.S. Environmental Protection Agency, *Drinking Water Source Protection Programs*, “Source Water Protection: Best Management Practices and Other Measures for Protecting Drinking Water Supplies,” [www.epa.gov/ogwdwooo/dwa/electronic/swp/swp.pdf](http://www.epa.gov/ogwdwooo/dwa/electronic/swp/swp.pdf), p. 1-8.
- <sup>4</sup> Trust for Public Land’s *Protecting the Source: Land Conservation and the Future of America’s Drinking Water*. [www.tpl.org](http://www.tpl.org).
- <sup>5</sup> *American Water Works Association Journal*, reporting on the results of a 1991 study by the American Water Works Association Research Foundation (Denver: American Water Works Association Research Foundation, 1991).
- <sup>6</sup> “The Safe Drinking Water Act,” U.S. Environmental Protection Agency, [www.epa.gov/safewater/sdwa/sdwa.html](http://www.epa.gov/safewater/sdwa/sdwa.html).
- <sup>7</sup> *Source Water 2000*, p. 23.
- <sup>8</sup> “Community Involvement in Drinking Water Source Assessments”, US Environmental Protection Agency, [www.epa.gov/safewater/protect/factsh4.html](http://www.epa.gov/safewater/protect/factsh4.html).
- <sup>9</sup> This number is anecdotal, based on TPL’s knowledge of source protection initiatives around the country. However, AWWA and EPA define mid-sized source areas in their water supplier surveys as ranging in size from 100,000 to 300,000 acres.
- <sup>10</sup> It is also important to understand the limitations of GIS mapping, including somewhat limited availability and varying degrees of scale and accuracy.
- <sup>11</sup> “Watershed Assessment Overview,” Center for Watershed Protection, [www.cwp.org/tools\\_assessment.htm](http://www.cwp.org/tools_assessment.htm).
- <sup>12</sup> “Overview of Watershed Monitoring,” U.S. Environmental Protection Agency, Watershed Academy Web, [www.epa.gov/watertrain/monitoring/](http://www.epa.gov/watertrain/monitoring/).
- <sup>13</sup> *Elements of a State Water Monitoring and Assessment Program*, U.S. Environmental Protection Agency, Assessment and Watershed Protection Division, Office of Wetlands, Oceans and Watershed; March 2003, [www.epa.gov/owow/monitoring/repguid.html](http://www.epa.gov/owow/monitoring/repguid.html).
- <sup>14</sup> Joel Salter, Water Programs Coordinator, U.S. Environmental Protection Agency, Region 10 (Personal communication, May 11, 2002).
- <sup>15</sup> Portland Water Bureau, [www.portlandonline.com/water/index.cfm?c=29459](http://www.portlandonline.com/water/index.cfm?c=29459).
- <sup>16</sup> *2002 Water Quality Report*, Portland Bureau of Water Works, <http://www.portlandonline.com/water/index.cfm?c=29814>.
- <sup>17</sup> Portland Water Bureau, [www.portlandonline.com/water/index.cfm?c=29817](http://www.portlandonline.com/water/index.cfm?c=29817).
- <sup>18</sup> Paul K. Barten, Avril L. de la Cretax, Matthew J. Donzella, and Yanli Zhang, “Protecting the Source: An Overview of Modeling Methods,” Trust for Public Land, May 23, 2002, p 1.
- <sup>19</sup> Paul Barten, et al, 2003a. “Land conservation for source water protection: Mapping, assessment, and implementation.” Proc. International Congress on Watershed Management for Water Supply Systems, M.J. Pfeffer, D. van Abs, and K.N. Brooks (Editors), New York, NY, July 2003, American Water Resources Association.
- <sup>20</sup> Recent papers by Barten and Ernst (2004) and Barten and others (2003) describe the adaptation and application of this GIS method on four pilot sites in the eastern U.S. as part of an EPA-funded source water protection project. Detailed reports and background information can be found on the TPL Web site (Box 1 and de la Crétaz et al. 2004).

- <sup>21</sup> Avril L. de la Crétaz, Yanli Zhang, et al. 2004. "Protecting the Source: A Guide to Database Compilation and GIS-Based Watershed Assessment Methods (v. 1)", University of Massachusetts-US Forest Service Watershed Exchange and Technology Partnership in cooperation with the Massachusetts Department of Conservation and Recreation, Amherst, MA.
- <sup>22</sup> Paul K. Barten, and Caryn Ernst., 2004. "Land Conservation and Watershed Management for Source Protection." *Journal of American Water Works Association* 96(4):121-135.
- <sup>23</sup> Paul K. Barten, Yanli Zhang, and Avril L. de la Cretaza, 2003, "Conservation, Restoration, and Stormwater Management Priorities for Source Water Protection in the Metedeconk River Watershed, New Jersey: Map Set for Supplemental Report," 15 pp.
- <sup>24</sup> Paul K. Barten Yanli Zhang, and Avril L. de la Crétaz, 2003b, "Conservation, Restoration, and Stormwater Management Priorities for Source Water Protection in the Nissitissit and Squanacook River Watersheds, Massachusetts and New Hampshire: Supplemental Analyses for the Stewardship Exchange and Implementation Phase," 40 pp.
- <sup>25</sup> Avril L. de la Crétaz, Yanli Zhang, David Kimball, Nathanael Lloyd, and Paul K. Barten, "Protecting the Source: A Guide to Database Compilation and GIS-Based Watershed Assessment Methods (Version 1)." University of Massachusetts and U.S. Forest Service, Watershed Exchange and Technology Partnership, in cooperation with the University of Massachusetts Department of Conservation and Recreation.
- <sup>26</sup> Nitrogen is removed by small streams at a rate of about 8 percent per kilometer of stream length, compared with a rate of less than 1 percent per kilometer for large streams. "Support of Total Maximum Daily Load Program Using Spatially Referenced Regression Models," Gerard McMahon, Richard Alexander, and Song Qian, *Journal of Water Resources Planning and management*, July/ August 2003, p. 322.
- <sup>27</sup> Bruce Peterson, et al, "Control of Nitrogen Export from Watersheds by Headwater Streams," *Science*, Washington, vol. 292, no. 5514, pp. 86-90, April 6, 2001.
- <sup>28</sup> D.A. Levy, et al, "Drinking Water from Forests and Grasslands," taken from "Surveillance for Waterborne-disease Outbreaks—United States, *Morbidity and Mortality Weekly Report*, 47(ss-5); 1-34, p. 63.
- <sup>29</sup> "Riparian Areas: Functions and Strategies for Management", Water Science and Technology Board, Board on Environmental Studies and Toxicology, National Academy of Sciences, 2004, [books.nap.edu/books/0309082951/html/index.html](http://books.nap.edu/books/0309082951/html/index.html).
- <sup>30</sup> "Buffer Strips: Common Sense Conservation," Natural Resources Conservation Service, United States Department of Agriculture, [www.nrcs.usda.gov/feature/ Buffers.html](http://www.nrcs.usda.gov/feature/Buffers.html).
- <sup>31</sup> Edward Atill, et al, "Efficacy of vegetative buffer strips for removal of amphixenotic *Cryptosporidium parvum* from runoff of dairies and grazed agricultural land," Veterinary Medicine Teaching and Research Center, School of Veterinary Medicine, University of California-Davis, Tulare, CA 93274, Department of Land, Air, and Water Resources, University of California-Davis, CA 95616; Department of Agronomy and Range Science, Univeristy of California-Davis, CA 95616.
- <sup>32</sup> James Sedell et al, *Water and the Forest Service*, USDA Forest Service, Washington Office, FS-660, January 2000, p. i.
- <sup>33</sup> W. T. Swank and P.V. Bolstad, "Cumulative Impacts of Land use on Water Quality in a Southern Appalachian Watershed," *Journal of the American Water Resources Association*, Vol. 33, No. 3, June 1997.
- <sup>34</sup> Trust for Public Land Water Supply Survey.
- <sup>35</sup> S.W. Golladay, J.R. Webster, "Catchment Disturbance and Stream Response: An Overview of Stream Research at Coweeta Hydrologic Laboratory," J.R. Webster, et al, *River Conservation and Management*, 1992; E.F. Benfield, "Changes in stream morphology and storm transport of seston following watershed disturbance," *Journal of North American Benthological Society* (6):1-11, 1987.
- <sup>36</sup> J.R. Webster, and E.F. Benfield, "Changes in stream morphology and storm transport of seston following watershed disturbance," S.W. Golladay, *Journal of North American Benthological Society* (6):1-11, 1987.
- <sup>37</sup> Defined as an ecosystem in which water is either at the surface or within the root zone, with hydric soils and where the vegetation is adapted to or tolerant of saturated soils.
- <sup>38</sup> *Tools for Watershed Protection*, p. 5-18
- <sup>39</sup> US Fish and Wildlife Service, Report to Congress on the Status and Trends of the Wetlands in the Coterminous United States, 1986 to 1997, Summary of Findings, [wetlands.fws.gov/bha/SandT/SandTSummaryFindings.html](http://wetlands.fws.gov/bha/SandT/SandTSummaryFindings.html).
- <sup>40</sup> Ibid.

- 41 United States Congress, *Federal Incentives Could Help Promote Land Use that Protects Air and Water Quality*, (United States General Accounting Office, Report to Congressional Requesters, 2001) GAO-02-12.
- 42 James Sedell et al., *Water and the Forest Service*, USDA Forest Service, Washington Office, FS-660, January 2000, p. 10.
- 43 Caryn E. Ernst, "Upper Little Tallapoosa River Watershed, Source Water Stewardship Exchange Team Report," Trust for Public Land, April 2002, pp. 2-9, [http://www.tpl.org/tier3\\_cd.cfm?content\\_item\\_id=11586&folder\\_id=249](http://www.tpl.org/tier3_cd.cfm?content_item_id=11586&folder_id=249).
- 44 Watershed Management Professional Program, Executive Leadership Institute; [www.eli.pdx.edu/watershed/law\\_policy.html](http://www.eli.pdx.edu/watershed/law_policy.html).
- 45 Peter F. Ffolliott, Malchus B. Baker, Jr., Carleton B. Edminster, Madelyn C. Dillon, Karen L. Mora, "Land Stewardship through Watershed Management; Perspectives for the 21st Century" (New York: Kluwer Academic/Plenum Publishers, 2002), p. 54.
- 46 "Safe Drinking Water Focus of Wellhead Protection Program," *The Plans Examiner*, City of Portland Bureau of Development Services, November 2002, p. 4.
- 47 The Columbia South Shore Well Field Wellhead Protection Program, Portland Water Bureau, [www.portlandonline.com/water/index.cfm?c=29890](http://www.portlandonline.com/water/index.cfm?c=29890).
- 48 "Portland, OR Moves to Protect Water Reserves," *WaterTech Online*, June 26, 2003, [waternet.com/news.asp?mode=4&N\\_ID=41327](http://waternet.com/news.asp?mode=4&N_ID=41327), as originally reported by *The Oregonian*.
- 49 "The Report on the Setting of the Raritan Basin," Raritan Basin Watershed Management Project Fact Sheet #1, [www.raritanbasin.org/education.htm#Public%20Opinion%20Survey](http://www.raritanbasin.org/education.htm#Public%20Opinion%20Survey).
- 50 "Raritan Basin Watershed Planning Underway," New Jersey Department of Environmental Protection News Release, October 26, 2000, [www.state.nj.us/dep/newsrel/releases/00\\_0125.htm](http://www.state.nj.us/dep/newsrel/releases/00_0125.htm).
- 51 "Raritan Basin Watershed Management Plan," December 2003, [www.raritanbasin.org](http://www.raritanbasin.org)
- 52 "Watershed Management for the Raritan River Basin, General Scope of Work, Phase 2," submitted by the New Jersey Water Supply Authority, September 2000, p. 6.
- 53 "Central New Jersey Survey Finds High Support for Water Quality Improvements," New Jersey Department of Environmental Protection New Release, January 10, 2002, pg. 1. The survey was conducted on behalf of the New Jersey Water Supply Authority by Technometrics. A total of 801 residents were surveyed; the margin of error is +/- 3.5 percent.
- 54 Daniel J. Van Abs, "Raritan Basin Targeted Watershed Grants: Update on the First Year," *Watershed Update*, American Water Resources Association Technical Committee, Volume 2, No. 2, March-April 2004, pp 1-3.
- 55 Steven Ainsworth, U.S. Environmental Protection Agency, *Source Water Protection, Best Management Practices and Other Measures for Protecting Drinking Water Supplies*, August 2002, [www.epa.gov/safewater/dwa/electronic/presentations/swp/swpbmp.pdf](http://www.epa.gov/safewater/dwa/electronic/presentations/swp/swpbmp.pdf), p. 46.
- 56 Ibid.
- 57 *Source Protection: A National Guidance Manual for Surface Water Supplies*, New England Interstate Water Pollution Control Commission, 2000, p. 30.
- 58 National Pollutant Discharge Elimination System, Storm Water Program summary, U.S. Environmental Protection Agency, [http://cfpub1.epa.gov/npdes/home.cfm?program\\_id=45](http://cfpub1.epa.gov/npdes/home.cfm?program_id=45).
- 59 *Source Water Protection: Best Management Practices and Other Measures for Protecting Drinking Water Supplies*, p. 1-36
- 60 Richard M. Stapleton, *Protecting the Source* (San Francisco, The Trust for Public Land, 1997).
- 61 Land Use Effects of Water Quality, Institute of Water Research, 1997, [www.iwr.msu.edu/edmodule/water/luwqual.htm](http://www.iwr.msu.edu/edmodule/water/luwqual.htm).
- 62 Ibid.
- 63 U.S. Environmental Protection Agency, Source Water Protection, case study, [www.epa.gov/safewater/protect/casesty/merrimack.html](http://www.epa.gov/safewater/protect/casesty/merrimack.html).
- 64 Developing a Local Wellhead Protection Plan, Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program, November 2001, p. 1.
- 65 U.S. Environmental Protection Agency, Source Water Protection, case study, [www.epa.gov/safewater/protect/casesty/merrimack.html](http://www.epa.gov/safewater/protect/casesty/merrimack.html).
- 66 Phyllis Myers, *GreenSense*, (Boston: Trust for Public Land, Spring 1997).
- 67 Janice Kaspersen, "The Stormwater Utility:

- Will It Work in Your Community?" *Stormwater: The Journal for Surface Water Quality Professionals*, 2001, [www.forester.net/sw\\_0011\\_utility.html](http://www.forester.net/sw_0011_utility.html).
- 68 LandVote 2002 (Boston and Washington D.C.: Trust for Public Land and Land Trust Alliance, 2003), p. 1.
- 69 Poll conducted for the Trust for Public Land and the Nature Conservancy by Fairbank, Maslin, Maullin & Associates and Public Opinion Strategies. A total of 1,500 registered voters were tested in April 2004 for a margin of error of +/- 3.5 percent.
- 70 Steven Glazer, LandVote 2001 (Boston and Washington D.C.: Trust for Public Land and Land Trust Alliance, 2002), pp. 16-17.
- 71 Steven Glazer, pp. 16-17.
- 72 Salt Lake City Department of Public Utilities, Wasatch Front Watershed, [www.slcgov.com/Utilities/watershed/default.htm](http://www.slcgov.com/Utilities/watershed/default.htm).
- 73 Dennis Romboy, "Don't Frolic in Water – Its for Drinking," *Deseret Morning News*, September 25, 2003, <http://deseretnews.com/dn/view/0,1249,515034299,00.html>.
- 74 "Protecting Drinking Water with the Clean Water State Revolving Fund," U.S. Environmental Protection Agency, <http://www.epa.gov/owmitnet/cwfinance/cwsrf/cwsrf8.pdf>.
- 75 "Funding Brownfield Remediation with the Clean Water State Revolving Fund," US Environmental Protection Agency, EPA 832-F-98-006, October 1998.
- 76 Robert H. Ramharter, "Wisconsin's Land Recycling Program: Using the Clean Water State Revolving Fund for Brownfield Remediation," [www.brownfields2002.org/proceedings2002/PDFS/Bo3%20RAMHARTER.pdf](http://www.brownfields2002.org/proceedings2002/PDFS/Bo3%20RAMHARTER.pdf).
- 77 Becky Johnson, "Watershed Logging Potential Creates a Stir," *Smoky Mountain News*, May 5, 2004, [www.smokymountainnews.com/issues/05\\_04/05\\_05\\_04/fr\\_watershed\\_logging.html](http://www.smokymountainnews.com/issues/05_04/05_05_04/fr_watershed_logging.html).
- 78 Jon Ostendorff, "Waynesville Leaders Delay Vote on Watershed," *Citizen-Times*, April 29, 2004, [http://cgi.citizen-times.com/cgi-bin/story/haywood\\_news/54060](http://cgi.citizen-times.com/cgi-bin/story/haywood_news/54060).
- 79 Clean Water Management Trust Fund, Board of Trustees Meeting Agenda, January 12, 2004, [www.cwmtf.net/january04agenda.htm](http://www.cwmtf.net/january04agenda.htm).
- 80 *Source Water Protection, Best Management Practices and Other Measures for Protecting Drinking Water Supplies*, U.S. Environmental Protection Agency, [www.epa.gov/watertrain/stepstonesourcebmp.html](http://www.epa.gov/watertrain/stepstonesourcebmp.html).
- 81 "Watershed Stewardship," Center for Watershed Protection, [www.cwp.org/stewardship.htm](http://www.cwp.org/stewardship.htm). Additional information is available in Article 27, The Tools of Watershed Protection, from CWP's The Rapid Watershed Planning Handbook.
- 82 R. Claytor, "Assessing the Potential for Urban Watershed Restoration," *Watershed Protection Techniques, Center for Watershed Management*, 1995. 1(4): 166-172.
- 83 *Source Water Protection, Best Management Practices and Other Measures for Protecting Drinking Water Supplies*.
- 84 "Metropolitan District Commission, Division of Watershed Management, Public Access Plan Update," Wachusett Resource Watershed, 2003.
- 85 Miriam Ibarra and Wayne C. Zipperer, *Drinking Water from Forests and Grasslands, A Synthesis of the Scientific Literature*, George E. Sissmyer, Ed., USDA Forest Service, Southern Research Center, General Technical Report, SRS-39, p. 78; David Cole, *Drinking Water from Forests*, p. 81.
- 86 Ibid.
- 87 Metropolitan District Commission, Division of Watershed Management, Public Access Plan Update; Wachusett Resource Watershed, 2003.
- 88 J. Craig Fischenich, "Technologies for Urban Stream Restoration and Watershed Management," *Ecosystem Management and Restoration, Technology News* from the Ecosystem Management and Restoration Research Program, May 2001, p. 4.
- 89 Contra Costa County, California, U.S. Environmental Protection Agency, [www.epa.gov/safe-water/protect/casesty/contracosta.html](http://www.epa.gov/safe-water/protect/casesty/contracosta.html).