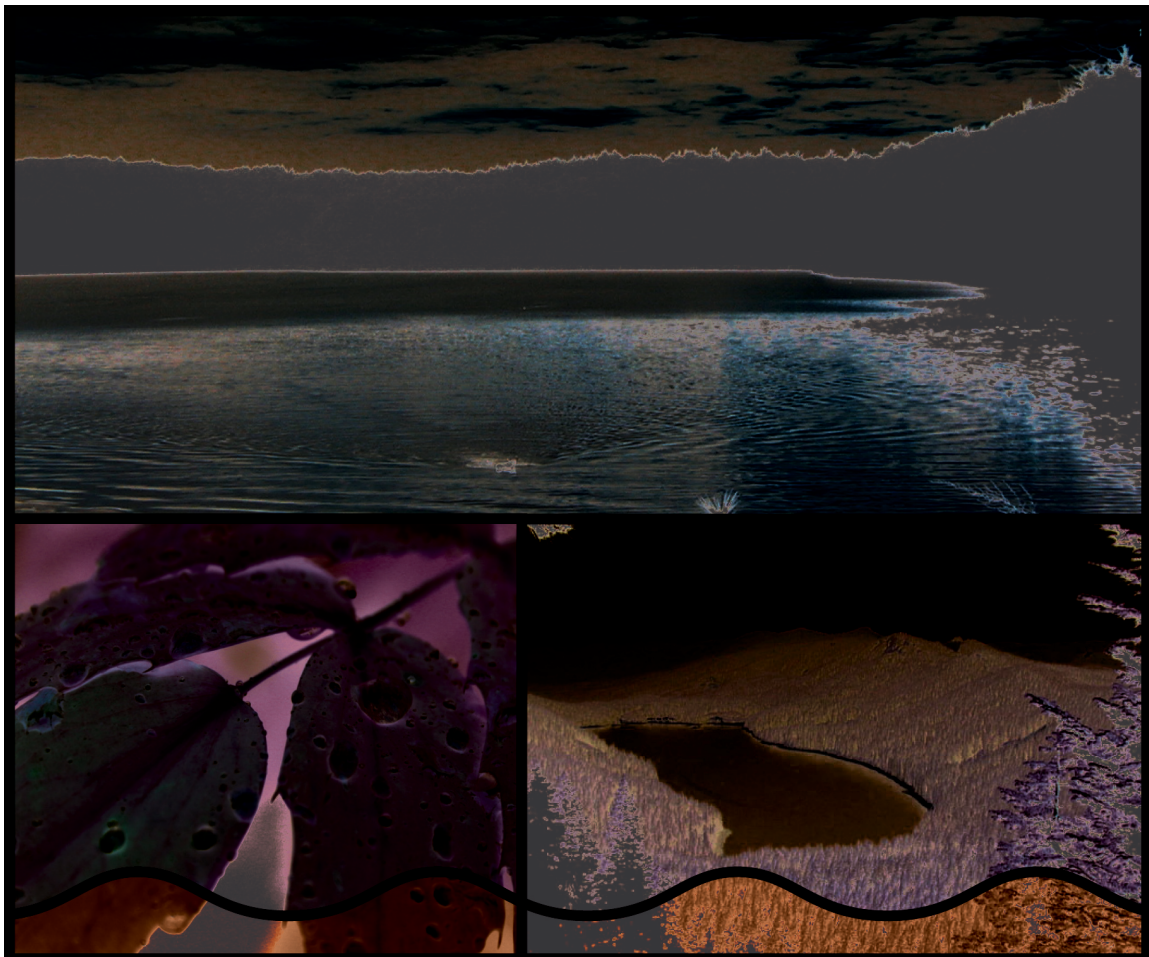

A Drop of Protection is Worth a Gallon of Cure

Making the Case for Source Water Protection

Patrick Hall, Kathryn Newhall, Joel Paque, Sarah Reich

May 3, 2005

Field Projects Final Report • Urban and Environmental Policy and Planning • Tufts University
Prepared for The Nature Conservancy • Project Liaison: Mark P. Smith



ABOUT THE PROJECT

THE NATURE CONSERVANCY

The Nature Conservancy (TNC) is a leading international non-profit environmental organization. The mission of the TNC is to protect the land and water necessary for the preservation of plant and animal species diversity. The organization's success is due to a collaborative approach and working with indigenous, business, and scientific communities. The TNC relies on a scientific approach to ensuring biodiversity and practices the discipline openly and transparently as it strives to complete its goals and carry out its mission.

FIELD PROJECTS: PLANNING AND PRACTICE

The professors of the Urban and Environmental Policy and Planning (UEP) Masters program at Tufts University recognize the importance of balancing classroom education with practical work experience. Field Projects: Planning and Practice is a class that strives to integrate theory with practice. The course combines research and problem solving in a community-service setting. Student teams function as consultants and work throughout the semester with a specific client to complete a project determined by both the client and the student team. Field Projects presents an opportunity for the client to draw on student expertise to further background research, collect data, and obtain a neutral assessment of an issue.

PROJECT GOAL

The Tufts University Team was enlisted by the TNC to help the organization "make the case" for extended funding to protect the lands around water resources and water supplies. The goal of the project was to produce a document that could be used by organizations both within the Commonwealth of Massachusetts and across the nation as a way to increase support for protecting lands around water bodies as well as provide funding opportunities and information for organizations. Several avenues of research were to be explored to gather information and data to justify the need for land protection funds: direct and indirect benefits of land protection, federal regulatory funding opportunities, model programs for funding across the nation, and case study examples. The final report will provide the TNC with a preliminary understanding of how funding for land protection around water supply and recharge areas can be acquired and why it is necessary.

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Executive Summary

Clean and abundant freshwater is important for environmental and human systems. Healthy lakes, rivers and streams provide not only sources of drinking water for human development, but also support diverse plant and wildlife species. One of the major threats to water resources is the rapid development of land for human uses. As land is appropriated and converted into developed area, drastic negative impacts can be seen in abutting bodies of water.

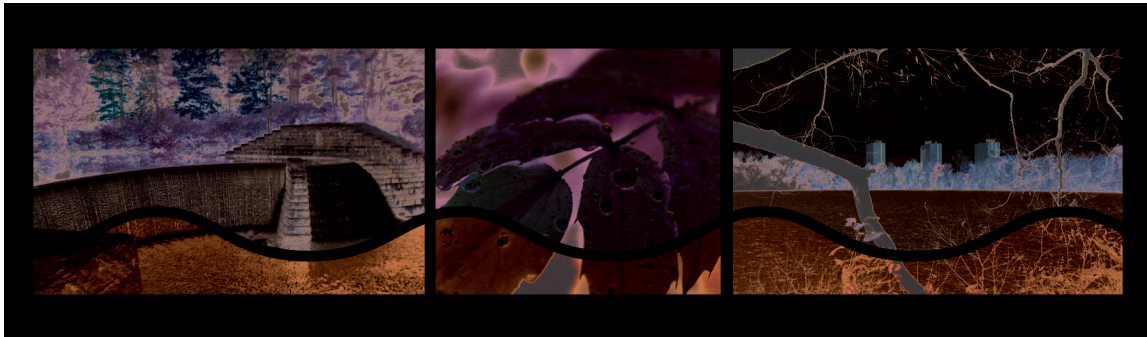
The protection and regulation of water resources in the U.S. stems primarily from the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA), both of which are administered by the U.S. Environmental Protection Agency (EPA), as well as standards and policies established by individual states. Currently much of the regulations concerning the protection of water resources focuses on numerical standards for known containments achieved “at the tap” for drinking water and on numerical standards for known pollutants on waters discharged from waste water treatment, other industrial facilities, and increasingly, runoff from dispersed “nonpoint source” pollution sources. While modern technical capabilities are effective in maintaining these standards for drinking water, construction and maintenance of this infrastructure can be extremely costly. Maintaining standards for natural bodies of water has proven more difficult; while many point-sources of pollution have been effectively controlled through regulation, controlling nonpoint sources of pollution remains an elusive goal.

The proper protection of land that contributes to a watershed can greatly reduce the need for expensive filtration, and is an extremely effective strategy for preventing pollution of water resources. The majority of funds available for water resource protection are currently being spent on upgrading the existing infrastructure as well as responding to the rapid pace of development in many parts of the US with expanded treatment facilities. More of the available funds for water resource protection should be spent on the acquisition and protection of land in watershed areas, which can often times better-protect waters used as drinking supplies, and provides myriad additional benefits for aquatic habitat.

In addition to federal support from programs such as the CWA and SDWA State Revolving Funds (SRF), individual states should seek to develop funding programs that place both a larger focus and a large percentage of water resource funds on the protection of land. Programs established in Ohio, New Hampshire, and Rhode Island, as well as funding strategies employed in Florida and California, are outlined at length in the report as effective models for other states to look to in focusing greater resources towards land protection.

It is essential in this era of rapid human expansion and development that a greater importance be placed on the acquisition and protection of land as a strategy to protect water resources in order to ensure the continued quality of this resource that is vital to both human and natural systems.

Introduction



Water is uniquely and fundamentally essential for all aspects of life, well-being and productivity.
- Mehta & la Cour Masden, 2004

This report examines the relationship between water resources and land protection. It argues that the provision of clean and abundant freshwater supplies is best ensured through the protection of water at its source. This approach focuses protection efforts at the watershed level, recognizing the land's importance in collecting, purifying and storing our freshwater resources.

The report advocates increased land protection, and establishes that in general watershed protection is an underutilized tool in the provision of the nation's municipal freshwater supplies. The report also addresses the environmental, health and economic benefits of such an approach, strengthening the case for aggressive watershed protection.

The report concentrates its analysis of watershed protection efforts and outcomes on Massachusetts, Pennsylvania and their neighbors within The Nature Conservancy's 14-state Eastern Region. Some of the best practices identified, however, are drawn from outside the region.

The role of government programs in affecting watershed protection receives special consideration in this report. Initiatives funded and administered by federal and state agencies frequently provide the resources and institutional framework needed to achieve significant gains. Through analysis of a sample of these programs, this report offers insight on how the most innovative and effective efforts may be replicated across jurisdictions. The value of this exercise resides in providing the opportunity for state and local governments to learn from one another; to implement organizational, financial and environmental strategies proven in their ability to protect source water and watershed resources.

Through assessment of national trends and presentation of specific case studies, the report identifies major threats to source water and watershed lands, as well as some of the scenarios that are emerging in light of a compromised hydrology. As such, the concerns and recommendations discussed in this report apply to the nation as a whole. While specific conditions vary by region, many of the same

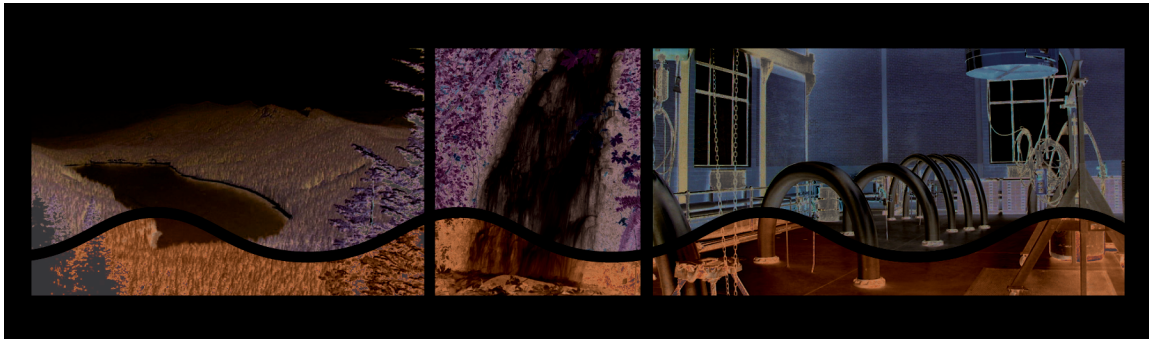
factors effecting source water and watershed quality in Massachusetts and Pennsylvania, for example, pose threats nationwide.

The report begins with an overview of the critical role a clean and abundant water supply plays in sustaining environmental and human systems, and includes information on public support for water resource protection, as well as the government's ability to protect and regulate. Section II defines the innate relationship between water and the land from which it flows. Section II illustrates the impact of land use activities on water quality and quantity, laying the foundation for an argument that centers on land protection as an effective means of maintaining abundant, high-quality freshwater resources. Section III addresses specific land protection strategies, practices, and outcomes. The data and analysis presented in Section III correlates watershed protection with a range of benefits across the health, environmental and economic dimensions.

Once the positive link is established between land protection efforts and water resources, Section IV exposes the fact that, in practice, land protection strategies remain underutilized. Section V argues for renewed emphasis on land protection efforts through the increased allocation of state and federal resources. Section V does not limit the definition of "resources" to tax or bond revenue. Rather, the report concludes by acknowledging that the solution to increasing support for land protection initiatives may well lie in a reframing of the water quality/quantity challenge. In this sense, "resource" is also human resource: creative problem solving, passionate advocacy, political will. This report will expose the interplay of all of these factors as it builds a case for the most prudent, effective approach to water resource protection possible.

Section I

Clean Water is Important for Human and Environmental Systems



For many of us, water simply flows from a faucet, and we think little about it beyond this point of contact. We have lost a sense of respect for the wild river, for the complex workings of a wetland, for the intricate web of life that water supports. - Sandra Postel, Last Oasis: Facing Water Scarcity, 2003

FOUNDATIONS

This report's primary argument rests on the assertion that clean and abundant water is important for environmental and human systems. While one may intuitively appreciate the truth and relevance of this statement, it is important to understand the intimate relationship water holds with the living world. As Mehta and la Cour Masden note in their discussion of a universal right to water:

Water is uniquely and fundamentally essential for all aspects of life, well-being and productivity. It is also the lifeblood of ecosystems, essential for many ecological functions (2004, p. 93).

And, specific to the discussion that follows:

[C]lean and affordable water is a prerequisite to achieving a minimum standard of health and to undertake productive activities (2004, p. 93).

A clean and abundant water supply thus affects all aspects of daily life, and provides a range of benefits. This report identifies benefits across three distinct realms:

- * Drinking water,
- * Biodiversity, and
- * Recreational opportunities.

America depends on its raw water resources to supply an extensive delivery network, much of which dates to the late 1800s. Boston first invested in a piped water delivery network in 1846, when iron pipe was laid between Long Pond—known today as Lake Cochituate—in Natick, and Boston. This investment provided Bostonians ample water for household use and boosted domestic consumption beyond expectations (Spirn, 1984).

The provision of clean drinking water across the U.S. is recognized as an underpinning of

the country's social and economic security. In the 2004 publication "Protecting the Source: Land Conservation and the Future of America's Drinking Water" from the Trust for Public Land (TPL), Dr. Jeffrey Griffiths of Tufts University warns that "Drinking water degradation is a critical threat to the foundation of our societies" (p. 17). Griffiths also notes that clean water is a key factor in the increase in life expectancy of the last 100 years. The TPL concludes that America benefits from one of the safest water supplies in the world (Trust for Public Land [TPL], 2004).

The U.S has long placed a priority on the provision of high-quality drinking water, and allocations are made at every level of government for the maintenance and operation of the nation's extensive service infrastructure. In her book *The Granite Garden*, Anne Whiston Spirn describes Benjamin Franklin's foresight regarding the importance of a piped water network in Philadelphia. Seeing the need to ensure a clean and abundant supply of water for the city's residents, Franklin "left a legacy to the city of Philadelphia, recommending that it be used to secure a public water supply" (p. 139). In his will, Franklin identifies impervious surfaces and groundwater contamination as necessitating the transfer of piped water from Wissahickon Creek (Spirn, 1984).

Since Franklin's prescient will was read in 1790, our reliance on a clean and plentiful supply of drinking water has only increased (Spirn, 1984). The nation's ongoing investment in drinking water resources has yielded tremendous benefits as the U.S. evolved from a mainly rural, agrarian society, to the highly urbanized, post-industrial state we know today.

Beyond meeting drinking and other household requirements, a clean and abundant supply of water is critical to maintaining biodiversity across habitats. Wetland habitats are

particularly reliant on a clean and abundant supply of water. According to Texas Environmental Profiles, an online collaboration between the Texas Center for Policy Studies and Environmental Defense, only rainforest ecosystems support more wildlife and plant species than wetlands (Texas Environmental Profiles, 2005). Ninety percent of all wetlands in the U.S. are freshwater ecosystems, offering a home to birds, fish, insects, mammals, amphibians and countless species of flora. In fact, almost one-half of North American bird species will at some point either nest or feed in a wetland habitat (National Parks Conservation Association, 2005).

Despite their value to the environment, the nation's wetlands and the biodiversity they harbor are threatened by a lack of clean, abundant water. The National Audubon Society estimates that roughly 100 million acres of wetlands remain in the U.S. today. This is less than half of the 215 million acres that existed prior to America's settlement by European colonists. As wetlands are drained and converted for agriculture or development, ecosystems fail, endangering the sustainability of species and further threatening biodiversity. Indeed, our nation's wetland habitats support nearly 50 percent of species designated by the federal government as either threatened or endangered (National Audubon Society, 1999).

Another benefit of a clean and abundant water supply lay in its recreational value. From cooling off in a summertime swimming hole or fishing a backwoods stream, to rowing across the lake in New York's Central Park, water is central to how we experience the world around us. A clean and abundant supply of water ensures a healthy, enriching recreational experience; one that draws us closer to the natural environment. As this report will show, many of the most effective water resource protection efforts to date count recrea-

tion as a primary objective. In considering water's place in modern society, its importance as a recreational resource cannot be overlooked. And, as the public opinion data presented next indicates, Americans justifiably place a premium on the quality and quantity of this nation's water resources.

PUBLIC OPINION

While last November's presidential election may indicate a nation evenly divided on many issues facing our society, there is one issue that consistently appeals to voters from across the political spectrum: preservation of our nation's water resources.

It is difficult to find any group or individual who does not agree that a clean water supply is much more of a "need" than a "want." According to a 2002 survey conducted by the Center of Public Opinion Research, commonly known as the Gallup Poll, 85 percent of respondents to the question, "How much do you personally worry about pollution of rivers, lakes, and reservoirs?" replied that they worried a "great deal" or "a fair amount" about such pollution (Polling the Nations, 2002).

More than a decade earlier, a Gallup Poll in 1990 posing the same question indicated that 87 percent of respondents worried a "great deal" or "a fair amount" about pollution of water resources (Polling the Nations, 1990). Clearly, the general public has a long-standing recognition of the importance of protecting the nation's water resources to ensure a clean and abundant supply.

Not only is there an established history of concern regarding water pollution, the public also consistently considers it an issue of relatively high significance. In a study conducted by the public opinion research firm of Belden, Russonello & Stewart, those surveyed were

asked the question: "Use a scale of 1 to 10 where one means something is not a problem at all and 10 means it is an extremely serious problem, rank the following issue—water pollution." The mean response was 8.6, with 36 percent of respondents answering "10" (Polling the Nations, 1999).

A survey recently conducted by the Luntz Research Companies and Penn, Schoen & Berland Associates (2005) shows tremendous public support for water resources, when compared with other hot-button political spending issues. Peter Gleick, a leading water resources scholar with The Pacific Institute, described the results in a recent published commentary:

[The survey results find] that by two-to-one Americans prefer spending for safe and clean water to tax cuts. By more than five-to-one, Americans would prefer to see the federal government invest in water than increase spending on entitlement programs. And by an astounding 10-to-one, Americans agree that needed federal investments should be made in the nation's rivers, lakes, and oceans (Gleick, 2005).

There is also a great deal of public support for the use of land acquisition and management as a means of preventing water pollution. According to a survey conducted by Fairbank, Maslin, Maullin & Associates on behalf of The Nature Conservancy (TNC) in April 2004:

[V]oters prioritize water as a critical reason to purchase and protect land: of those polled 84 percent see it as 'very important' to buy land to protect drinking water quality; 75 percent to improve the water quality in our lakes, streams and rivers; 72 percent to protect lakes, rivers and streams; and 66 percent to protect watersheds (pg. 2).

These survey results highlight public awareness of the importance of protecting water resources. They also indicate recognition of the role land protection plays in achieving this goal. Based on these data, this report reasons that it is politically feasible for more resources to be allocated for land acquisition and management as a means of ensuring clean and abundant freshwater supplies.

THE ROLE OF GOVERNMENT

The concept of political feasibility is important, particularly in light of the priority government places on protecting and regulating the nation's water resources. The U.S. Environmental Protection Agency (EPA), formed in 1970, has assumed a lead role in setting and enforcing guidelines for the management and distribution of the nation's public water supplies. In considering the polling data presented above, it is important to note that the EPA was in fact formed by Congress and the White House in response to "public demand for cleaner air, water and land" (United States Environmental Protection Agency [EPA], 2005a).

Within the EPA, the Office of Water is supporting implementation of the agency's new Strategic Plan, which will guide EPA efforts through 2008. One of the Strategic Plan's five main goals is "Clean and Safe Water," which aims to:

Ensure drinking water is safe. Restore and maintain oceans, watersheds, and their aquatic ecosystems to protect human health, support economic and recreational activities, and provide healthy habitats for fish, plants, and wildlife (EPA, 2004c).

Through these and similar initiatives, the EPA and its sister agencies are able to define policies and regulations that safeguard the na-

tion's water resources. And, despite the EPA's relatively recent rise to prominence, the U.S. government has a long history of source water and watershed protection programs.

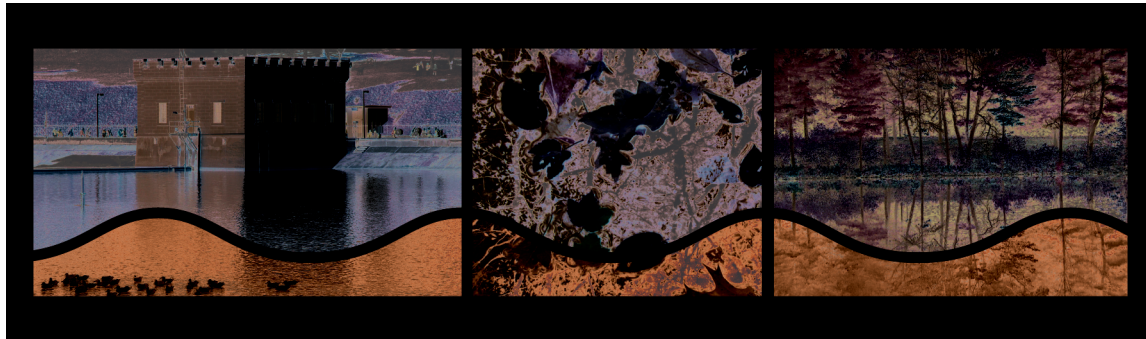
Federal prioritization of a clean and abundant water supply dates back generations. The Flood Control Act of 1944 empowered the U.S. Department of Agriculture (USDA) to make watershed improvements in order to reduce flooding, as well as damage caused by sedimentation and erosion. Through the Flood Prevention Program, the Act also supports conservation and management of water resources within the catchment (Natural Resources Conservation Service [NRCS], 2005).

The bulk of the government's water resource protection efforts today, however, hinge on enforcement of the Clean Water Act (CWA) and Safe Drinking Water Act (SDWA). The CWA addresses water quality in the broad sense, as it applies to habitats, the environment and recreation. As explained in "Protecting the Source" from TPL, the CWA is intended to "restore and maintain the chemical, physical, and biological integrity of the nation's waters" (p. 10).

The SDWA is geared towards the provision of municipal water supplies, and sets standards and provides financial support to ensure the delivery of high-quality drinking water into homes nationwide. Both the CWA and SDWA will receive more detailed analysis in Section IV of this report. Until then, it is important to acknowledge the value government places on protecting and regulating the nation's water resources, which, in turn, helps to ensure a clean and abundant supply.

Section II

Land Use Impacts on Water Quality and Quantity



Filthy water cannot be washed. - West African Proverb

Our overall ability to ensure a clean and abundant supply of water rests in large part on our treatment of the land that collects, purifies and stores this vital resource. “Protecting the Source” includes a quote from Luna Leopold that captures the essence of this relationship: “The health of our waters is the principal measure of how we live on the land” (p. 6). Such a perspective is key when considering the role of watershed lands, as the decisions we make regarding their use hold profound implications for the nation’s water supply.

This section examines the threats that various land uses pose to local water resources. From this discussion the report is able to illustrate the differing trade-offs of converting land for agricultural, residential and commercial uses. These trade-offs are viewed in terms of their impact on water quality and quantity.

Among the most preeminent land use threats to water quality and quantity is suburban development. In his book *Managing Growth in America’s Communities*, Douglas Porter ex-

plores the interplay of economic, political and cultural forces that have led to a nearly unbridled conversion of land for suburban expansion. In reflecting on the predominant form of growth, Porter notes that: “Standards of development were not high; the usual procedure was to bulldoze the site into shape without worrying too much about stands of trees and stream valleys. Environmental sensibilities were virtually unknown” (p. 30).

Most of this nation’s built development since the end of World War II has, in fact, assumed this pattern. Unfortunately, this type of low-density residential development—“sprawl”—is a particularly pernicious form of conversion, consuming large tracts of forested and agricultural land to house suburban residents (Porter, 1998). Statistics on the amount of land converted nationwide—even in the last generation—for development into residential and other uses are alarming:

- * The USDA estimates that by the 1990s development topped 2 million acres annually (Smart Growth America, 2002).

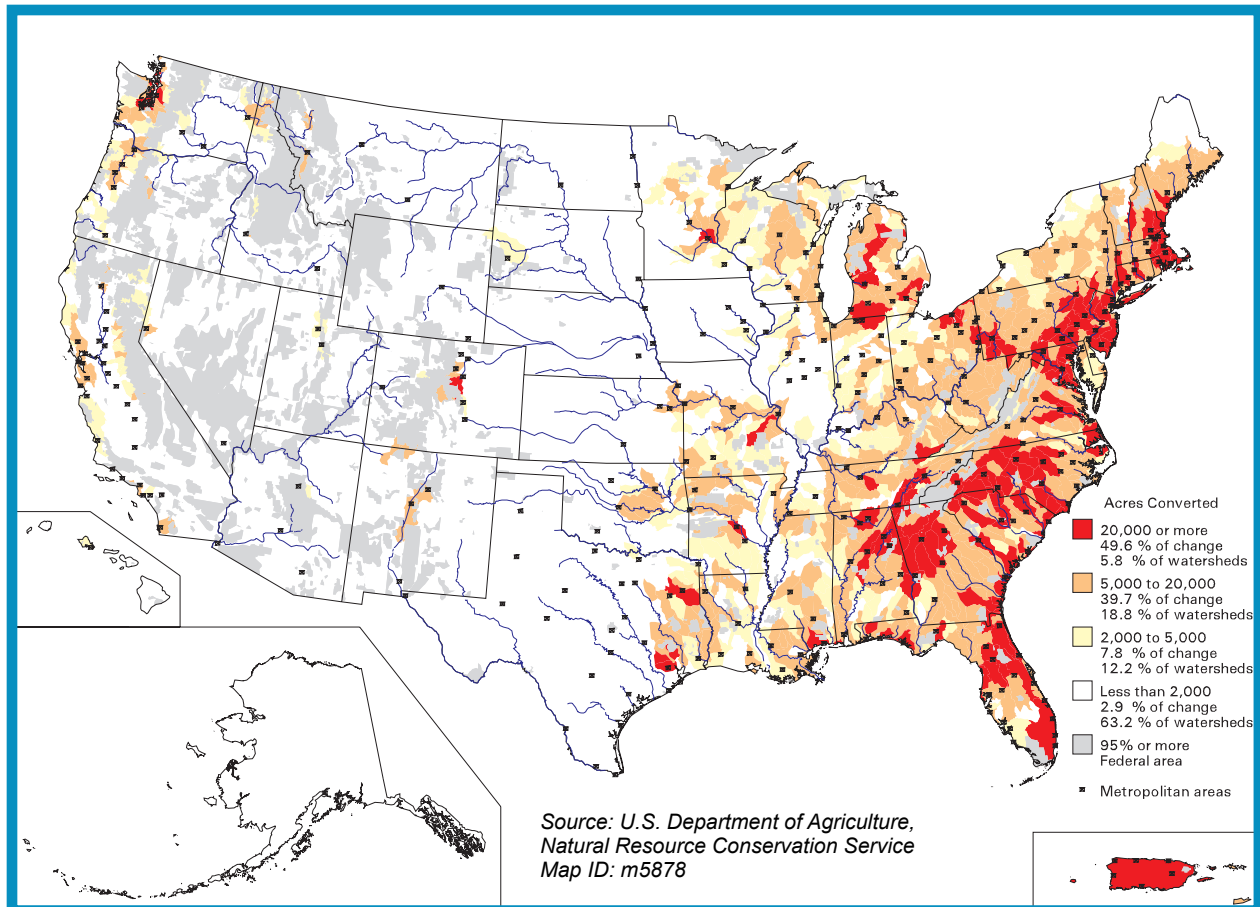
* A National Resources Inventory (NRI) conducted by the USDA's Natural Resources Conservation Service (NRCS) concluded that 10.3 million acres of the nation's forest land were converted for development between 1982 and 1997. Map 1 illustrates the location of these conversions, and offers a sense of the amount of forest land lost to development over this 15-year period. The map also enables one to identify conversion "hotspots" at a national level.

* Between 1982 and 2001 an area the size of Illinois—about 34 million acres—was converted for development. As of 2001 this figure brought the total developed area in the contiguous United States to a little more than 106 million acres.

The run-off generated by the impervious surfaces synonymous with development—streets, sidewalks, parking lots, driveways—deprives underground aquifers their natural recharge mechanism. On average, 40 percent of Americans obtain their drinking water directly from groundwater sources. The balance rely on surface water extractions that count on the groundwater that normally constitutes about half of a stream's volume (American Rivers, Natural Resource Defense Council and Smart Growth America, 2002). The conversion of forested and agricultural land destroys natural habitats and disrupts the hydrological cycle, threatening a clean and abundant water supply.

While one may appreciate the causes of sprawl, it is often more difficult to discern its

Map 1: Acres of 1982 Forest Land Converted to Developed Land in 1997



long-term impact on watershed lands and ground and surface water resources. The environmental costs of sprawl are manifold, with the destruction of open spaces for habitat and recreation simply being the most visually apparent. The aesthetic, cultural and economic value of undeveloped land should not be discounted. Like the diverse wetland ecosystem discussed in Section I, it is an important component of our human and environmental systems. At the same time, we cannot underestimate the importance of this land in ensuring clean and abundant freshwater supplies.

A 2002 study by American Rivers, the Natural Resources Defense Council, and Smart Growth America estimates that, by the late 1990s, the 15-year-period of development beginning in 1982 had reduced groundwater infiltration in and around Boston by up to 100 billion gallons annually. According to United States Geological Survey (USGS) data, which places per capita water consumption in the U.S. at 80-100 gallons per day, Boston's annual groundwater infiltration losses alone could meet the average daily household needs of more than 2.7 million residents per year (American Rivers, Natural Resource Defense Council and Smart Growth America, 2002).

The effects of development at a statewide level are well documented in the November 2003 report from Mass Audubon: "Losing Ground: At What Cost?" In considering development's impact on a single New England state, Mass Audubon estimates that between 1985 and 1999 Massachusetts lost 40 acres per day to "visible" development; in all more than 200,000 acres (Mass Audubon, 2003). In roughly the same period encompassed by the Mass Audubon report—1982 to 1997—only Atlanta converted more land for development than metropolitan Boston (American Rivers, Natural Resource Defense Council and Smart Growth America, 2002).

In detailing this development, "Losing Ground: At What Cost?" shows that more than half of Massachusetts' recent land conversions are attributable to the construction of low-density homes on half-acre lots or larger. The most concentrated development of both forested and agricultural land in Massachusetts has occurred in the southeastern portion of the state. Smaller communities like Barnstable, Plymouth and Falmouth led the state in development of open space. And while the conversion of previously agricultural land is more evenly distributed throughout eastern Massachusetts, the top 20 municipalities developing this land account for nearly one-quarter of all agricultural land conversions in the 1985-1999 period (MassAudubon, 2003).

The conversion of open space for suburban development has multiple negative impacts on watershed land and its ability to collect, purify and store ground and surface water resources. As watershed is built upon, the natural environment's ability to provide a clean and abundant water supply is threatened. Groundwater infiltration is limited by the presence of impervious surfaces, affecting water quantity, and water quality is most frequently affected by contamination.

It is easy to fixate on the potential harm that pollutants pose to water resources serving our household and drinking water needs. However, a priority should be placed on protecting all water resources from contamination. These resources—which may serve primarily recreational or habitat needs—are equally at-risk of contamination stemming from imprudent or disruptive land uses. Many of the same pollutants that can adversely affect human health in drinking water supplies can adversely affect the natural balance in wetland or riverine ecosystems.

Unfortunately, it is not simply the conversion of land for suburban growth that threatens water resources. Agricultural practices, too,

endanger the health of local watersheds and compromise water quality through nutrient loading. When introduced in excessive quantities into a lake, river or coastal estuary that is home to aquatic biology, agricultural pollutants such as nitrogen, phosphorus and copper can cause serious problems.

Nitrogen and phosphorus are essential to maintaining healthy plant and animal populations, with each habitat requiring a specific and delicate balance of nutrients to maintain aquatic life. Elevated concentrations of nutrients can lead to excessive, often unsightly growth of aquatic plants. Overgrowth of aquatic plants like algae and thick reed beds can interfere with recreational activities, such as fishing, swimming and boating. When these plants begin to decay it can result in strong, pungent odors, which further reduce the water resource's recreational and aesthetic value. Excessive aquatic plant growth also reduces the amount of dissolved oxygen in the water resource, altering aquatic habitats critical for fish and other biodiversity.

A 1998 national water quality inventory conducted by various states and Native American Tribes found that excessive nutrients were a leading cause of water quality impairment in

the nation's rivers, lakes and estuaries. Elevated concentrations of nutrients were found in 10 percent of the 840,000 miles of rivers and streams assessed, and contributed to 30 percent of reported water quality problems in the impaired rivers and streams. A follow up inventory in 2000 found that nutrients were still a concern (Munn, 2003). The USGS continues to conduct such inventories to better understand the impact of excessive nutrient concentrations in our natural water resources, and to better identify the sources of such nutrients.

One of the most common sources of such nutrient loading is agricultural run-off and storm water run-off (Munn, 2003). Both of these forms of pollution, known as non-point source pollution, can be effectively controlled through more stringent land use and proper watershed management techniques. The nature and extent of various land uses within a watershed determines both the amount of precipitation that ends up as run-off, and the pollutants it carries with it. More rigorous control of these land use activities can prevent excessive amounts of nutrients and other pollutants from entering our water resources, thus protecting overall quality and quantity.

AN INTERNATIONAL PERSPECTIVE

A case study of Istanbul, Turkey

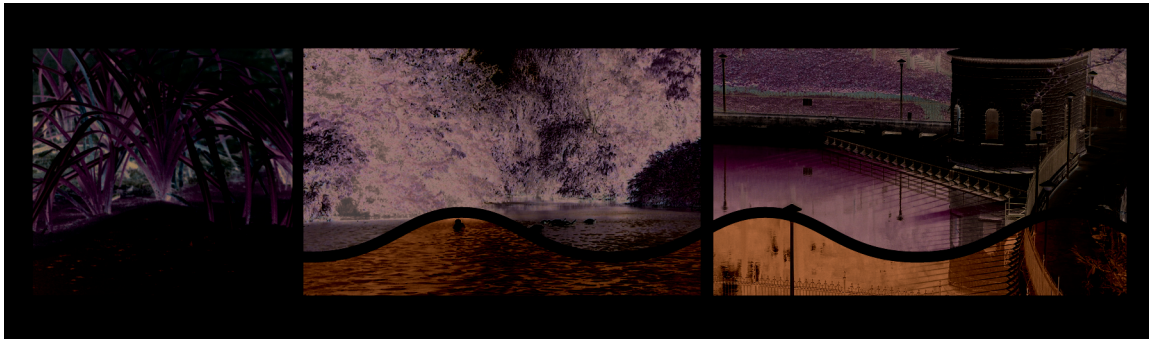
The challenge of balancing land use with effective water resource protection is not limited to municipalities in Massachusetts, or any other state. The efficient provision of an adequate, high-quality source water supply is an issue of global concern, and has become especially problematic for the world's mega-cities. These urban centers must grapple with continued in-migration amidst dwindling land and water resources. In Turkey, for example, Istanbul relies on six surface reservoirs to provide 90 percent of water supplied to the city's more than 10 million residents. The leaders of mega-cities like Istanbul must work together to identify the most acceptable means of meeting water demand given local quality, quantity and cost requirements. For their part, Istanbul's planners face the immense challenge of developing conservation strategies that can sufficiently limit land use activities within each of the six reservoir watersheds (Baykal, et al, 2003).

Istanbul's demand for water increases parallel to its expanding population. In this situation, point-source pollution prevails over non-point-source pollution in each watershed as municipal services fail to keep pace with the city's burgeoning demand. At its current rate of growth, Istanbul expects to have to import piped water from distant sources within the next 20 years (Baykal, et al, 2003). However, the threat of pollution posed by a growing, underserved populace on local water resources may well force the city to tap these distant sources sooner than planned. In this scenario, a failure to employ land use strategies as a means of adequately protecting local water resources will necessitate the construction of costly infrastructure to pipe drinking water into the city.

In order to maintain the quality and sustainability of local water resources, action must be taken to control pollution at its source, prior to its entrance into the water body. The city must regulate land conversion for housing, restrict industrial activity, and implement pollution control measures to protect water quality in the six reservoirs. Inappropriate land use decisions and unsustainable practices will jeopardize the quality of local water supplies, potentially forcing authorities in Istanbul to import water from distant sources. This capital-intensive approach will require significant funding and likely place additional costs on the city and customers. For Istanbul, the issues of land use planning and watershed protection remain critically important. Both offer a route for sustaining the city's endangered local water resources.

Section III

Land Protection: an efficient way to maintain high quality freshwater resources



In every glass of water we drink, some of the water has already passed through fishes, trees, bacteria, worms in the soil, and many other organisms, including people...Living systems cleanse water and make it fit, among other things, for human consumption.
- Elliot A. Norse, in R.J. Hoage, ed., *Animal Extinctions*, 1985

LAND PROTECTION DEFINED

For the purposes of this paper, land protection, also referred to as watershed protection, or source water protection, can be defined as a means to insulate the area around a body of water and protect it from further development, erosion and run-off, and the intrusion of chemical and toxic substances into the water body. Land protection can encompass regulatory measures, such as restrictive zoning, as well as market techniques, such as the purchase of conservation easements or the outright purchase of title. Although all of these strategies can ensure the integrity of the water source, both for environmental concerns, such as wildlife habitat, and human consumption of drinking water, this paper focuses primarily on land acquisition techniques.

Regulation

Certain regulatory strategies can be employed to protect watershed lands, ensuring high quality freshwater resources. Ultimately, the integrity of the watershed rests on effective land protection practices: how the land is used and maintained. Zoning is a regulatory tool that can be employed by local governments as an effective way to maintain high quality freshwater resources, by restricting the kinds of activities that can occur on specific parcels of land. Zoning can be an effective tool in creating reservoir or wellhead protection areas, restricting the kinds of and locations of development that are permitted. Zoning and other land use regulations can require permits before certain activities or uses are begun on sensitive land. In the permit-granting process, stipulations and mitigations can be put into place to minimize the impact of devel-

opment on drinking water and freshwater resources.

While zoning plays an important role in watershed protection efforts, it can't always eliminate uses that threaten water quality. If a regulation goes to far, eliminating most or all rights in a piece of property, that government action can trigger a regulatory takings claim, requiring government to compensate landowners for lost value in the property. In these cases, land acquisition or the purchase of conservation easements may be a more appropriate strategy.

Land Acquisition

Land acquisition involves the actual set-aside of private land to prevent further development and maintain high quality freshwater resources. Although property rights are well defined by legal and cultural norms—and should not be treated lightly in the context of land protection efforts—there are several means of converting private land into publicly held open space:

- * Long-term leasing,
- * Establishment of a conservation easement,
- * Purchase from a willing seller, and
- * Government condemnation through eminent domain.

The acquisition or set-aside of private land as open space for watershed protection can preclude development, thereby ensuring long-term viability of local freshwater resources. While these efforts do require significant public and private capital, this report outlines the long-term benefits of such investment. The benefits of land protection include both human and environmental health. In considering the relationship between nature and human and environmental health, one appreci-

ates the way in which the value of these protected lands extends beyond the provision of sustainable freshwater resources.

Zoning and land acquisition are two ways to ensure adequate land protection around freshwater resources. These tools, used to implement land protection, can be combined with several other strategies to ensure high quality freshwater, both for human consumption and for environmental concerns; they represent the first barrier to unwanted substances entering a body of water in the multi-barrier approach. This approach depends on effective land protection as the first step to ensuring the integrity of freshwater resources.

THE MULTI-BARRIER APPROACH

The multi-barrier approach is a system of procedures, processes, and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health (Federal-Provincial-Territorial Committee on Environment and Occupational Health, 2002). The five commonly used barriers are: source protection as the first barrier, followed by treatment, securing the distribution system, implementing monitoring programs, and well-planned contingency programs should one of the barriers fail (O'Connor, 2002). Protecting the land is the first step in the system; it is the first method to ensuring high quality freshwater resources.

Each tool in the system must work cooperatively to be successful. This synergistic approach must also exist between federal, state, and local authorities. It is important for authorities to keep site of the goal to provide adequate protection of public health and the natural environment by ensuring high quality freshwater resources. The goal of the system should be to reduce the level of risk to something so negligible that a reasonable and in-

formed person would feel safe drinking supplied water and feel confident that ecological health is being adequately protected.

THE FIVE BARRIERS

Source Water Protection – lowers the risk of contaminants that enter the treatment facility and keeps “raw” water clean to ensure ecological health

Treatment – filtration, chlorination, ozonation, and ultraviolet radiation to remove contaminants

Securing the Distribution System – ensures an appropriate free chlorine residual throughout water; precautions against intrusion of contaminants during delivery

Monitoring Programs – warning and automated control equipment to detect existing contaminants.

Contingency Plan – response system, including specific plans should a barrier fail and water quality deteriorate.

Source: Federal-Provincial-Territorial Committee on Environment and Occupational Health, 2002.

Precautionary Principle and Risk Management in the Multi-Barrier Approach

A key feature in managing risk involves being preventative rather than reactive. Municipalities should learn from experience and invest resources in risk management that are proportional to the danger posed (Federal-Provincial-Territorial Committee on Environment and Occupational Health, 2002). This means choosing between strategies to reduce risk, which is usually done on the basis of the greatest lowering of risk for available resources. By implementing land protec-

Pre • cau • tion • ary Prin • ci • ple
noun

When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.

Source: takingprecaution.org

tion as a way to reduce water contaminants, the risk of unhealthy freshwater systems is lowered.

When devising a multi-barrier approach to drinking water, municipalities can choose to err on the side of safety. The principle can be used in situations where risk cannot be estimated without uncertainty and precautionary measures should be taken to prevent potential irreversible harm to both the environment and to public health. The goal of precaution is not to achieve perfect safety, but to reach a level of risk that a majority of the citizens can find tolerable. Risk management and precaution can be applied cooperatively because of the uncertain nature of hazards and situations where suspected adverse affects may be irreversible (O'Connor, 2002).

LAND PROTECTION IN COOPERATION WITH TRADITIONAL FILTRATION METHODS

While filtration serves to clean the water that enters a treatment facility, it does not address the quality of the freshwater at its source, which is important both ecologically and in terms of public health and economic reasons. Implementing land protection as a precautionary method to ensure safety in the face of uncertainty can help to maintain high quality freshwater resources. There are several public health and ecological uncertainties and

costs associated with the traditional filtration system:

- * Greater treatment methods are needed to clean water that is already contaminated.
- * Emerging biological contaminants present a difficulty in removal.
- * Contamination can occur through disinfection by-products.
- * Uncertainty surrounding some of the contaminants and their effects as well as how to effectively remove them from freshwater resources.
- * Lack of addressing freshwater quality for habitat and ecological purposes.

“Raw” Water Quality

It is economically efficient to keep watershed lands protected; if the land surrounding watersheds is protected, then the costs of filtration infrastructure will decrease. Regardless of the treatment plan used for supplying quality drinking water to communities, the success of the water treatment facility is greatly dependent on the quality of the raw water entering the facility. Land protection methods can decrease the costs of filtration by maintaining a higher quality of raw water.

CASE STUDY

Impact of water quality on treatment costs for Texas Municipalities

Researchers used Texas municipalities that used surface waters as principle sources of municipal water in a case study of the chemical costs of municipal treatment expressed as a function of raw surface water

quality. Data was collected over a 3-year period for twelve water treatment plants. Data from monthly water reports, which included daily information on the number of gallons of water treated, type and amount of chemicals used, and the observed turbidity, was obtained.

Sedimentation runoff, which accounts for 68 percent of total suspended solids, was used as an indicator of water quality. Increased sedimentation or turbidity from crops, forests, pastures, and range runoff decreased the overall quality of water entering the treatment plants.

Turbidity was used as an indicator of pollution. Turbidity indicates the presence of clay, silt, organic matter, algae, and microorganisms. High turbidity levels can increase water filtration costs because they interfere with chlorination.

Results – supported theory that higher quality water entering a treatment facility was less expensive to process than lower quality water.

A 1 percent decrease in the amount of turbidity would reduce the chemical costs of water treatment by \$69,826 per year for production of 349,131 million gallons. Protecting the land around source waters to reduce agricultural sedimentation could yield consumer savings by decreasing the need for chemical water treatment.

The models used in this case study can be applied to any municipality in any state to determine the costs and benefits of protecting freshwater resources prior to their entry into a water treatment facility.

Source: Dearmont, 1998

Emergent Contaminants

New pollutants and threats to drinking water are emerging all of the time. Emerging microbial contaminants such as Cryptosporidium, Giardia, and Hepatitis E are resistant to traditional treatment processes including chlorination and disinfection. They have been shown to be resistant to medical treatment and antibiotics once they have infected humans. These emerging contaminants can be spread easily by animals and humans and are highly infectious. Non-microbial contamination, both organic and synthetic in origin, are also emerging and posing risks to human health. Methods of detection may not be able to determine whether or not these contaminants are actually in the drinking water; and if they are detected, traditional methods of filtration and treatment may not be effective at removing them. Many experts agree that keeping them out of the drinking water is our best protection (Ernst, 2004).

THREATENED PUBLIC HEALTH

Between 900,000 and 2 million people become ill each year as a result of consuming contaminated drinking water that has been processed through municipal water treatment facilities.

1990, Cabool, Missouri, four people died and 243 people were ill from E. Coli outbreak.

1993, Milwaukee, Wisconsin, 403,000 people became ill from a Cryptosporidium outbreak.

Walkerton, Ontario, seven people were killed and 2,300 people were ill from E. Coli in drinking water.

Source: "Protecting the Source," published by the Trust for Public Land and AWWA.

Cryptosporidium

Cryptosporidium is a naturally occurring parasitic oocyst that is transmitted through fecal contamination of food or water. Known carriers include large and small warm-blooded creatures—humans included—as well as birds. Cryptosporidiosis, the resulting diarrheal disease in humans, can be contracted from ingesting very low doses of the parasite. It is most prevalent in people with compromised immune systems, but people with normal immune systems are also susceptible. According to the Centers for Disease Control, cryptosporidiosis “has become recognized as one of the most common causes of waterborne disease within humans in the United States.” (Centers for Disease Control, 2004).

Cryptosporidium has been a known contaminant of drinking water for over twenty-five years (CDC, 1995). It is often introduced into surface water through effluent from sewage treatment plants, or through runoff from areas where livestock congregate. Although even the purest natural water source can be contaminated with cryptosporidium, the risk of large quantities entering the water decreases as the most common sources are eliminated (EPA, 2003a).

Cryptosporidium burst onto the public health scene after a massive outbreak of cryptosporidiosis in Milwaukee, Wisconsin in 1993, during which 400,000 people became ill and several people died. Since that time, there have been a handful outbreaks attributed to contaminated drinking water supplies the United States. As cryptosporidium has emerged as an important pathogen in drinking water, improving technology is beginning to allow detection and treatment with increasing accuracy and decreasing costs. However, detection of cryptosporidium remains a difficult, time consuming, and expensive process. Treatment is still the best way to prevent

cryptosporidium from causing problems in municipal water supplies. A treatment strategy employing multiple processes, represents the best method to treat drinking water with confidence (Betancourt & Rose, n.d.; Coffey, n.d.). In accordance with the multi-barrier approach, land protection should lead these processes as a first line of defense against widespread cryptosporidium contamination.

Disinfection By-Products

Disinfection by-products result from the application of certain chemicals to water during the filtration process. When chlorine is added during the treatment process to kill microbial contamination in water, it reacts with organic matter also present in the water to form cancer-causing substances called trihalomethanes and haloacetic acids. Land protection of freshwater resources may be able to decrease the need for intensive chlorination, by reducing overall contamination loads. Additionally, in certain cases land protection may reduce overall organic content in water by preventing organic matter from running off of impervious surfaces. In-tact riparian areas surrounding waterways may filter out organics, leaving a lower overall organic load in the water to react with the added chlorine. By reducing the reactivity of the chlorine, and reducing the overall amount of chlorine, land protection efforts may aid in the attempts to deal with the risks posed by disinfection byproducts.

Endocrine Disrupters

As the body of research surrounding EDs expands there is increasing interest in the source of EDs as well as their potential effects on the hormones and reproductive systems in both wildlife and humans, especially developing fetuses, infants, and young children. EDs can potentially come from a variety of sources:

- * Pesticides – alachlor, aldrin, atrazine, DDT, and dieldrin;
- * Compounds – especially plasticizers like bisphenol A;
- * Dioxins, furans, PCBs; and
- * Arsenic, cadmium, lead, and mercury.

An **endocrine disrupter (ED)** is any substance that interrupts the production and activity of the body's hormones. It can be a naturally occurring substance in the environment or it can be a pollutant or toxic chemical released by human activity.

EDs can potentially be found in waterways, like any other pathogens. These chemicals can enter the drinking water supply and affect wildlife and humans. The populations most at risk include developing fetuses and young offspring, in both wildlife and human populations, because all of their systems are not fully developed. The EDs can enter the organism and mimic estrogens, thereby disrupting proper development. However, the disruption does not often result in an outward disability. Once the hormones in the organism have been disrupted by a synthetic hormone there can be cognitive development problems as well as malformations of sexual reproduction organs. The future implications of widespread endocrine disruption include fertility problems as well as behavioral issues for all organisms, animal and human alike.

ENDOCRINE DISRUPTORS AND LAND PROTECTION

The EPA's ED testing program is slow to start, partly because testing for ED substances is difficult and causation is hard, if not impossible, to determine. Testing all of the chemicals already present in the environment is another daunting task. Banned substances still persist in the environment, adding to the ED testing puzzle. Decades may pass before a sufficient testing methodology is created.

Until adequate testing is conducted, we must rely on freshwater protection methods to protect wildlife and human populations from potential ED exposure.

Standard treatment processes may not be completely effective in filtering EDs out of the water. There is much uncertainty surrounding this issue. Until certain filtration methods are established, land protection as prevention of EDs getting into freshwater resources may be most efficient way to guard against them.

One way to prevent these substances from entering the water body is to implement stringent land protection measures so that pollutants are not able to run into the water body.

Source water protection can limit run-off of several of these ED chemicals. It can also reduce human impacts of development that may introduce several ED substances into the water supply.

LAND PROTECTION IS ECONOMICALLY EFFECTIVE

The EPA lists specific advantages to land protection over filtration. The first advantage is the reduction of future costs. Land protection is cheaper than the costs of cleaning up contamination spills, installing or upgrading treatment facilities, and drilling for the purposes of locating new water sources. Another advantage to land protection for the maintenance of freshwater resources is the reduction of current costs. Protecting the land and habitat around the source may make it eligible for monitoring waivers. Chemical monitoring and treatment procedures associated with standard water treatment and filtration may not be needed due to increased land protection. This can result in significant savings to the community as long as the community can show that there is no threat to source water (EPA, 2005b).

PROTECTING THE SOURCE

A study of twenty-seven water suppliers, conducted by the Trust for Public Land (TPL) and the American Water Works Association (AWWA) in 2002, found that forest cover in watershed areas results in lower treatment costs.

For every 10 percent increase in forest cover, treatment and chemical costs decreased approximately 20 percent.

The city of Auburn, Maine saved \$30 million in capital costs and \$750,000 in annual operating costs by spending \$570,000 in land acquisitions within the Lake Auburn watershed. The community was able to avoid constructing a new filtration plant by protecting 434 acres of watershed land (Ernst, 2004).

Land protection, as a tool to maintain high quality freshwater resources, is an effective means to protect public health and to reduce treatment costs, while protecting the environmental integrity of the water body. There are strict national regulations that mandate treatment and filtration of all water used for human consumption. However, several cities were able to receive a filtration waiver due to sufficient land protection around their drinking water sources. These communities were able to implement land protection so effectively that the EPA permitted them to forgo traditional treatment measures.

LAND PROTECTION IS A GLOBAL ISSUE

Not only is land protection for the maintenance of high quality freshwater resources a national issue, but countries around the globe are aware of the importance of protecting the land around drinking water sources. The economic incentives of land protection are often greater than the incentives produced through treatment facilities in many countries.

Whether protecting the land is needed because quickly developing countries are facing poor water quality, or populations are expanding too quickly and surpassing the filtration capacities, more nations are turning toward source water protection as the best solution.

CASE STUDY

Land Protection in Taiwan

The quality of source water in Taiwan was rapidly deteriorating in the early 1990s and water treatment plant upgrades were not happening quickly enough to remedy poor water quality according to regulatory standards. There were stringent standards for

drinking water, but the standards for source water were disputed. The Environmental Protection Agency of the Republic of China (ROCEPA) wanted to set a rational standard for source water quality.

The ROCEPA knew that legislation regarding source water quality protection would not be successful without institutional support and sufficient funding. In order to protect source water quality, protection zones must be designated, distances from water intakes must be determined, and water pollution control projects must be executed. There must also be coordination between all levels and organizations within the government. Source water protection serves an indisputable purpose – to provide water of the highest quality for human consumption at sufficient quantities (Chang, n.d.).

LAND PROTECTION IS A PROVEN APPROACH

Lessons from Unfiltered Systems

As a result of significant amendments to the Safe Drinking Water Act in 1986, the EPA was mandated to set Maximum Contaminant Levels (MCL) and Maximum Contaminant Level Goals (MCLG) for 83 different contaminants. Additionally, Congress required that the EPA ensure that proper disinfection and filtration of the nation's surface water supplies occurred. As a result of this mandate, in 1989, the EPA promulgated the Surface Water Treatment Rule. This rule required that surface water systems and ground water systems under direct influence of surface waters meet new zero-tolerance microbial MCLGs by employing specific treatment techniques (EPA, 2005c).

At the time that this rule was promulgated, several large cities with unfiltered water supplies protested the new regulations. The result was a filtration avoidance waiver built into the Surface Water Treatment Rule that cities could apply for if they maintained certain quality standards in finished drinking water, and implemented watershed protection plans. Six cities in the United States, drawing high quality water from well-protected watersheds, have since complied with EPA's filtration avoidance criteria and remain unfiltered systems. These systems, serving metropolitan areas on both coasts of the United States, include

- * Massachusetts Water Resources Authority (MWRA), Boston Area, MA;
- * New York City, New York;
- * Portland, Oregon;
- * San Francisco, California;
- * Seattle, Washington; and
- * Tacoma, Washington.

The very existence of a filtration avoidance provision illustrates that when properly protected, watersheds can yield safe and clean water with only minimal engineering interventions¹. Many of these protected watersheds exist today because early leaders understood the value and importance of protective land barriers between development and potable water sources, and had the foresight to implement protection measures around high quality water resources. Without exception, the unfiltered systems are served by reservoirs that were secured and protected in the late nineteenth and early twentieth centuries (The City of New York Department of Environmental Protection, 2002; Wallace, Floyd, As-

sociates, 1984; Portland Water Bureau, 2005; Seattle Public Utilities, 2003; Tacoma Water, 2002). For the cities on the west coast served by unfiltered systems, large areas of pristine land still existed at the time of the water supply development. This land was acquired or otherwise secured before significant structural or natural resource development found its way to these areas (Portland Water Bureau, 2005; Seattle Public Utilities, 2003; Tacoma Water, 2002). On the east coast, a long history of water supply spoilage from unencumbered growth around existing drinking water sources led to the development of more distant protected watersheds to serve as the source water for the cities of New York and Boston (The City of New York Department of Environmental Protection, 2002; Wallace, Floyd, Associates, 1984).

The ability to continue to obtain filtration waivers from the EPA has not been an easy task for some of these cities. New York City has been in constant negotiations with the EPA since 1993 over the filtration waiver granted to the Catskill/Deleware Watershed (EPA, 2005c). The MWRA and EPA found themselves in Court in 1998 over a dispute about whether MWRA should continue to qualify for its filtration waiver. In both cases, the systems prevailed over EPA's arguments, largely because of the existence of detailed watershed protection plans that each system had developed to ensure the on-going health and safety of the drinking water (Kavanaugh, 1999; Schneeweiss, 1997).

In many ways, today's water resource managers face greater challenges to protect water supply sources than did their counterparts at the turn of the last century. Development pressures are more pervasive (SPRAWL CITE), and vast stretches of undeveloped land

¹ All of the unfiltered systems are still required to sufficiently disinfect their water with a chemical and/or UV treatment process.

encompassing entire watersheds simply don't exist anymore. To accomplish the same efforts that were successfully realized to protect Portland's, Seattle's, and Boston's watersheds, today's managers must shape a patchwork quilt of land use characteristics using a wide range of planning and management

tools. The examples imparted on us by the remaining unfiltered systems should inform and provide resounding support for source water protection efforts, even if they may not be possible to duplicate across most of the United States today.

CASE STUDY

Massachusetts' Efforts in Land Protection

Massachusetts is home to one of the six cities that are able to receive a filtration waiver from the EPA due to effective land protection strategies. This represents the historical importance of land protection in the Commonwealth. Today, Massachusetts continues this legacy of land protection to ensure the maintenance of high quality freshwater resources. Several regulatory bodies are responsible for the preservation of freshwater resources in the Commonwealth. Cooperation and communication must be present among these agencies to protect freshwater bodies for human consumption and for wildlife habitat and other environmental concerns.

The protection and preservation of Massachusetts' water resources falls to the Massachusetts Executive Office of Environmental Affairs (EOEA), which oversees the work of the Massachusetts Department of Environmental Protection, the Massachusetts Water Resources Authority, and the Massachusetts Department of Conservation and Recreation, all of which have authority over some aspect of water resource protection. The EOEA states the following as its Water Resource Protection Objectives (EOEA, 2005):

- * Protect and restore the natural flows of our rivers and the natural waters of our ponds, lakes, and wetlands.
- * Identify and protect future water supplies.
- * Protect and restore the water quality of our surface, ground, and coastal waters.
- * Provide safe, good tasting, affordable drinking water to the residents of the Commonwealth.
- * Accomplish these objectives by building partnerships, building the capacity of others to protect the environment, and undertaking collaborative problem solving and decision-making.

Division of Water Supply Protection and Land Acquisition

When it comes to land management and acquisition for source water protection, the Division of Water Supply Protection (DWSP) within the Department of Conservation and Recreation

has pursued an ambitious but successful strategy. DWSP is charged with protecting the watersheds of the Quabbin and Wachusett Reservoirs and the Ware River. As of 1999 the DWSP had purchased 40.8 percent of the three watersheds, with another 19 percent of watershed lands under some sort of protection through conservation easement or purchased development rights (DWSP, 1999). A bond measure was passed in 1998 authorizing an additional \$98 million for the purchase of land within the three watersheds to occur on an annual basis until the entire \$98 million is spent by or before 2009. It is the success of these land acquisition programs that have enabled the MWRA to receive a filtration waiver from the EPA.

EOEA Water Task Force

In 2004 the Massachusetts Office of Environmental Affairs assembled a Water Policy Task Force to devise and publish a comprehensive set of policy directives to help restore and protect Massachusetts's water resources. The final report, published in November 2004, contained a recommendation to "Protect and restore critical land and water resources" (EOEA, 2004). It is noteworthy that the word "land" is not only included, but is stressed elsewhere in the document as well. One of the action steps falling under this recommendation is to "Establish a grant program that (EOEA, 2004):

- * Prioritizes current and future unprotected municipal water supply lands, aquifer lands, lands abutting headwaters (primary order streams), and other riparian corridors.
- * Identifies acquisition projects that maintain natural filtration capability and can serve as recharge areas
- * Leverages Municipal/external resources that encourage sustainable development
- * Provides extra points for biological integrity, i.e. for land referenced in Living Waters and Bio Map

Recommendations for Massachusetts

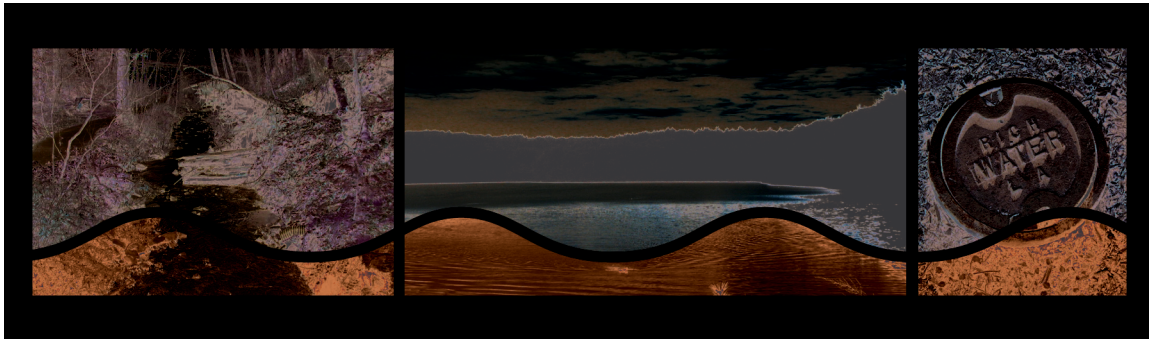
The EOEA should follow the recommendations outlined by the Water Policy Task Force, and implement a grant program that provides funding specifically for land acquisition projects, especially one that awards projects that provide a benefit for "biological integrity" as well as waters used as source water for drinking water.

Massachusetts should capitalize on the success of its protection around the MWRA managed watersheds by using this experience as a chance to implement similar acquisition programs around other major bodies of water in the state.

Funding for such programs can be modeled after successful programs such as those in New Hampshire, Rhode Island, and Ohio, or through bond issues.

Section IV

Land Protection: An Underutilized Strategy



*By two-to-one Americans prefer spending for safe and clean water to tax cuts.
- From a 2005 nation-wide survey, Luntz Research Companies, et. al.*

In the preceding pages, this report has examined the need for, and effectiveness of, land protection as a strategy to produce clean and abundant water resources. This section focuses on the federally supported regulatory programs and funding mechanisms that sustain many of the freshwater and source water protection efforts underway across the country.

Major organizations including the EPA and the AWWA have identified source water protection as an important approach in effective water management. The guiding legislation protecting our freshwater and drinking water resources has been amended in recent years to reflect this position, accommodating land protection as a legitimate strategy to achieve positive gains in water quality. Today however, land protection efforts do not rank highly among the major types of projects that receive federal funding. The data and analysis presented in the following pages shows that in the instances where funding is ear-

marked for source water protection, the opportunities are often underutilized. This is not to say that the interest in land protection as a part of an overall strategy to cleanse and sustain our nations' water resources does not exist. Instead, the diminished priority of land protection is perhaps a symptom of ever-tightening budgets, constrained resources, and the attention required nation-wide to keep our aging water and wastewater infrastructure from crumbling beneath us.

In the final analysis, land protection remains an underutilized strategy—not because it is ineffective or runs asynchronous to the goals we have set as a nation for clean water, but because land protection programs 1) are not mandated, 2) compete with important infrastructure improvements, 3) have yet to capture widespread public demand, and 4) have jurisdictional boundaries that don't always correspond to the geographical boundaries required for comprehensive source water protection.

EXISTING GOVERNMENTAL FRAMEWORK FOR SOURCE WATER PROTECTION

The federal government, state governments, and local governments are all involved in the regulation of our nation's waters. However, since the 1970s, state and local management of water has been driven largely by federal regulations. While states are primarily responsible for the management and use of waters within their own borders, water is not usually confined by political boundaries. This unbounded flow of water, and its critical importance to the economy and every day life in our country, has demanded the involvement of the federal government in water management. Federal regulations generated from the Clean Water Act and the Safe Drinking Water Act reach through every level of government, guiding how municipalities treat and distribute drinking water, how states oversee the quality of even the most minor waterways, and importantly, how both states and local governments choose to manage land uses surrounding waterways.

As water resource regulations are primarily shaped by the federal government, many of the financial resources for supporting these regulations also flow from the federal government through the states, to the local level. These funds influence the kinds of projects that states, cities, and towns embark upon, and the priorities that drive the broad goals of water management today.

Federal regulations established by the EPA serve to protect the nation's natural resources from excessive pollution and exploitation. The Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA), passed by Congress in the 1970s, are the two major regulatory frameworks for ensuring that the national protection of freshwater resources. The former regulates discharged pollutants into sur-

face waters while the latter sets the standards for drinking water resources and oversees the states and localities in charge of implementation. These two regulations do not strictly focus on source water protection. However, there are provisions and funding opportunities that can be utilized for this specific goal. Both the CWA and the SDWA provide opportunities for states to apply for loan monies to fund programs aimed at ensuring clean and safe water resources. These programs are called State Revolving Funds (SRF). These self-proliferating programs can be used to fund projects aimed at maintaining and conserving water supplies. While the federal government established and oversees the evolution of water quality regulation in this country, several mechanisms in the guiding legislation give states a significant role in shaping the enforcement and implementation of both the CWA and the SDWA.

First, states may apply for "primacy". A grant of primacy from the EPA to a state bestows the primary enforcement responsibility for clean water and public water systems to an appropriate state agency. The federal government remains ultimately responsible for ensuring that public health and safety standards are met, but the state manages the day-to-day permitting and enforcement activities under the relevant CWA and SDWA provisions.

Second, both the CWA and the SDWA provide financial resources to states to fund efforts aimed at creating and sustaining clean and safe water. Of the manifold funding opportunities offered through these Acts, the single most significant are loan programs called State Revolving Funds (SRF). These self-proliferating accounts, described in greater detail later in this section, fund projects aimed at maintaining and conserving water supplies and freshwater resources.

The CWA and the SDWA were enacted as broad programs to improve the water re-

sources of the United States. While the CWA focuses on overall water quality, and the SDWA focuses on drinking water protection, both laws acknowledge that source water protection is an important strategy for achieving clean water. To this end, both provide explicit guidance and funding that can be utilized in forwarding land protection and acquisition efforts. In fact, in recent years, the CWA and the SDWA have been further attuned to underscore the importance of watershed and source water protection (Cox, 1997; Copeland, 1999).

The Safe Drinking Water Act and Source Water Protection

In 1996, Congress amended the SDWA to address a number of emerging issues in drinking water protection. According to the EPA (2005d), the amendments emphasized, among other things, “community-empowered source water assessment and protection.” In an analysis of the SDWA, legal scholar Dan Tarlock (1997) wrote, “The increased emphasis on source water protection is one of the major innovations of the Amendments.”

In emphasizing source water protection through the SDWA, the EPA has set a goal for states to develop source water protection programs for local water supplies, to be in place by 2005. This goal, when it is reached, will help to protect water supplies in 30,000 communities that serve 60 percent of U.S. residents (Pontius, 1997). The passage of the SDWA amendments established six programs that are specifically aimed at source water protection measures: source water assessment, source water petition, underground injection control (UIC), sole source aquifer (SSA), wellhead protection, and comprehensive groundwater protection grants. The programs offer flexibility to each state so that initiatives can be created that will meet individual needs at the local level (Pontius, 1997).

They aim to initiate and build on cooperative efforts between local, state, and federal officials, water supply agencies, and nonprofit organizations to ensure that efforts for the protection of water supplies will be successful. According to the EPA (2005e), efforts to address source water protection are well underway in communities throughout the United States: as of 2005, “Source water assessments have been completed for more than 90 percent of the systems in the country and water utilities and local communities have begun to take action to protect their drinking water.”

The Clean Water Act and Watershed Protection

The Clean Water Act embodies a broader mission than does the SDWA in protecting our nation’s waters. The SDWA’s explicit emphasis on drinking water precipitates its focus on source water protection, as detailed above. The CWA has undergone a similar shift, with an increased emphasis on watershed protection. Since the 1970s, the CWA curtailed the release of pollutants directly into water bodies through permitting and enforcement activities. Largely in response to the challenge of controlling non-point source pollution, the implementation approach for these regulations has changed over the years, to rely more heavily on watershed protection. According to EPA (2003):

Evolution of CWA programs over the last decade has also included something of a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies.

Since the early 1990s, the watershed approach has enjoyed broad support from officials in the EPA (1996). The release of the Clean Water Action Plan (CWAP) in 1998 emphasized the watershed approach as an effective way to

reach clean water goals through broad-based partnerships. The CWAP established funding opportunities for communities engaged in watershed protection (Copeland, 1999). Since 2003, the EPA has offered the Targeted Watershed Grants Program to support successful watershed-based protection efforts. These grants provide funding and resources for a variety of water-quality improvement activities, including watershed land protection (EPA, 2005f).

STATE REVOLVING FUNDS

Through the CWA and the SDWA Congress appropriates funding to help states implement projects that improve water quality. Billions of dollars are provided each year through the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) to fund critical water quality improvement projects; freshwater and source water protection projects are ideal recipients of these funds.

The CWSRF and DWSRF function through a virtually identical process. Federal money is funneled into special accounts set up by each state, and matched by a proportionate amount of state funds. Low- to no-interest loans are then provided to local public and private non-profit entities who submit project applications to the state. To decide how SRF dollars are distributed, each state must draft an Intended Use Plan (IUP) for each fund. These plans, developed annually, identify how each fund will be used, and are finalized only after official public review and commenting periods are provided. As applications are submitted to the state agency authorized to manage each fund², a priority list is developed based on the uses outlined in the IUP. Loans are granted to the projects that rank at the top of the list ac-

ording to priority. The interest payments made on these loans are paid back to the fund over a period of up to 20 years, replenishing the capital and funding additional projects each year.

States are able to set up SRF funds in a variety of ways; some states combine CWSRF and DWSRF funds and shape a general environmental infrastructure grant program around both sources of money, while other states dole out the money from each fund separately. The federal law guiding the SRF funds stipulates a broad set of requirements that each project must meet to be funded. These requirements differ between the CWSRF and the DWSRF. However, as non-point source control projects have proliferated under the CWSRF and source water protection efforts have been added to the DWSRF, both SRF programs can be helpful in supporting land protection strategies (EPA, 1997a).

Clean Water State Revolving Fund Background

The CWSRF is recognized as the nation's most successful federal water quality funding program (EPA, 2003b). It was established to replace the Construction Grants Program (CGP), a source of financial assistance that had been a part of the CWA since 1972. The original CGP was conceived to shoulder the cost burden of building sewage treatment facilities, providing at least 75 percent of construction costs for these projects without a repayment requirement (Deegan, 1992). The Clean Water State Revolving Fund, a loan program that funded a wider variety of projects than the CGP, was phased in with the 1987 amendments to the CWA. The replacement of the CGP with the CWSRF was implemented in part to help the states finance

² The agency may be the same, although in many states one agency manages the DWSRF while a different agency manages the CWSRF.

the difficult problem of combating non-point source pollution—a problem that remains one of the greatest challenges in water quality improvement today.

The CWSRF program funds can be used for the construction of municipal wastewater facilities as well as programs for the implementation of non-point source (NPS) pollution control projects and estuary protection programs (EPA, 2003c). According to the EPA (1997b), “the SRF provisions in the Clean Water Act give no more precedence to one category or type of project than any other.”

In recent years, the CWSRF has provided approximately \$4 billion annually to individual municipality water quality projects (EPA, 2005g). The program is attractive due to the low interest rates, flexible terms, assistance to a variety of borrowers, and potential partnerships with other funding sources. Municipalities are able to borrow money for projects that can be specifically tailored to meet the individual needs of each water source. Since 1987, the CWSRF has distributed \$43.5 billion to the states, providing 14,200 separate loans to municipalities (EPA, 2005g).

Drinking Water State Revolving Fund Background

The DWSRF was established with the passage of the SDWA amendments of 1996. It was the first major authorization of funding to drinking water systems for the purpose of compliance with federal regulations and ensuring public health protection. Much like the CWSRF, states rank and prioritize projects submitted by water suppliers, towns, and non-profit organizations. However, unlike the CWSRF, priority must be given to projects that:

- * address serious risks to public health,

- * are necessary to comply with provisions of the SDWA, and

- * aid those systems in greatest need on a per household basis (EPA, 2000a).

In general, funding may be used to upgrade drinking water delivery infrastructure, enhance operational quality and efficiency, and promote source water protection. Like the CWSRF, public, private, and nonprofit groups are eligible for funding (EPA, 2000a). While much of the focus of the DWSRF is on infrastructure enhancement, there is a new emphasis on the prevention of contamination of drinking water supplies (Blette & Bourne, 1998).

The DWSRF program allows the states to take advantage of what are called “set-asides,” (a feature with no analog in the CWSRF) to specifically support activities related to source water protection. Once money has been allocated to a state, it may reserve up to 25 percent of the funds for specific, earmarked purposes. Up to 10 percent of the allotted funds can be reserved to administer source water protection programs. An additional 15 percent of the funds can be dedicated to loans for acquiring land and conservation easements, implementing wellhead protection programs, and for voluntary incentive-based source water quality measures. Of the 15 percent of funds designated for specific projects, no more than 10 percent can go to any one activity (EPA, 2000b).

Since its first pay-outs in 1996, the EPA has awarded \$6 billion in grants to the states, that, in turn with matching funds, have provided over \$8 billion in project loans (EPA, 2005g).

State Revolving Fund Prospects for Land Acquisition Projects

When they were established, in 1987 and 1996 respectively, the Clean Water and

Drinking Water SRF programs focused primarily on financing traditional capital projects like wastewater treatment plants, sewer system upgrades, and drinking water treatment plants. Since then, both programs have been adjusted to accommodate environmental restoration and land protection efforts that contribute to improved water quality and source water protection. Has opening the funds to these types of projects resulted in a significant shift of public resources towards these ecosystem-oriented solutions? The available data and examples suggest that, while a few states have actively funded restoration and protection projects, these changes have not resulted in a widespread proliferation of land protection activities. Financing structural improvements—the “pipes and pumps” of our drinking water and wastewater systems—remains the predominate strategy employed by most states.

There are several reasons why state actions have not followed the EPA’s words—why the EPA’s evolving message, which seems to place a high priority on watershed and source water protection, has not resulted in a corresponding mass-movement of funding resources into these activities.

First, there is no mandate in either SRF that says states must fund land and source water protection programs. While the SRF programs establish a menu of applicable projects to which loans may be granted, the states create their own intended use plans and priority lists. States are not required to select any specific kind of project, nor are they encouraged to include all possible project options among their funded applications.

This fact, which on one hand recognizes local autonomy by allowing states to make decisions that most adequately meet their specific needs, results in some states explicitly allowing SRF funds to be used for land protection,

while other states omitting it entirely from their programs.

Although source water protection programs are not explicitly delineated as a qualified category in the CWSRF, land protection has a clear place in the categories that are explicitly identified: nonpoint source projects, and estuary management projects. Several states around the country have used CWSRF financing for successful coordinated land acquisition programs under the nonpoint source provision. For example, California has used over \$112 million to purchase 29,000 acres of land that would have been converted to development, contributing to nonpoint source pollution. Ohio has also successfully used its CWSRF funds for land acquisition and source water protection (EPA, 2003d).

In most states, however, land protection activities continue to represent a slim minority of projects funded by the CWSRF. Table 1 shows how the states in the northeastern region of the country are employing CWSRF funds towards strategies involving land protection.

As late as 2003, just under half of the states in this region of the country have actually dedicated a certain portion of the CWSRF fund to land protection activities. Greater movement on these efforts may have happened since this time, but this is still a paltry number when one considers that activities such as these have been technically eligible for CWSRF funding since 1986.

The lack of a state mandate to support land protection efforts is problematic in the DWSRF as well. Unlike under the CWSRF, where land protection is an implicit qualifying strategy under the explicitly defined nonpoint source mitigation, land acquisition and source water protection programs are explicitly qualified projects under the DWSRF. According to the SRF Drinking Water Guide-

lines, “A State may provide assistance, only in the form of a loan, to a public water system to acquire land or a conservation easement from a willing party for the purpose of protecting the system’s source water(s) and ensuring compliance with national drinking water regulations (EPA, 1997b).” In fact, the DWSRF program allows states to go beyond this potential opportunity, where land protection projects compete among all of the other eligible kinds projects for loan funds, to allot a specific percentage of funds solely for the purchase of land acquisition through the set-aside program.

Again, however, the operative word is may. States are not required to use their DWSRF funds for land protection. In fact, language in the DWSRF actually mandates states to give money first to projects that address serious risks to public health and are necessary to comply with the provisions of the SDWA. It would be in only rare cases that a land protection application would rank highly among other eligible projects when these criteria are employed. Table 2 illustrates the existing imbalance in the funding of land acquisition programs through the DWSRF. Between 1996 and 2004, the U.S. total project assistance through the DWSRF amounted to almost \$8 billion. Of this total, only \$21.2 million, or 0.3 percent financed land acquisition efforts. In the northeastern region, the average percent is even smaller, and of fourteen states within this region, fewer than half even included land acquisition among their funded programs.

In the DWSRF set-aside program, states are again merely given the option of reserving funds to dedicate to land protection. While many states took advantage of the set-aside in 1997 to support the mandated Source Water Assessment Program this was an option only available for 1997 funds), only a handful of states have used the set-aside program on an

State	Funds used for Land Protection?
Connecticut	No
Delaware	No
Maine	No
Maryland	Yes
Massachusetts	Yes
New Hampshire	No
New Jersey	Yes
New York	Yes
Ohio	Yes
Pennsylvania	Yes
Rhode Island	Yes
Vermont	No
Virginia	Yes
West Virginia	No

Table 1: CWSRF and Land Protection, by NE Region States

annual basis to further goals related to source water protection (EPA, 2000b). Further still, only three states in the northeastern region—Maine, Maryland, and Vermont—have actually dedicated some or all the 10 percent of set-aside funds allowable explicitly for land acquisition applications (EPA, 2004c).

Unfortunately, the expenditures out of these funds between 1996 and 2004 are extremely low. Maine’s set-aside program, which has been running the longest and has expended the most dollars, demonstrates the challenges that states face in reserving this money for particular purposes. Although it has reserved money to fund loan applications for land acquisition projects since 1997, only 11 loans have been granted, for a total payout of just under \$2 million. Since 2002, no applications for land acquisition loans have been submitted, even though money has been available

State	Total Funding (millions)	Land Acquisition (millions)	Land Acquisition as Percent of Total
Connecticut	\$59.90	\$0.70	1.2
Delaware	\$38	\$0.00	0
Maine	\$56.40	\$0.10	0.2
Maryland	\$65.10	\$0.00	0
Massachusetts	\$431.80	\$0.00	0
New Hampshire	\$60	\$0.00	0
New Jersey	\$355.30	\$0.00	0
New York	\$1,282.80	\$5.40	0.4
Ohio	\$289	\$0.00	0
Pennsylvania	\$261.60	\$0.00	0
Rhode Island	\$72.60	\$0.00	0
Vermont	\$49.80	\$0.20	0.4
Virginia	\$117.10	\$1.70	1.45
West Virginia	\$33.10	\$0.00	0

Table 2: DWSRF and Land Protection, by NE Region States

(R. Crouse, personal communication, April 8, 2005).

Why do so few states set financial resources aside to support land acquisition programs for source water protection? Why did the money that was set aside in Maine go begging?

When asked why so few applications had been made to the land acquisition loan fund, Maine's drinking water program assistant manager Roger Crouse identified one overarching reason: today's drinking water suppliers have many competing financial priorities. Land protection efforts are squeezed out in favor of projects that must be completed to meet federal health and safety regulations. Managers don't want to raise rates in order to purchase land, and the public isn't demanding land acquisition programs (R. Crouse, personal communication, April 8, 2005).

This dynamic leads to a second reason why land protection remains an underutilized

strategy in water management today. The aging infrastructure plaguing the vast majority of cities across the United States (Water Infrastructure Network [WIN], n.d.) may be diverting relatively scarce financial resources, as well as public attention, from addressing source water and freshwater protection with the energy it could otherwise garner.

States continue to dole out money primarily for traditional infrastructure programs because these systems are rapidly aging and new systems are typically beyond the capability of most municipalities to fund on their own. According to the EPA's needs assessments, for Drinking Water and Clean Watersheds, the total anticipated funding demand for infrastructure alone is \$332.1 billion over the next 20 years (EPA, 2000c; EPA, 2002). Independent analyses report needs at least as great as the EPA's needs assessments. The Water Infrastructure Network found that the total need for wastewater systems alone could

approach \$377 billion, while The Clean Water and Drinking Water Infrastructure Gap Analysis conducted by EPA suggested that wastewater figures could exceed \$400 billion (EPA, 2000c).

Given the choice of fixing leaking sewer and drinking water pipes (contributing directly to water pollution and lost revenue respectively), and faced with limited resources, few states choose to give the money over to source water protection efforts instead, as indicated by data presented in Table 2, and hinted at by the data in Table 1. In fact, states develop priority lists based on threat to the environment and public health; under the current regime, these urgent projects will always end up at the top of the priority list, while restoration and land acquisition projects seen as “less urgent” will fall to the bottom of the priority list. Unless states embrace programs like the DWSRF set-aside, dedicating a certain proportion of funds directly to source water protection, or otherwise make an unequivocal commitment to land acquisition projects, this situation is unlikely to change.

LACK OF COORDINATED MULTI-LEVEL STRATEGY FOR LAND PROTECTION EFFORTS

Effective source water protection initiatives can be found at multiple levels, from federally enforced EPA regulations, to community-based activism. While the objectives of preserving a clean and abundant water supply remain constant across organizations and agencies, there is often little in terms of institutional direction and oversight that is capable of binding and channeling these efforts in common cause. This lack of a unified and coordinated multi-level strategy can be considered a limiting factor in engendering widespread support for programs that encourage the prioritization of source water and watershed protection efforts. It also contributes to

difficulties in developing source water protection programs that would ideally transcend state boundaries. Both of these complications likely contribute to an underutilization of source water protection as a strategy to produce clean and abundant water supplies.

To assess the impact of a diffuse network of water resource protection and preservation actors, one need look no further than state government. All states have their own set of guidelines and recommendations regarding the protection of watershed and freshwater resources. In Massachusetts, for example, the Watershed Management Division of the state’s Department of Environmental Protection (DEP) is charged with protecting water quality across the state’s watersheds and surface water resources (Massachusetts Department of Environmental Protection [MADEP], n.d.).

Massachusetts’ Water Management Act, enacted in 1986, authorizes the state’s DEP “to regulate the quantity of water withdrawn from both surface and groundwater supplies” (MADEP, n.d.) and includes provisions for registration and permitting programs. Withdrawals that require a permit typically include those for municipal water suppliers, golf courses, fish hatcheries, and agricultural and industrial consumers. Massachusetts DEP has established the threshold for requirement of a Water Management Act Permit at an average annual consumption of 100,000 gallons per day, or 9 million gallons in any three-month period (MADEP, n.d.).

But while the DEP claims dominion over the state’s surface and ground water extractions, the Massachusetts Water Resources Authority (MWRA) serves as the primary water provider for more than 2.5 million of the state’s residents, including most of metropolitan Boston. (MADEP, n.d.) This division of statewide responsibility for water resource protection and distribution depends on the

expertise and financial wherewithal of numerous agencies. At the same time, consumers are presented with a potentially perplexing cross-section of jurisdictions, regulations, and enforcement policies regarding the allocation and management of their local and regional water supplies. A lack of public awareness and familiarity with the source of local water supplies is one obstacle to enlisting broad support for comprehensive—and potentially costly—protection and conservation initiatives. In such scenarios the onus will remain on organizations like The Nature Conservancy to help clarify the relationship between land protection and water resources, as well as demystify the multi-agency approach often embodied by state government.

If efforts to build momentum behind broader source water protection initiatives are stymied by complexities at the state and local levels, inter-state coordination of source water protection remains an even more elusive prospect. Take, for example, the Monongahela and Potomac Rivers. With headwaters in West Virginia, these two rivers supply Pittsburgh and Washington D.C. respectively with drinking water. A comprehensive source water protection program for either of these water supplies would require significant inter-state cooperation and investment from water suppliers or governments to cross state lines. Unfortunately, the SRF program is not structured to fund this type of inter-jurisdictional support. Consequently, in this situation existing federal support programs for land acquisition place responsibility for the protection of source water resources that ultimately benefit major metropolitan areas out of state on the people of West Virginia.

West Virginia, however, has not expressed tremendous interest in source water protection programs for surface water resources, as evidenced by spending on land protection efforts from its SRF funds (see preceding ta-

bles), as well as its lack of independent source water protection funding. According to Thomas Minney, Conservation Programs Manager with The Nature Conservancy in West Virginia, the state's poor economy, combined with the fact that much of its drinking water comes from ground water sources, results in West Virginia having little practical incentive to allocate the monies needed to develop an effective source water protection program (T. Minney, personal conversation, March 21, 2005).

While coal mining in West Virginia has long existed as a threat to water quality, many of the other land uses that pose risks to the integrity of natural source water protection, like development and sprawl, have historically not been present. However, the growing market for second homes in West Virginia is increasing the amount of land converted for residential development.. In the last ten years, the number of houses owned as second homes in West Virginia has risen by 71 percent. West Virginia has the fastest-growing market for vacation homes in the U. S. (Associated Press, 2003). And the state continues to actively recruit retirees and vacationers to build second homes (Tranum, 2001). This relatively recent increase in land conversions adds a new dimension to the need for source water protection in West Virginia, and further complicates the ability to implement a unified and coordinated protection strategy.

This rise in residential development, which is welcomed in West Virginia where tax revenues and prospects for economic development increase accordingly, poses potential risks to the headwaters of the Monongahela and Potomac Rivers, which spring forth in the state's northern region. If Pittsburgh and Washington D.C. wanted to protect their city's source water areas by purchasing the surrounding land before its conversion to residential development, the SRF funds and state pro-

grams—if available in Maryland, Virginia and Pennsylvania—would likely not provide much assistance, as those dollars are generally restricted to in-state use.

Given the need for coordinated action in situations such as this, and in the absence of a more formal governmental or institutional framework, watershed partnerships are often established to transcend jurisdictional boundaries. These regional organizations may find creative solutions to circumvent rigid funding policies. In fact, this is already happening on the Potomac River. The Interstate Commission on the Potomac River Basin (ICPRB) was established in 1940 to address water quantity and quality issues impacting the entire Potomac River watershed. The Potomac River Basin Drinking Water Source Protection Partnership was formed within the ICPRB in 2004, specifically to identify strategies for protecting drinking water sources. A collection of suppliers and government agencies, this Partnership is just beginning to formulate a strategy for carrying out its work. The Partnership plans to fund its source water and watershed projects through contributions from the associated partners, and from grants (ICPRB, 2005). Positioned with many of the important decision-makers and water suppliers on board, the Partnership is potentially in a position to identify the most critical areas where land protection could make a difference in water quality for the entire basin. In the absence of such a collaborative effort, each agency and organization would be working alone to impact individual parts of the basin for which they have oversight. In this model, scarce resources could be spread even more thinly.

Comprehensive land protection efforts remain an underutilized strategy, in part because of the way current funding programs target the compartmentalized management structure

which rarely has the capacity to transcend political boundaries. Overcoming complex jurisdictional responsibilities through new partnership that capture greater levels of public and organizational support, and creating funding opportunities tailored for inter-state and trans-boundary situations would open up new opportunities for land protection to play a role in maintaining source water quality. A coordinated multi-level approach to funding and organizing source water protection efforts, which embodies the inherent cross-jurisdictional nature of water management, may improve the success of land protection efforts in these cases, fostering new and stronger partnerships, and building on the significant beginnings we see today.

INTEREST IN EXPANDED SOURCE WATER PROTECTION EFFORTS EXISTS

A Case Study from Pennsylvania

Pennsylvania has implemented a number of programs aimed at preserving and protecting the state's water resources. In 1988 the state also created a public agency chartered with administering SRF allocations from the federal government. At its inception, the Pennsylvania Infrastructure Investment Authority—"PENNVEST"—was capitalized with \$900M in state funds. The agency has used these resources to manage a revolving loan fund for financing statewide infrastructure investments. Beyond this initial capitalization, PENNVEST now relies on loan repayments, as well as ongoing SRF disbursements, to back qualifying projects (P. Marchetti, personal communication, March 25, 2005).

While PENNVEST is sustained by SRF monies and the repayment of infrastructure-related loans, several other Pennsylvania pro-

grams rely on tax and bond revenue to achieve their land and water protection initiatives.

The Keystone Recreation, Park and Conservation Fund Act of 1993 – Also known as the “Key 93” program, legislation creating this program cleared both the Pennsylvania Senate and House of Representatives with overwhelming support. This enthusiasm was echoed by citizens in a November 1993 referendum when 67 percent of voters affirmed \$50M in bond revenues for the program (Pennsylvania Land Trust Association, 2005).

Establishing a critical link between the sale and protection of state land, Key 93 specifies that 15 percent of Pennsylvania’s Real Estate Transfer Tax be allocated as program revenue. This has created a sustainable source of funding that enables the state and its municipalities to “acquire lands important to maintaining the integrity of existing State parks and forests” and to “acquire recreation areas and natural areas” (Pennsylvania Department of Conservation and Natural Resources [Pennsylvania DCNR], 2005). In order to meet its acquisition objectives, Key 93 legislation mandates that 10 percent of the real estate tax revenue be used for land purchases (R. Carlson, personal communication, March 25, 2005).

Rick Carlson, Director of Policy for the Pennsylvania Department of Conservation and Natural Resources (DCNR), asserts that that decision to draw funding from the state’s real estate transfer tax was one of the “best decisions ever made” in that it “assured a source of revenue” for Key 93’s conservation and protection efforts (R. Carlson, personal communication, March 25, 2005). Carlson points out that “bond discussions” in the early 1990s led Pennsylvania to seek an alternative to debt financing. As a result, the Key 93 program was implemented—with the modest \$50M jump-start noted above—to fund DCNR and

other state agencies. Carlson acknowledges that this funding strategy has proven “a boon” for DCNR, which receives about 60 percent of Key 93 monies. Carlson also applauds Key 93’s emphasis on the conversion of land and the opportunities created by earmarking tax revenue from these transactions for conservation and protection initiatives (R. Carlson, personal communication, March 25, 2005). However skeptical Carlson and his colleagues may have been concerning this funding strategy in the early 1990s, it has certainly provided the resources needed to sustain Key 93 and achieve program objectives.

A short list of Key 93 program accomplishments compiled by the Pennsylvania Land Trust Association (2005) is listed below. These reflect program achievements through the 2001-2002 timeframe:

- * More than \$77 million granted for the acquisition of open space for new public parkland and improvements to existing facilities and park programming.
- * More than \$28 million granted to 164 preservation and protection efforts encompassing 35,000 acres of “critical natural areas.”
- * Nearly \$7 million in grants allocated across 139 rail-trail projects for the construction of 500 miles of recreational trails.
- * More than \$6.5 million in project support for locally based Rivers Conservation efforts.

The other noteworthy source of funding for land protection in Pennsylvania is the state’s Environmental Stewardship Fund, also known as the “Growing Greener” fund. This fund was implemented in early 1999 and draws its revenue from an increase in landfill disposal fees, typically referred to as ‘tipping fees’ (Pennsylvania Land Trust Association, 2005). As a 1999 press release indicates, the

Fund is to be used for “priority programs such as protecting watersheds, preserving open space, investing in parks and environmental recreation, and reclaiming abandoned mines and wells, and reorienting other programs to encourage sound land-use practices and to discourage sprawl” (Pennsylvania DCNR, 1999).

This same press release from January 26, 1999 goes on to highlight the Fund’s five main areas of concentration, along with the planned allocation of Growing Greener monies across the Fund’s initial five-year timeframe (Pennsylvania DCNR, 1999):

- * Stewardship of public lands (\$95 million)
- * Community conservation (\$50 million),
- * Abandoned mine/well reclamation (\$160 million),
- * Watershed restoration (\$95 million),
- * Sewer/water incentives (\$25 million).

According to Rick Carlson, Growing Greener monies are allocated across four state agencies. The DCNR typically receives about 25 percent of Growing Greener monies, which DCNR is able to use at its discretion (R. Carlson, personal communication, March 25, 2005).

In elucidating the “watershed restoration” component of its Growing Greener program, the state notes that the Fund will help to create a new program within PENNVEST to address nonpoint source pollution (Pennsylvania DCNR, 1999). Unfortunately, PENNVEST has had no such opportunity to help fund watershed protection (P. Marchetti, personal communication, March 25, 2005).

Paul Marchetti, Executive Director of PENNVEST, indicates that the agency “would be happy” to help finance the pur-

chase of land for watershed protection. He echoes the expectations set by the 1999 Growing Greener press release, where PENNVEST is named as a partner in the protection of state watersheds. Despite a willingness to help acquire these lands as part of its infrastructure investment strategy, Marchetti notes that PENNVEST has not “seen a project” that requests the agency’s participation or financial backing. According to Marchetti, his agency lacks the partnerships needed to access and direct PENNVEST resources towards land acquisition and protection. And, although PENNVEST has publicized its interest in engaging a partner for the purpose of land acquisition, there remain “no takers” (P. Marchetti, personal communication, March 25, 2005).

Instead, the single largest share of PENNVEST loan disbursements for water-related investment is earmarked for wastewater collection and treatment (P. Marchetti, personal communication, March 25, 2005). In essence, PENNVEST monies are used primarily for the replacement and rehabilitation of aging sewer systems. This reflects the general trend in water sector investments seen nationwide, particularly as it concerns the application of SRF funds, which PENNVEST manages.

A March 2005 press release announcing PENNVEST funding for statewide water infrastructure improvements outlines how \$100 million will be distributed across “drinking water, waste water and storm water projects” (Pennsylvania Infrastructure Investment Authority [PENNVEST], 2005). The largest allocation—totaling nearly \$25 million—will fund construction of a regional wastewater and collection network for five communities in Butler County. The press release makes no mention of more inclusive watershed protection projects (PENNVEST, 2005).

The PENNVEST press release makes clear the fact that, despite its desire to embark upon

land acquisition and broader watershed protection efforts, the agency's resources remain focused on "pipes and pumps." This underscores how Pennsylvania, like so many other states, has failed to fully implement a water resources protection strategy incorporating land acquisition as a central theme. The dearth of partners willing to engage with Paul Marchetti and PENNVEST in watershed protection efforts denotes an under-investment in state land capable of ensuring a clean and abundant water supply.

Section V

Additional Resources Should Be Directed to Land Protection Efforts



*Source water protection should be pursued diligently for every water supply source.
- American Water Works Association*

The acquisition of land is often an expensive process. Areas that are being heavily developed are often the areas most in need of protection measures, and are also experiencing rapidly escalating real estate values. Although many government agencies focus funding on treatment facilities, an increased effort for land acquisition can often be made from existing sources, without diverting funds from the often badly need maintenance projects to existing infrastructure. Below are just a few examples of programs that use innovative funding activities to bolster land acquisition efforts as a means of protecting water resources, without diverting funds from other projects, or drastically increasing the tax burden of individual citizens.

STATE MODEL PROGRAMS

Included below are examples from three states that have adopted unique programs for the funding of land acquisition and management to protect bodies of water. All three of

the programs provide specific models for the funding of such programs that could be implemented in other states. The program from Ohio uses federal funds available to all states. The Rhode Island Program uses a minimal water use surcharge. While the New Hampshire program does depend on some funds allocated by the state budget each year, 75 percent of the funding for the program comes from end users and not the state. All three of these models could be examined and adapted for broader use in other states, and all three have proven successful at increasing the amount of protected lands in their respective state.

Ohio

The State of Ohio has developed what may be the most innovative program for the funding of projects that use land management and purchase in order to ensure the preservation of its natural bodies of water. The Ohio Department of Environmental Protection, Divi-

sion of Environmental and Financial Assistance is in charge of administering the states Clean Water Act State Revolving Fund, which they title as the Water Pollution Control Loan Fund (WPCLF), and has come up with a program titled the Water Resource Restoration Sponsor Program (WRRSP) (Background information on the Ohio WRRSP from Gordon, Theresa, personal interview, 3/29/2005).

Funds from the WPCLF can only be issued to municipalities for the improvement of existing wastewater treatment facilities or for the completion of new wastewater treatment facilities. Because this does not address the problems associated with non-point source pollution, the Ohio EPA has created the WRRSP as a way of using Clean Water Act SRF funds to address non-point source pollution. The stated goal of the WRRSP "...is to counter the loss of ecological function and biological diversity that jeopardizes the health of Ohio's water resources. The WRRSP will achieve this goal by providing funds, through WPCLF loans, to finance planning and implementation of projects that protect or restore water resources, ensuring either maintenance or attainment of designated aquatic life uses under Ohio Water Quality Standards" (OEPA, 2005)

The program works by advancing the interest payments from a WPCLF loan to a sponsored project with no obligation to repay the advanced interest. A sponsored project can be operated by the municipality that has secured the WPCLF loan, or by an outside organization such as a local parks commission, conservation commission, or non-profit group. Participating WPCLF communities are also given a 0.1 percent discount on their interest rate. For example, a city may secure a loan for \$10,000,000 to update their wastewater treatment facility at an interest rate of 3.5 percent. This same city could then sponsor a local watershed authority as a recipient of a

WRRSP project. This organization would then receive \$350,000 for an authorized project. Because of the discounted interest rate, the cost to the community taking the loan is the same – they can borrow \$10,350,000 at 3.4 percent for the same yearly payments as borrowing \$10,000,000 at 3.5 percent. These projects can include (OEPA, 2004):

- * riparian buffer acquisition, enhancement, expansion or restoration;
- * conservation easements;
- * wetland buffer extension/restoration;
- * wetland restoration in conjunction with an adjoining high quality water resource;
- * stream bank stabilization/natural channel design techniques;
- * reestablishment of native plant communities on modified properties; and
- * in-stream habitat enhancements/dam removals.

If a project will involve the purchase of land, it is mandatory that permanent conservation easements be placed on the land in order to ensure its protection in perpetuity. This is to ensure that any progress made on the purchased lands cannot be undone at a future date.

The Ohio WRRSP is a program that could be implemented in other states as it depends on federally supplied funds and uses them in a unique way at the state level. Every state could create a similar program to advance federal money to local organizations for the acquisition of land to protect water resources, without having to increase taxes or utility costs, and without securing the passage of a bond issue.

Rhode Island

Rhode Island is another state with an innovative program for funding projects that look towards land management as a means to protect surface waters. The Rhode Island Water Resource Board's (RIWRB) "Penny Per Hundred" program has proven to be a successful and well-received program. For every one hundred gallons of water delivered by major water suppliers one cent is collected and set aside for land acquisition or for water quality improvement projects to protect the quality of drinking water supplies. Currently these funds are not used to protect surface bodies of water that do not serve as drinking water supplies (RIWRB, 2005).

Each water supplier participating in this program must spend a minimum of 55 percent of these collected funds for land acquisition – the primary protection activity. Examples of other projects that contribute to improved water quality include non-point source pollution or run-off prevention measures, treatment facility upgrades, water main cleaning or relining, and the purchase of water conservation kits or signage to inform the public that they are in a protected watershed area.

Since 1994, the Rhode Island Water Resources Board has successfully disbursed \$18,343,382. Of this total \$13,614,265 protected 2,410 watershed acres through land acquisition or the purchase of development rights. \$244,254 was spent to develop watershed protection plans and \$4,484,863 was spent on forty-nine water quality improvement projects. Although the program requires only 55 percent of collected fund to be spent on land acquisition, in actuality 78 percent of the total funds have been spent on land protection (RIWRB, 2005).

New Hampshire

Land protection is the single most effective means of protecting drinking water sources from contamination" (NHDES, 2005A).

This quote reflects the public opinion of the New Hampshire Department of Environmental Services, which provides another example of an innovative program to fund land protection for surface waters. The State of New Hampshire legislature established and funded the Water Supply Land Grant Program in 2000 following joint research between the NH Department of Environmental Services and the New Hampshire Society for the Protection of Forests. This research demonstrated that very little water supply lands were actually protected and called for a plan to place more of these lands under some sort of protection (Pillsbury, Sarah, personal interview on 3/30/2005).

This grant program provides municipalities with 25 percent of the cost of protecting critical water supply lands through ownership or the purchase of a conservation easement. The state grants must be matched 75 percent from local sources. These match sources can include donated land or easements that are also within the source water protection area, public funds, transaction expenses, or private funds. Also, there is a low interest load fund available from DES that may be used to finance the match that draws on Clean Water Act SRF funds (NHDES, 2005B).

Lands through which water flows to sources of drinking water serving public water supply systems are eligible for these grants. If a surface or ground water body is not currently being used as a water supply, but is designated as a potential future source of water, it may also be protected under these grants. Waters that are not currently used as a drinking water supply, and are not designated as a po-

tential future water supply are currently not eligible (Pillsbury, Sarah, personal interview on 3/30/2005).

Since 2000, \$3.6 million dollars of water supply land grant funds have been provided to municipalities. This has leveraged \$19.9 million in private and municipal funding. As of February 1, 2005 over 3400 acres of critical water supply lands have been protected as a result of the states investment and has averaged approximately \$1000 per acre (NHDES, 2005A).

State Bond Issues

It does not take an innovative program to raise funds for the acquisition of land to protect water resources. Many states have had success in issuing bonds to raise funds for the protection of bodies of water. In 1990, the Florida Legislature began the Preservation 2000 program. Preservation 2000 is a program designed to protect Florida's unspoiled natural resources of all sorts. The program receives \$300 million annually through the sale of bonds. The five water management districts receive 30 percent of this fund, which has been used to accelerate acquisitions of land that will help preserve bodies of water, whether used as sources of drinking water or not. Preservation 2000 acquisitions by these five water districts must meet at least one of the following (NFWFMD, 2005):

- * Project is in imminent danger of subdivision;
- * A significant portion of the land is in imminent danger of subdivision;
- * Land value is appreciating rapidly;
- * Project serves to protect or recharge ground water, valuable natural resources or provide space for resource-based recreation;

- * Project can be purchased at 80 percent of appraised value or less; or
- * Project protects habitat for endangered and threatened species or natural communities.

California is another state that has seen the successful passage of a large scale bond issue that allocated funds for the acquisition of land with the intent of preserving and protecting water resources. "Proposition 50" was passed in November of 2002 and provides \$200 million dollars for various projects whose purpose is "The acquisition and restoration of riparian habitat, riveting aquatic habitat, and other lands in close proximity to rivers and streams. Also for acquiring facilities necessary to provide flows to improve water quality downstream" (CRA, 2005).

The cost of obtaining land should not be a deterrent to government agencies seeking to better protect their natural resources. Programs such as those found in Ohio, New Hampshire and Rhode Island, as well as the successful passage of bond issues in Florida and California demonstrate that it is possible for states to fund programs aimed at the acquisition of land specifically for the protection of water resources. It is not enough to set up conservation districts or outline protection objectives unless the necessary funding is provided to allow such agencies to properly implement policies that will ensure the ongoing protection of the resources they are charged with protecting. The Saco River in Maine is one area in need of further protection where measures have been taken to ensure this protection is provided, including the establishment of the Saco River Corridor Commission (SRCC). However, the SRCC has not been adequately equipped to carry out its mission of preserving the quality of the Saco River.

CASE STUDY

The Saco River

The Saco Lake in the White Mountains of New Hampshire gives birth to the Saco River, which flows 75 miles southeastward through Maine ending in Biddeford where it meets the Atlantic Ocean. The majority of land along the Saco River banks is privately owned, which makes monitoring potential pollution sources difficult. The river serves as a water and electricity supply for private citizens and industry in Saco, Biddeford, Old Orchard Beach, and part of Scarborough. Local communities consider the river an important part of life; its clean waters flow close to metropolitan areas and serve as an important source of recreation and tourism.

However, the clean water and its proximity to Maine cities make the Saco River attractive to developers. The communities that rely on the river for drinking water want to prevent the encroachment of unplanned development. A 500-foot buffer along each side of the riverbank constitutes the Saco River Corridor. A governing body was needed to oversee the corridor. The Saco River Corridor Commission (SRCC) was formed to evaluate potential development opportunities and ensure high water quality. Anyone who wants to develop within the corridor must apply for a permit from the SRCC (The Saco River Corridor Commission, 2005). If all of the requirements, stated by the SRCC, are met, then development will not be prohibited.

Examples of Successful Land Protection

Both the Cape Cod Commission (CCC) and the Delaware River Basin Commission (DRBC) have been able to successfully implement land protection measures in their respective regions. Both commissions rely on a variety of funding options to implement their

programming and both are well-supported by their constituencies.

An innovative program that the residents of the Cape use to protect land around water sources is the Land Bank program. The program specifically sets aside money for the purpose of acquiring land around water bodies. Funds are raised through a 3 percent surcharge on real estate property tax bills in each community of Barnstable County. The money is put into a bank account to accrue interest and taken out when land becomes available for purchase. Funding for the program also used to comes from a \$15 million state matching program, which has since run out, as well as private donations (The Cape Cod Commission, 2005).

SACO RIVER CORRIDOR COMMISSION (SRCC)

The SRCC has been granted authority over riverfront development by the state of Maine through the Saco River Corridor Act (SRCA). The Commission reviews applications and granting permits to public and private entities

The SRCC has limited ability to protect the land around the Saco River watershed. The SRCA has given the commission the authority to hold land to prevent development, but has rarely used it.

The SRCC does not currently implement any programs strictly related to land conservation. This is mainly due to the lack of funding available for such programs.

The majority of the Commission's funding is appropriated from the state of Maine. Every two years the SRCC must defend its funding to the legislators, which creates instability in the Commission's budget.

The CPA is another self-imposed taxing program on the Cape. It allows communities to tax up to 3 percent to generate revenue for implementing programs to protect open space, the preservation of historical buildings, and the creation of affordable housing. The act has minimums, so that each of the three goals are addressed and not all of the money only goes to one cause. Most communities will vote in favor of converting Land Bank into the CPA because of the state-matching program that the CPA has. Any revenue that is generated through the tax is eligible for the state matching grant funds. This would, in effect, double the amount of money available to communities for these three areas. In one case, the CPA has the opportunity to provide more money, but on the other hand, there is a larger pie in which to divide the funding up. Land Bank focused solely on land protection while the CPA has three focuses, land protection being one of them (H. McElroy, personal communication, March 31, 2005).

The DRBC primarily encourages implementation of source water protection programs at the local level. The creation of the River Basin Plan serves as a guide to local authorities for river protection goals. While the plan does not specifically set an implementation plan or schedule, it does provide the Commission and local authorities to a set of goals in which to work toward. All programs that the Commission implements or authorities in each of the four states implement must be working to accomplish the goals outlined in this plan. The plan serves as a guide, specific programming is not included. Most of the programs for source water protection are at the local level; however, there are a few programs that the Commission implements to protect water quality.

Funding for the DRBC comes from a variety of public and private sources. A significant portion of money comes from the EPA in the

form of grants. These EPA grants are typically for specific programs, like the PCB tracking program. The EPA also provides the 106 grant, which also funds specific water protection programs, like the Special Protection Water Regulations. This one grant provides approximately \$600,000 for water quality protection measures. The four states also provide funding to the regional body. Portions of the SRF money that each state has applied for through their own environmental protection agencies goes to the DRBC to help fund regional initiatives (K. Najjar, personal communication, April 8, 2005).

Challenges for the SRCC

Lack of Cooperation: The primary challenge for the SRCC may be in the lack of cooperation between the communities that rely on the Saco River. Both the CCC and the DRBC are able to attribute at least part of their success on regional cooperation to achieve specific goals.

Lack of motivation: Maine is not facing the same type of development pressures that Cape residents felt. Without the urgent need to protect the land around the Saco, there is little motivation to implement programming.

Lack of planning authority: SRCC is not a planning agency, only a regulatory one. The lack of a planning component in the Commission may limit ability to implement land protection measures.

Lack of funding: The CCC and DRBC rely on a variety of sources of funding. SRCC primarily relies on funding from the Maine government, which is subject to variability.

Despite the significant challenges of implementing land protection programs along the Saco River, there are strategies that can be enacted to help promote the expansion of the

SRCC's authority into source water protection.

Recommendations

- * Foster a sense of community and cooperation along the river. Several communities depend upon the river for both personal and industrial uses; they all need the river water to be of high quality. The DRBC prides itself on its conflict resolution and negotiation abilities. If the SRCC took on this role of mediator between communities, cooperation around the region may increase.
- * The Saco River is a local tourist destination, but has the potential to draw visitors from the entire New England area and beyond. The need to preserve the quality of the water in the Saco River hinges on the revenues from the tourism industry. If the river can be marketed as a tourist destination, which will increase state revenues, more money, as well as priorities, may shift to increased land protection.
- * Propose a self-imposed tax where the revenues will go directly into source water protection programs. If the residents along the Saco River are not amenable to this, a voluntary donation included on either property tax or state tax forms may be a better option.
- * Reduce the dependence on state funding:
- * Explore grant options. Grant money is available for use in source water protection programs. Grant-writing is a skill and once mastered, can provide significant amounts of money for specific purposes. If the SRCC does not have an "in-house" grant writer, utilizing volunteers can help fill this need.

- * Explore SRF options. There is money specifically designed for land protection programs. Communities along the Saco River can apply for SRF money to implement local source water protection programs.

SOURCE WATER ASSESSMENT PROGRAM

An opportunity for better protection

The Safe Drinking Water Act (SDWA) Amendments of 1996 requires states to develop and implement Source Water Assessment Programs (SWAP) to analyze existing and potential threats to the quality of the public drinking water throughout the state.

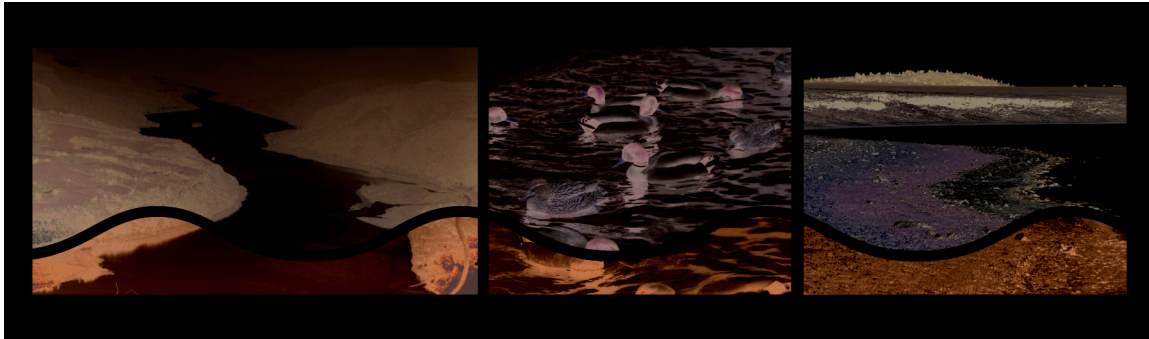
State programs were due to EPA by February of 1999. The States had a great deal of flexibility in how they designed their program. EPA has approved the plan outlines for all fifty states' SWAP, and most states have fully completed their programs. A state SWAP includes

- * delineating the source water protection area;
- * conducting a contaminant source inventory;
- * determining the susceptibility of the public water supply to contamination from the;
- * inventoried sources; and
- * releasing the results of the assessments to the public.

The EPA has yet to require specific actions to follow up on the information gathering process started with the SWAP program. However, such a comprehensive and complete information source should not be allowed to go unused. These SWAP assessments are

intended provide each state with a clear “big picture” view of its water resources. Each state could use these SWAP reports to identify bodies of water that are in critical need of protection and remediation. Because the SWAP requires the delineation of each source water protection area, the logical next step would be to implement programs that will ensure the proper protection of those delineated areas, including the acquisition of critical lands within the delineated area. On its web page on the SWAP program the EPA even suggests using state DWSRF funds for, “... continued implementation of the state well-head protection program, land acquisition and conservation easements” (EPA, 2005i). The EPA should not only suggest, but require that a portion of DWSRF and CWSRF funds be specifically used to follow up on acquisition of land and conservation easements on waters identified in each states’ SWAP.

Conclusion



*A river is more than an amenity, it is a treasure.
- Justice Oliver Wendell Holmes*

Clean and abundant freshwater plays an important role in sustaining both environmental and human systems. Threats, such as sprawl, erosion, and run-off are jeopardizing the quality of the nation's freshwater supplies, as well as water supplies around the globe, as illustrated in the Istanbul case study. Land protection efforts can reduce these threats, as well as reduce the threats to public health from emerging biological contaminants, endocrine disrupters, and disinfection byproducts. This strategy of protecting freshwater supplies is effective, as illustrated by the six unfiltered cities around the country, but underutilized. Significant amounts of money, as well as support from the public, are available to implement land protection programs, but very few regions and states are taking advantage of these resources. For example, resources made available through PennVest, can be used to specifically protect land around freshwater, but there have been no proposals to utilize the available funding in this way.

Land protection efforts across the country as well as around the globe serve as model pro-

grams that effectively recognize the interplay between the land and the water. Cooperation between cities and towns as well as agencies is an integral key to maintaining freshwater resources. The lack of cooperation, as seen in the Saco River region in Maine, can lead to few successful land protection initiatives. Regional cooperation, as illustrated by both the Cape Cod Commission and the Delaware River Basin Commission, has been a key to their success in implementing land protection efforts to protect freshwater resources. Public cooperation and support for water resource protection, in conjunction with government programming and funding opportunities and other resources, must be harnessed in order to effectively maintain high quality freshwater supplies.

The provision of clean and abundant freshwater resources for human consumption as well as environmental and habitat needs can best be ensured through land protection around the water bodies themselves. By focusing land protection efforts at the watershed level, maintaining, collecting, purifying, and storing

freshwater resources is more effective and efficient. Currently, land protection, as a means of protecting freshwater, is an underutilized tool in the provision of the nation's municipal freshwater supplies. The benefits of increased land protection efforts span environmental, health, and economic concerns. It is the inclusion of each of these factors that strengthens the case for expanded land protection as a means of maintaining freshwater resources.

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Attachment I

Memorandum of Understanding

**MEMORANDUM OF UNDERSTANDING
BETWEEN
TUFTS UNIVERSITY FIELD PROJECTS TEAM NUMBER SIX
AND
THE NATURE CONSERVANCY**

I. Introduction

Project (i.e., team) number: 6

Project code: NC-11

Project title: *Securing our Future Water Supplies – The Case for
New Investments in Water Supply and Water Resource Protection*

This Memorandum of Understanding (the “MOU”) summarizes the scope of work, work product(s) and deliverables, timeline, work processes and methods, and lines of authority, supervision and communication relating to the Field Project identified above (the “Project”), as agreed to between (i) the candidates for the Master of Arts degree enrolled during the spring 2005 semester in the Field Projects and Planning course (UEP-255) (the “Course”) offered by the Tufts University Department of Urban and Environmental Policy and Planning (UEP) who are identified in Paragraph (1) below (the “Field Projects Team”); (ii) The Nature Conservancy, further identified in Paragraph (2) below (the “Client”); and (iii) a Tufts faculty member directly involved in teaching the Course during the spring 2005 semester.

II. Specific Provisions

(1) The Field Projects Team working on the Project consists of the following individuals:

- | | |
|-----------------|--------------------------|
| 1. Patrick Hall | patrick_e_hall@yahoo.com |
| 2. Kate Newhall | kiataurh@hotmail.com |
| 3. Joel Paque | joel.paque@tufts.edu |
| 4. Sarah Reich | sarah.reich@tufts.edu |

- (2) The Client's contact information is as follows:

Key contact/supervisor: Mark P. Smith
Email address: msmith@tnc.org
Telephone number: (617) 542-1908 x 237
FAX number: (617) 542-1620
Client name: The Nature Conservancy
Address: 11 Avenue de Lafayette, 5th floor
Boston, MA 02111-1736
Web site: www.nature.org

- (3) The goal/goals of the Project is/are:
The Field Projects team will develop the rationale and approaches for the new and expanded public and private conservation and protection of watershed and water resource lands in Massachusetts and "at least one other Eastern state," to be determined by the Client. The goal is a balanced, well documented and refined assessment that presents a compelling rationale for advocating expanded watershed and water resource protection measures and funding; a report that underpins The Nature Conservancy's and others' ability to "make the case" among a diverse audience, including opinion leaders and the general public. Moreover, the team's analysis is expected to be broadly applicable across The Nature Conservancy's 14-state Eastern Region.
- (4) The work processes and methods by which the Field Projects Team intends to achieve this goal/these goals is/are:
The Field Projects team will conduct research to define the threats to and level of current protection of water supplies, the benefits of strong source water protection, focusing primarily on land protection strategies, and to perform comparative analyses to identify key components of a range of policies, programs and approaches that can achieve the above goal. Scope of research will include national and state-level issues related to watershed and water resource protection. Analyses and recommendations will be integrated into a formal report that employs graphics, numerical data and case study-type examples. The formal report will delineate several specific "angles of approach" that enable The Nature Conservancy to benefit from related initiatives and implement a best-in-class strategy.
- (5) The Project work products and deliverables are:

The Field Projects team will deliver draft and final reports, addressed above, as well as a presentation, suitable for review at the state and national level. The report will include data and case study-type examples drawn from across the United States. The report will address a selected issue(s) "in depth," providing substantive background and assessment and warranting critical review by The Nature Conservancy. The report will be tailored to identifying opportunities for furthering watershed and water resource protection efforts in multiple contexts.

- (6) The anticipated Project timeline is:
The Field Projects team will deliver to the Client a draft report for review and comment by Friday, April 1, 2005. The Client will provide relevant feedback and direction on the draft report by Wednesday, April 13, 2005. The Field Projects team will develop the accompanying presentation in parallel with the report. The final presentation, which will incorporate Client feedback to the draft report, will be made no later than Tuesday, May 3, 2005. Precise date of the final presentation will be determined by the Field Projects course instructors, and depends also on Client availability. The final report will be delivered on or before Tuesday, May 3, 2005.
- (7) The lines of authority, supervision and communication between the Client and the Field Project Team are:
The Client point of contact is Mark P. Smith. Mr. Smith will communicate with the Field Projects team primarily through team member Kate Newhall. Other communication/interaction with the Client or related parties will be approved and facilitated by Mr. Smith as necessary. Additionally, Mr. Smith will provide exclusive supervision of the Field Projects team on the Client's behalf.
- (8) The understanding with regard to payment/reimbursement by the client to the Field Projects Team of any Project-related expenses is:
The Field Projects team will address the need for project-related payments/reimbursements with Client as necessary through the course of Project work. Mr. Smith is amenable to considering requests for payment/reimbursement. No spending to be reimbursed by The Nature Conservancy may be made by the Field Projects team without advance written approval from the Client.

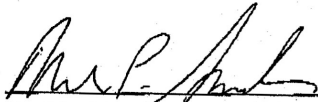
III. Additional Representations and Understandings

- A. The Field Projects Team is undertaking the Course and the Project for academic credit and therefore compensation (other than reimbursement of Project-related expenses) may not be provided to team members.
- B. Because the Course and the Project itself are part of a larger academic context, it is understood that the final work product and deliverables of the Project (the "Work Product") – either in whole or in part – may and most likely will be shared with others inside and beyond the Tufts community. This may include, without limitation, the distribution of the Work Product to other students, faculty and staff, release to community groups or public agencies, general publication, and posting on the Web. Tufts University and the Field Project Team may seek and secure grant funds or similar payment to defray the cost of any such distribution or publication. It is expected that any issues involving Client confidentiality or proprietary information that arise in connection with a Project will be narrow ones that can be resolved by discussion among the Client, the Field Projects Team and a Tufts instructor directly responsible for the Course (or his or her designee). Field Projects team and representatives from Tufts University will, to the greatest extent possible, inform the Client of intended use and distribution of the report prior to its use and distribution, with the exception of the report's use within the Tufts community by faculty, students and staff.

The Nature Conservancy will acknowledge, in at least one instance, the contribution of the Field Projects team in program materials produced as part of any initiative implemented as a result of the Field Projects report and presentation.

- C. It is understood that this Project may require the approval (either through full review or by exemption) of the Tufts University Institutional Review Board (IRB). This process is not expected to interfere with timely completion of the project.

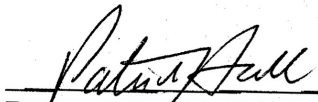
IV. Signatures



For The Nature Conservancy

By: Mark P. Smith

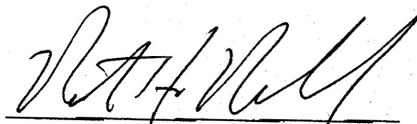
Date: 2-11, 2005



Representative of the Field Projects Team

By: Patrick Hall

Date: 2/15, 2005



Tufts UEP Faculty Representative

By:

Date: 2-14, 2005

Attachment II

IRB Approval

TO: Sarah Reich, Patrick Hall, Kate Newball, Joel Paque

This letter is your official notification that your research project

Securing Our Future Water Supplies: The Case for New Investments in Water Supply Protection

is exempt for IRB review for the following reasons:

2. Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior UNLESS the information is recorded in a manner in which the subject can be identified AND disclosure would place the subject at risk of criminal or civil liability or be damaging to financial standing, employability, or reputation. This does not apply where the subjects are children except where it involves passive observation of public behavior.

4. Research involving the collection or study of EXISTING data, documents, records, or specimens if the sources are publicly available or the information is recorded by the investigator in such a manner that subjects cannot be identified directly or through identifiers or codes.

Please be sure to print a copy of this notification for your files.



Helen A. Page

IRB Administrator

Helen A. Page, Ed.D.

Associate Director of Research Administration

Office of the Vice Provost for Research

Ballou Hall, 1st Floor

Tufts University

Medford, MA 02155

Phone: 617-627-5187

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Email: helen.page@tufts.edu

February 14, 2005

Date of Email Notification