SOURCE WATER PROTECTION

Linking surface water quality to the watershed: Problems, sources, and solutions.

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Introduction

The purpose of this Source Water Protection Guide is to help community water systems safeguard their surface water supplies. This guide was produced as part of Maine's Source Water Assessment Program (SWAP) in order to help surface water systems move from source water assessment to source water protection. This guide is intended to help small utilities manage and minimize risks identified by SWAP by focusing on the watershed causes of specific water quality problems.

The organization of the guide is circular in nature, with each section cross-referencing the others. Items in **bold** refer the reader to other pages of the manual. If you are having a specific water quality problem, you can go directly to that section (green) to find out about the problem and specific short-term solutions and treatment options. Also listed are the larger watershed-scale activities that can cause the various water quality impairments (yellow) and the long-term solutions to the watershed issues (blue). This guide focuses on source water protection, so these watershed sources and their management are emphasized.

What is Source Water Protection?

Source Water Protection is the process of managing activities in the watershed of a water supply to minimize adverse effects on water quality, as opposed to managing water quality by treatment technologies. Over a period of years, source water protection will generate savings by avoiding costs of additional water treatment or supply development. It is much easier and less costly to protect water quality than it is to restore water quality, and in many cases water quality is impossible to restore once it has been degraded.

Public water systems are legally mandated to deliver safe, dependable water to consumers. Minimizing health risks requires that the source water be as clean as possible. Activities in the watershed that threaten water quality take many forms, yet managing these watershed activities is a critical part of minimizing health risks. Source Water Protection means that each public water system has a plan to inventory the watershed and a strategy to respond to problems that affect water quality.

In 2002 the Maine Drinking Water Program will complete the first phase of the SWAP, which will provide an inventory of potential risks in the watershed of each surface water supply. The inventory process is the necessary first stage of a Source Water Protection program. Chemical analyses of source water quality, quantity measurements (storage and delivery) and observations of the physical state of the source are needed to complete the assessment phase. A Source Water Protection program can be initiated just by using the SWAP inventory, utility-generated data, and this guidance manual. This guide, like any other reference book, is intended to provide information about specific problems and to guide response. Some issues will require additional guidance from the Drinking Water Program and technical assistance from consultants. For this reason, references and resources are provided wherever possible.

Getting Started

The following quiz asks questions about the water supply. This information is necessary to understand water quality problems and develop a source water protection plan.

Watershed Quiz

1. What is the surface area of the source pond, lake, or impoundment?
2. What is the watershed area of the source pond, lake, or stream?
3. How much water is withdrawn on an average day? Average year? Are there seasonal changes in demand (for example, increased water use in summer)?
4. Are there any anticipated increases or decreases in demand? (For example, new schools or factory closings)?
5. How many inlets and/or outlets does the pond or lake have? Are there other ponds or lakes upstream? If the source is a stream or river, are there many tributaries upstream?
6. How much of the watershed is covered by wetlands?
7. How much of the watershed is covered by steep slopes and/or erodible soils?
8. What are the physical characteristics of the supply (lake or impoundment volume, maximum depth, average depth, water residence time, safe yield)?
9. Does the lake or pond stratify during the summer? How deep?
10. Do you monitor for nutrients? Is there a volunteer water quality monitor through the State Volunteer Lake Monitoring (VLMP) or Stream Teams programs or other regional organization?
11. Do you have algae problems? Do they only occur at certain times of the year or only some years?
12. Do you have problems with disinfection by-products in the distribution system?
13. Do you have problems with turbidity levels?
14. Are organisms such as total coliforms, E. coli, Cryptosporidium, or Giardia present or abundant?
15. Are wildlife such as beavers, geese, and deer a nuisance?
16. How much livestock are in the watershed (dairy farms, horse farms, etc.)?
17. How much of the watershed is covered by farms, forests, suburban or urban development, roads?

18. What are the permitted land uses and zoning in the watershed? (For example, resource protection, erosion control, commercial, residential zones).
19. What land protection ordinances exist in the watershed? Does the town or towns have an active comprehensive plan?

The following resources will help you complete the answers to the quiz:

Maps

United States Geological Survey (USGS) topographic maps, available at libraries, outdoor stores, from the USGS, and from the Maine Geological Survey. 287-2801 www.state.me.us/doc/nrimc/mgs/mgs.htm

SWAP maps and reports from the Maine Drinking Water Program.

Town tax and zoning maps, from your town office.

National Wetlands Inventory maps delineate wetlands greater than one acre. www.nwi.fws.gov/ or from the USGS/Earth Science Information Center at 703-648-5920 or 888-275-8747 and from the Maine Geological Survey.

Soils maps and information from Natural Resource Conservation Service Soil Surveys, available at libraries, from the United States Department of Agriculture (USDA) office in Bangor at 564-2321, and your local Soil and Water Conservation District (see Resources in **Appendix B**).

Watershed maps and information are available from the Maine Department of Environmental Protection (DEP).

Other Watershed Information

Town comprehensive plans and zoning ordinances.

State Planning Office 287-3261 or 800-662-4545 www.state.me.us/spo

Watershed organizations (see **Appendix B**).

Technical Assistance

Drinking Water Program 287-2070
www.state.me.us/dhs/eng/water/index.html

Maine Water Utilities Association 832-2263
www.mwua.org

Maine Rural Water Association 729-6569
www.mainerwa.org

Source Water Monitoring

Many of the questions in the Watershed Quiz can only be answered by monitoring the raw water. For many small surface water supplies, minimal financial or staff resources limit the amount of raw water monitoring that can be done. **Watershed groups, lake associations, and schools** can help with monitoring. A monitoring plan that involves other stakeholders in the watershed will contribute to community awareness of water quality issues. An effective monitoring program must be able to determine sources and relative importance of parameters of concern, while taking into account seasonal and annual variations and the operational flexibility of the supply system. Adjust the basic monitoring plan shown on the next page based on your specific needs. Consistency is important! Establish sampling locations (for example, above intake, at deep hole, or at major tributaries) and always sample from the same locations at roughly the same time of day at regular intervals. Monitoring data should be recorded and organized in order to track trends over time. Identifying the seasonality of problems (when they occur and how often) is useful for locating their possible sources in the watershed and selecting treatment options.

Resources

The Volunteer Lake Monitoring Program, with the DEP, provides training for water quality monitoring. It is recommended that the staff member or volunteer who conducts water quality sampling for the public water system becomes certified through the VLMP. Contact the VLMP at 225-2070 or www.state.me.us/dep/blwq/doclake/vm.htm

For detailed sampling procedures, see the *Instruction Manual for Baseline Water Quality Sampling* available from DEP at www.state.me.us/dep/blwq/doclake/baselinb.pdf or by calling 287-3901.

PEARL, the Maine Lakes Database, contains water quality and monitoring information on lakes and ponds in the state. http://pearl.spatial.maine.edu/

Volunteer Lake Monitoring (EPA440-4-91-002) www.epa.gov/volunteer/lake/index.html
Order from the National Technical Information Service (www.ntis.gov) 800-553-6847

Volunteer Stream Monitoring (EPA 841-B-97-003)
Order from the National Service Center for Environmental Publications 800-490-9198
www.epa.gov/cgi-bin/claritgw?op-Display&document=clserv:epa-cin9:184;&rank=1&template=epa

Contact the State Testing Laboratory for information on analysis and other certified laboratories at 287-2727 or www.state.me.us/dhs/etl/homepage.htm

RECOMMENDED WATER QUALITY MONITORING PLAN

Parameter	Sampling Frequency	Sampling location	SWAP Risk Ranking*		
			Low	**Moderate**	**Significant**
Turbidity	At least weekly	Intake/Treatment Plant	< 1 NTU	< 5 NTU	> 5 NTU
Transparency	Every two weeks April-October	Deep holes, coves	> 8 meters	4-8 meters	< 4 meters
Total Phosphorus	Every two weeks April-October	Intake, tributaries	< 10 ppb	< 20 ppb	> 30 ppb
Chlorophyll-a	Every two weeks April-October	Intake, tributaries	< 2 ppb	2-6 ppb	> 6 ppb
Dissolved oxygen/ Depth	Profiles once per month April-October	Every meter at deep hole(s)	> 7 mg/L	5-7 mg/L	< 5 mg/L
Temperature	Profiles once per month April-October	Every meter at deep hole(s)	ambient	---	> 10° C
pH	At the same time as other parameters	Intake	6.5-8.5	---	< 6.5 or > 8.5
Total organic carbon	4 times per year	Intake	< 4 mg/L	4-8 mg/L	> 8 mg/L
Color	With turbidity	Intake	< 5	5-15	> 15
Pesticides/ herbicides	Depends on land use	Intake, tributaries	absent	---	detected
VOCs	Depends on land use	Intake, tributaries	absent	---	detected
Total Coliform/ E. coli	Depends on treatment, public access	Deep holes, access points	< 29/100mL	occasional	> 142/100mL
Phytoplankton/ Zooplankton	Once per month	Same as transparency	N/A	N/A	N/A
Alkalinity	Once per month	Intake	N/A	N/A	N/A
Conductivity	Every two weeks April-October	Same as transparency	N/A	N/A	N/A
Water level[1] and flow	Weekly	At dam, from intake, or stilling well	N/A	N/A	N/A

*from *Maine Public Drinking Water Source Water Assessment Program*, Drinking Water Program, Maine Department of Human Services.

[1]How to measure water levels: Install a staff gauge at an accessible spot, and tie its location to a fixed point or surveyed vertical benchmark (marked on topographic maps). Water levels can also be measured by installing a pipe or staff gauge from the intake or inside a stilling well or clear well. Measuring from a stilling well is ideal because currents and wave action will not obscure the water level, however measurements can only be taken when pumping has stopped. Another option is solar-or radio-powered transmitters available from various environmental, scientific, and forestry supply companies. These transmitters can be tied directly to a computer database. If the water system is installing a new dam or intake, have a stilling well installed to monitor water levels. Use of a boulder or rock as a reference point is less desirable because rocks can move; a bedrock ledge or concrete dam wall is better.

Problems with the Nature of the Water Supply and Raw Water Quality

Many surface water supplies have natural characteristics that create challenges during treatment and distribution. For example, ponds that receive drainage from large areas of surrounding wetlands can be naturally highly colored from organic matter loading. The organic matter can combine with chlorine during treatment to form disinfection by-products.

When water quality problems are inherent in the nature of the supply, and not the result of human activities in the watershed, most solutions must be applied during the treatment process. While this guide is emphasizing source water protection, several common water supply problems and treatment options will be addressed here.

Problems with raw water quality, which are sometimes symptoms of larger issues, are the first noticeable sign of potentially damaging activities in the surrounding watershed. The following pages list common water quality problems and short-term solutions. Possible watershed sources of the problem(s) and long-term solutions are also listed. Refer to the corresponding sections for more detail on watershed sources (yellow) and solutions (blue).

While treatment-based solutions exist for many of these problems, locating and abating their sources in the watershed is the most effective and least expensive long-term solution.

The key to reducing most of these problems is the details. What is the exact nature of the problem? When is the problem most acute? How often does the problem occur? All of these questions are intended to provide clues to what in the watershed might be causing the problem.

Low Dissolved Oxygen

Chemical and biological processes, such as organic matter decomposition and plant and animal respiration, modify the amount of oxygen in lakes and rivers. The bottom waters of some lakes and ponds may naturally become oxygen depleted, or hypoxic, during stratification. When bottom waters are completely depleted, or anoxic, compounds in the sediments may be released as decomposition processes continue. For example, phosphorus in the sediments can be re-released to the water column in this way, contributing to algae bloom problems.

Conducting dissolved oxygen and temperature profiles as part of a **monitoring** plan can help to identify when, where, and why low dissolved oxygen conditions exist. According to the SWAP Assessment Guidelines, dissolved oxygen levels below 5 mg/L are considered to be a significant risk. If a pond or stream exhibits seasonal oxygen depletion, the first step is to determine the possible causes and then to reduce the demand for oxygen created by excess productivity.

Treatment-based solutions include adjusting the intake depth, in-source aeration or water circulation, and treating the pond with aluminum-based compounds to reduce release of phosphorus.

See the section on **Algae** for watershed solutions and resources.

Taste and Odor

Substances that cause taste and odor problems can be present in the raw water, can be added or created during treatment, or can arise within distribution or storage systems. There are seven common causes (see Gray, 1994, in Bibliography):

1. Decaying vegetation and algae produce fishy, grassy, and musty odors as they decay. These problems are usually seasonal.

2. Molds and actinomycetes (a kind of bacteria) produce musty, earthy, or moldy odors and tastes. They are found when water sits in pipes or when water is warm, and are associated with water-logged soil. When actinomycetes are present, decaying algae will form organic compounds like geosmin and 2-methylisoborneol that produce musty/earthy odors.

3. Iron and sulphur bacteria produce odors as they decompose (i.e., hydrogen sulfide or "rotten egg" smell).

4. Metals (iron, manganese, copper, zinc) impart a bitter or metallic taste.

5. Sodium chloride (from salt or seawater) will make the water initially taste flat or dull, then salty.

6. Industrial wastes (pesticides, solvents) can impart a strong sweet, medical, or chemical taste or odor.

7. Chlorine by itself will only produce a strong odor if water is overdosed during disinfection. Chlorine reacts with a wide variety of compounds to produce chlorinated products, which can have a chlorine taste or odor.

Treatment with activated carbon adsorption will remove actinomycetes (geosmin and 2-methylisoborneol). If problems are seasonal and occasional, powdered activated carbon can be added to the water before filtration.

See **Algae** for ways to control species that cause taste and odor problems.

Rivers and Streams as Sources

The 18 public water systems in Maine that use rivers or streams as sources have a unique set of source water management issues. Stream watersheds are more likely to share watersheds with other towns. The Source Water Assessment Program has delineated Source Water Protection Areas for surface water systems. However, for rivers and streams the Source Water Protection Area only extends one mile upstream from the intake location. The actual watershed can extend miles or hundreds of miles upstream and have many small tributaries, making it difficult if not impossible to control activities that may impact water quality or quantity. If possible, **monitor** larger tributaries in addition to the supply portion of the river in order to locate sources of nutrient loading in the watershed.

Supply issues are also more complicated with rivers, as there are more withdrawals and competing uses. Hydroelectric dams, wastewater treatment plants, agriculture, and mill diversions or discharges upstream can impact water quantity and quality. For the public water supplier using a stream source, it is especially important to cooperate with towns, neighboring states or Canada, and local watershed organizations. See **shared watershed**, **watershed groups**, and **schools** in the solutions section.

Resources

Canadian Resources

Canadian Water and Wastewater Association 613-747-0524 www.cwwa.ca

Environment Canada 819-997-2800 www.ec.gc.ca/envhome.html
Atlantic Office (New Brunswick and Maritimes) 902-426-7231
Water Issues Branch 819-953-6161 www.ec.gc.ca/water/index.htm

Government of New Brunswick, Environment & Local Government 506-453-2690
www.gnb.ca/0009/index-e.asp

Environment Quebec 418-521-3830 www.menv.gouv.qc.ca/index-en.htm

St. Croix International Water Commission 506-466-7550
www.asf.ca/orgsnb/sciwc/index.html

Maine Resources

Maine Rivers 800-287-2345 www.mainerivers.org

DEP Stream Teams 888-769-1036 (Front Desk at Maine DEP - Portland Office)
www.state.me.us/dep/blwq/docstream/team/streamteam.htm

UM Cooperative Extension http://www.umext.maine.edu 800-287-0274

See also watershed organizations in **Appendix B.**

Water Supply and Drought

Concerns about adequate supply can arise during times of increased demand and flood or drought conditions. While water quantity is not directly related to source water protection, it is indirectly related in the sense that quantity can affect quality. Water quality may improve during drought conditions because of less runoff from the watershed, while floods or periods of heavy rains can send pulses of material to surface waters. Preparing for weather and climate variability requires knowledge of the hydrology and dynamics of the source.

"Safe yield" is the maximum quantity of water that can be withdrawn during an extended dry period or drought. Safe yield is an accounting system for the supply, managed much like balancing a checkbook, and is calculated using data from the drought of historical record. It is important to recognize that seasonal variations of recharge or demand can affect either water quantity or quality, or both, thus affecting the supplier's ability to provide safe, dependable water service. Close attention to inflows, water levels, usable storage volumes, customer demand and other factors can help you understand the relationships between water quantity, water quality and variations in supply.

Understanding safe yield and supply variability requires knowledge of the following:

- Watershed area (direct drainage to lake)
- Inputs to lake or reservoir from streams (based on stream flow data)
- Precipitation records
- Evaporation and transpiration rates
- Infiltration rates
- Pumping rates
- Outflow over dam or through streams
- Total lake volume
- Volume of water above the intake
- Maximum drawdown point above the intake below which ice or other damage may occur.
- Number of large water users
- Changes in customer demand
- Water level variation (see **Monitoring**)

Solutions

For technical assistance in determining safe yield, contact an engineering or environmental consulting firm.

Town cooperation is important in order to raise awareness of critical water supply and quantity issues with town officials and residents.

Resources

Maine Emergency Management Agency www.state.me.us/mema/homepage.htm 800-452-8735 or 626-4503

Federal Emergency Management Agency www.fema.gov New England Office 617-223-9522

USGS Maine drought information me.water.usgs.gov/droughtme.html 622-8201

National Weather Service Climate Prediction Center (flood and drought forecasts) www.cpc.ncep.noaa.gov 301-763-8000

Maine Historical Climate Data- NOAA's Climate-At-A-Glance http://lwf.ncdc.noaa.gov/oa/climate/research/cag3/ME.html

New England River Basins Commission. 1980. *Before the Well Runs Dry: A Handbook for designing a local water conservation plan*. Federal Emergency Management Agency, US Government Printing Office.

Maine State Climate Office www.umaine.edu/maineclimate/default.htm 581-3441

Disinfection By-products – See also Color/Total Organic Carbon

Disinfection by-products (DBPs) are chlorinated or brominated compounds that are formed by disinfection chemicals reacting with organic matter in the water. DBPs are tested in the finished water and distribution system. Some DBPs are considered to be a human health hazard and the EPA has set maximum contaminant levels for specific compounds.

By-products form when the disinfectant reacts with organic "precursors". DBPs can be controlled by treating for the by-products themselves or by removing the precursor material to keep the by-products from forming. Many factors can affect DBP formation, including the location in the treatment plant where chlorination occurs, temperature, and pH.

Removing DBP precursors (total organic carbon) from the raw water can reduce the formation of disinfection by-products. This can be accomplished by a combination of coagulation, filtration, or softening in conjunction with careful management of chlorine-chemical use.

Treatment methods for controlling precursors to DBPs include:

- Use of alternative oxidants (ozone, chloramine or chlorine dioxide), which combine less readily with organic matter. Note that ozone treatment can activate bromide and cause formation of bromate, a regulated DBP.
- Enhanced coagulation (increase coagulant amount, lower pH, switch coagulants, use appropriate polymer dosage).
- Dissolved organic carbon adsorption by granular activated carbon or charcoal.
- UV disinfection.
- Membrane filtration.

Characterization of the organic matter by sampling for total organic carbon (TOC) in raw water is essential to finding the best ways to remove DBP precursors.

Color/Total Organic Carbon

Water "color" can be an indicator of the amount of natural dissolved carbon compounds, such as tannins and lignins, which can stain water brown or red. Total organic carbon (TOC) includes particulate and dissolved carbon. TOC is derived from plants and animals and enters waterways from decomposing plant matter, runoff, and septic systems in the watershed. Wetlands around the pond or in the watershed can be a source of large amounts of organic carbon, contributing to naturally highly-colored water. Organic carbon is also formed within water bodies by biological processes, and even clear-looking water can contain organic matter that contributes to disinfection by-product formation. Chemically, the organic matter is either protein (~45%), carbohydrate (~45%), or lipid (~10%). The carbohydrates are easily decomposed and are likely the major source of carbon for disinfection by-product (DBP) formation. While difficult to control, organic carbon can be managed at the watershed level and with various treatment methods.

For eutrophic water bodies subject to high nutrient loading from their watersheds, algae are likely to be the greatest source of DBP precursors during the summer and early fall. Chlorophyll-a is the best indicator of productivity in colored lakes (as opposed to total phosphorus). See **Algae** for more information on controlling nutrient loading.

The SWAP assessment guidelines consider TOC levels below 4 parts per million (ppm) to be a low risk for disinfection by-product formation. However, if levels are above 2 ppm, it is recommended that TOC be characterized by determining the relative proportions of dissolved and particulate organic carbon. Analysis of TOC should continue for a period of time (i.e., a year) in order to determine the relationship between TOC and DBP precursors.

Watershed Sources

Wetlands in the watershed or around a pond can release organic compounds that naturally stain water brown or red. This is a fairly constant input but may vary seasonally.

Stormwater runoff from **residential and urban development** carries organic matter.

Forestry and logging activities can disturb and release organic matter to surface waters.

Flooding and wood harvesting by **wildlife** (beavers) releases organic matter.

Solutions

Watershed and shoreline surveys will identify wetlands and erosion.

Encourage use of forestry best management practices through **landowner education**.

Resources

Controlling Disinfection By-Products and Microbial Contaminants in Drinking Water (EPA 600-R-1-110) available at www.epa.gov/cgi-bin/claritgw?op-Display&document=clserv:epa-cinb:1941;&rank=4&template=epa or from the National Service Center for Environmental Publications 800-490-9198.

Algae

Algae blooms can be an indicator of excess nutrients, specifically phosphorus and nitrogen. Soil erosion is the major source of excess phosphorus in surface water. Phosphorus is bound to soil particles that are suspended in stormwater runoff. Increased temperature and residence time of the source water can also contribute to algae growth. Algae can be responsible for the following water quality and supply problems:

- Clogged filters
- Color
- Turbidity
- Taste and odor
- Altered pH of the water
- Seasonal oxygen depletion
- Disinfection by-products (some algae can release substances rich in organic carbon, contributing to disinfection by-product formation, or substances that are toxic).

A visual inspection of an algae bloom can provide some information on the type of algae present, but linking algae to treatment problems such as taste and odor requires identification at the species level. A 500 or 1,000 mL sample of water is filtered to concentrate the algae, which are then viewed under a microscope. It is recommended that all surface water systems own a microscope and related equipment. Laboratories that can identify algae include the DEP Bureau of Land and Water Quality and the Augusta Water District.

If algae are a recurrent or seasonal problem, it is especially important that the raw water is monitored for total phosphorus and chlorophyll-a.

The use of herbicides such as copper sulfate to control algae is not recommended, since chemicals can affect other organisms in the lake and the dead and decaying algae can release carbon and phosphorus.

Watershed Sources

Intensive **forestry** can lead to sediment erosion, which carries phosphorus to surface waters.

Runoff from **residential and urban development** can carry fertilizers and sediment.

Agriculture and livestock can be a source of eroded sediment, fertilizers, and nutrient-rich manure runoff.

Geese and other **wildlife** contribute nutrients.

Solutions

Conduct a **watershed and shoreline survey** to identify areas of erosion, steep slopes, sediment deposits, and unbuffered surface runoff.

Promote the use of phosphorus-free fertilizers and vegetative buffers through **landowner outreach and education**.

Encourage proper road construction and runoff management through **development review**.

Control sources of phosphorus through **land conservation and acquisition.**

Watershed groups, lake associations, and schools can help with outreach and surveys.

Resources

To report an algae bloom or have algae species identified:
Contact the DEP Bureau of Land and Water Quality at 287-3901.

State Testing Laboratory 287-2727 www.state.me.us/dhs/etl/homepage.htm

Augusta Water District 395-2098 www.augustawater.org

The American Water Works Association offers an Algae Identification guide on cd-rom as well as other manuals, including *Problem Organisms in Water: Identification and Treatment*. AWWA Manual M7. Available from www.awwa.org or 800-926-7337.

Algae information on-line:
biology.smsu.edu/phycology/plank_algae.htm
www.thealgaesource.net/

Standard Methods for the Examination of Water and Wastewater contains algae identification plates. See reference in Bibliography.

Pathogens

Pathogens are disease-causing microscopic viruses, bacteria, and protozoan parasites. Example organisms include fecal coliform and *E. coli* bacteria, *Cryptosporidium*, and *Giardia*. Fecal coliform and E. coli should be monitored in the raw water. This is usually done with a presence/absence color test; however, a quantitative number count is the recommended method. The number of coliform samples required depends on the size of the population served. Those water supplies with public recreational access should monitor swimming beaches and other areas more often. Some microbial contaminants can be removed by coagulation and filtration, but success depends on the concentration used. Chlorine disinfection is effective against bacteria and viruses, but protozoa (e.g., *Cryptosporidium*) are resistant to chlorination.

Watershed Sources

Sources of pathogens include failing waste disposal systems and stormwater runoff from **residential and urban development**; **wildlife** such as beavers, muskrat, deer, gulls, geese, etc.; **agriculture and livestock**, especially runoff from feedlots and manure storage; and **public access** (recreational swimming).

Solutions

Participate in **development review** to encourage stormwater management.
Work on **land conservation** to control development.
Conduct a **shoreline survey** for animal presence (beaver lodges, muskrat dens, etc.).
Establish nutrient management programs in **agriculture and livestock** areas.

Resources

Drinking Water Program 287-2070 www.state.me.us/dhs/eng/water/index.html

Information on water quality for beach managers
http://www.state.me.us/dep/blwq/beach.htm or contact Clough Toppan at the Division of Health Engineering, Bureau of Health, Department of Human Services 287-2070.

Turbidity

Turbidity is a measure of the transparency of water, or how light is scattered or absorbed by particles in the water. As turbidity increases, less light penetrates the water. Turbidity can be caused by eroded sediment and stormwater runoff from the watershed or shoreline, and by organic matter within the water body. Turbidity is used as an indirect indicator of water quality, for example, nutrient levels or filtration effectiveness. Higher turbidity levels may be associated with higher levels of disease-causing microorganisms. Turbidity interferes with disinfection, requiring an increase in filtration and disinfectant use.

Turbidity is a problem that is often intermittent or seasonal, and requires **monitoring**. In addition to measuring turbidity with a meter at the treatment plant or by sending water samples to a laboratory, water clarity can also be measured with a secchi disk. Weekly secchi disk readings or turbidity measurements can help track transparency trends and identify potential sources of high turbidity.

Watershed Sources

Intensive **forestry** and **agriculture** can be sources of eroded sediment.

Wildlife (especially beaver) activity can erode sediment.

Sediment is carried by runoff from **residential and urban development,** construction sites, camp roads, and impervious surfaces.

Solutions

Watershed and shoreline surveys will identify forestry and agricultural practices and roads that might be contributing to erosion.

Participate in **development review** to promote stormwater management, proper road construction, buffers, and the use of erosion control during construction.

Watershed Sources of Impaired Water Quality

Various land uses and activities within the watershed of a surface water supply can affect water quality, resulting in some of the problems discussed in the previous section. The following pages describe some of the more common sources.

If you do not yet have a specific water quality problem, but are concerned about land uses in the watershed, this section will help you identify what kind of problems might result from certain activities. For example, if your lake or pond has good water quality but the surrounding watershed is being rapidly developed with residential subdivisions and commercial businesses, this section will identify water quality problems that can result, such as algae blooms and turbidity. This section will also refer to various watershed management techniques and resources in the **Solutions** section.

Residential and Urban Development

Residential and urban development issues fall into two categories, or scales. The first is development near the shoreline, immediately around the lake or along the river. Camps and homes on the water supply source can be direct, acute sources of nutrients, pathogens, sediment and runoff. The other category of development is on a watershed scale, where increasing development throughout the watershed of the lake or river can be a chronic source of contaminants, having small but cumulative impacts on a water body. The following are some of the more common sources of water quality impairment:

- Construction activities can disturb and release large amounts of sediment.
- Impervious surfaces associated with development (roads, rooftops, driveways, parking lots) create stormwater runoff that carries sand, salt, oil, tire wear, chemicals, pathogens, and nutrients from the land to the water supply.
- Runoff from lawns and landscaping carries sediment, pesticides, and nutrients from fertilizers.
- Sewage disposal systems can be direct sources of nutrients and pathogens.
- Highways, railroads, pipelines, and powerline easements are potential sources of spills and leaks of oil and hazardous materials. These throughways can also be sources of polluted stormwater runoff, herbicides, and erosion.
- Home heating oil storage and commercial fuel storage in the source water protection area represents a risk of spills or leaks. See **Security** on page 29.

Water Quality Problems

Algae

Pathogens

Turbidity

Pesticides, herbicides

Fuel storage and spills

Solutions

Through **development review and landowner education,** encourage stormwater management, erosion controls, vegetative buffers, and cluster zoning. Public Law 761, described in the section on Development Review, enables water suppliers to be involved in construction and development planning.

Watershed and shoreline surveys will identify areas of existing or potential problems.

Town cooperation and ordinance can help to communicate threats to water supply and make water supply protection part of the Town's comprehensive plan.

Land acquisition and conservation will protect land and prevent further development. Work with the Department of Transportation, the railroads and power companies to minimize effects on water quality.

Security measures include responding to spills and leaks.

Resources

Maine Department of Transportation 624-3000 www.state.me.us/mdot
DOT Surface Water Resources Unit
www.state.me.us/mdot/env/surface_water_resources.htm

Under the federal National Pollution Discharge Elimination System Phase I and II Stormwater program (http://cfpub1.epa.gov/npdes/home.cfm?program_id=6), permits are required for some municipal separate storm sewer systems and construction activity disturbing between 1 and 5 acres. Under Maine's 1997 Stormwater Management Law, a construction project may require a permit from the DEP if the project includes 20,000 square feet or more of impervious area or 5 acres or more of disturbed area and is located in the watershed of a public water supply. Contact the Stormwater Coordinator, David Ladd, at the Bureau of Land & Water Quality at 287-3901 for more information.
www.state.me.us/dep/blwq/stormwtr/index.htm

The Wastewater and Plumbing Control Program should be contacted for concerns regarding subsurface waste disposal systems at 287-5689
www.state.me.us/dhs/eng/plumb/index.html

U.S. EPA: Urbanization & Streams: A Study of Hydrologic Impacts
www.epa.gov/owow/nps/urbanize/report.html

The Center for Watershed Protection provides publications, research, and technical assistance on watershed and development issues. www.cwp.org 410-461-8323

Effects of Watershed Development and Management on Aquatic Ecosystems. L.A. Roesner, ed. New York: American Society of Civil Engineers. 1997.

Selected Findings and Current Perspectives on Urban and Agricultural Water Quality by the National Water-Quality Assessment Program. USGS Fact Sheet FS-047-01. United States Geological Survey. 2001. water.usgs.gov/pubs/FS/fs-047-01/

Schueler, T. 1995. *Environmental Land Planning Series: Site Planning for Urban Stream Protection*. Center for Watershed Protection, Silver Spring, MD, and the Metropolitan Washington Council of Governments, Washington, DC.

More planning resources are located in **Appendix B**.

Agriculture and Livestock

Well-managed agriculture can be a viable land use in the watershed of a water supply. When Best Management Practices (BMPs) are applied to control erosion and non point-source pollution, agriculture can contribute less pollution than other types of land uses, including residential development. Yet agriculture is often a source of water quality impairment. Crop and turf farms can be sources of pesticides and nutrients from fertilizers and eroded sediment. Livestock operations can be sources of pathogens and nutrients from manure storage and runoff.

Water Quality Problems

Algae

Turbidity

Pathogens

Pesticides and herbicides

Solutions

Watershed and shoreline surveys can identify certain agricultural practices in need of improvement.

Once problem areas are identified, conduct **landowner education** and work with the farmers. Encourage agricultural BMPs for erosion, manure management, crop harvesting, and pesticide/fertilizer application.

A viable agricultural community can be sustained through **town cooperation and ordinance.** If the town has a comprehensive plan, how does it account for the role of agriculture?

Land acquisition and preservation does not always mean prohibiting all uses of the land. Many land trusts and local conservation organizations are interested in preserving and protecting both working and retired farmland. Farmers can receive benefits for conserving land through federal programs such as the Conservation and Wetland Reserve Programs.

Resources

UM Cooperative Extension http://www.umext.maine.edu 800-287-0274

The Maine Nutrient Management Law establishing a comprehensive Nutrient Management Program was enacted in 1998. The Nutrient Management Rules that were developed based on the Nutrient Management Law were updated in February 2001, and include nutrient management plans for some farms, setbacks for manure storage areas,

and a ban on winter manure spreading. The Nutrient Management Program is administered by the Maine Department of Agriculture. 287-3871
www.state.me.us/agriculture/homepage.htm
www.state.me.us/agriculture/oanrr/NutrientManagement.htm

Maine Board of Pesticides Control 287-2731 (Augusta); 764-2039 (Presque Isle)
www.state.me.us/agriculture/pesticides

Soil and Water Conservation Districts (see **Appendix B** for phone numbers)
www.state.me.us/agriculture/oanrr/soil3.htm

American Farmland Trust provides tools, publications, and technical assistance for protecting farmland. New England Field Office 413-586-9330
www.farmland.org/regions/ne/index.htm

USDA Conservation Programs are administered through your local USDA/Farm Service Agency office. Maine State Consolidated Farm Service Agency 990-9140
www.fsa.usda.gov/dafp/cepd/default.htm

Forestry

From a water quantity and quality standpoint, forests are the preferred watershed land cover. Forestland can enhance water quality, provide wildlife habitat, and allow for passive recreation. A forest management plan that is designed to enhance water quality and increase water yields can include commercial logging. By supplying clean water and generating income through the sale of lumber, forest management is highly beneficial. Income from forest harvesting can subsidize watershed management programs. Logging and other silvicultural activities are widely recognized as acceptable water supply watershed uses which, when properly managed, will not degrade water quality. BMPs should be applied to protect water quality, soil structure, residual trees, and cultural resources.

Water Quality Problems

When not conducted in accordance with a forest management plan or when forest is in small privately owned woodlots, logging can contribute to the following water quality problems:

Algae
Turbidity
Pathogens
TOC/Disinfection by-products
Pesticides and herbicides

Solutions

Watershed and shoreline surveys can identify areas of erosion.

Conduct **landowner education** for foresters and woodlot owners about BMPs. Standards for BMPs are available from state agencies.

Resources

Maine Forest Service www.state.me.us/doc/mfs/mfshome.htm
The State Forester can be reached at 800-367-0223

UMaine Cooperative Extension 800-287-0274
Forestry Office 581-2892 www.umext.maine.edu/topics/forestry.htm

Small Woodland Owners Association of Maine assists small woodlot owners and works to raise public awareness of the cumulative importance of managed forests to Maine's economy and ecology, particularly in areas experiencing development pressures.
www.swoam.com 626-0005 or 877-467-9626

Dissmeyer, G.E., ed. 2000. *Drinking water from forests and grasslands: a synthesis of the scientific literature.* USDA Forest Service, Southeast Research Station, Asheville, NC. General Technical Report SRS-039
www.srs.fs.fed.us/pubs/viewpub.jsp?index=1866
828-257-4832 ext.392

US Forest Service *Wildland Waters* quarterly newsletter about forests and water supplies is available online at
www.fs.fed.us/wildlandwaters or for a hard copy subscription, send a request to:

Richard Schneider
Rocky Mountain Research Station,
USDA Forest Service
240 West Prospect Road, Fort Collins, CO
80526-2098
rschneider@fs.fed.us
fax 970-498-1396

National Association of State Foresters http://www.stateforesters.org/

North East Foresters Association http://nefa.conknet.com/

Society for the Protection of New Hampshire Forests http://www.spnhf.org/ 603-224-9945

Society of American Foresters http://www.safnet.org/index.shtml 301-897-8720

Wildlife

Both wild and domestic animals contribute to water quality problems. While natural wildlife populations are usually not a problem, an overabundance of some species can be a significant source of water quality impairment. For example, aside from causing the obvious water-level problems, beaver dams can flood land upstream from the supply source, sending pulses of carbon and phosphorus downstream. Beaver and muskrats can be sources of pathogens and eroded sediment. Geese are often sources of excess nutrients.

The Department of Inland Fisheries & Wildlife should be contacted for all wildlife-related problems. There are several measures to limit the presence of geese, the most important of which is to prohibit feeding. Other steps include eliminating lawn areas, which attract birds, planting shrubs and groundcover, and employing various noise and visual disturbances.

Water Quality Problems

Algae

Turbidity

TOC/Disinfection by-products

Pathogens

Solutions

Watershed and shoreline surveys will identify the presence of beaver and muskrats.

Educate the public and ensure **town cooperation** to discourage feeding of wildlife.

See the section on **Agriculture** for information on controlling runoff from livestock and domestic animals.

Resources

ME Department of Inland Fisheries and Wildlife 287-8000
www.state.me.us/ifw/index.html
To reach a game warden 24-hours a day, call the Maine State Police:
Augusta 800-452-4664 Houlton 800-924-2261
Skowhegan 800-452-4664 Orono 800-432-7381
Thomaston 800-452-4664 Gray 800-482-0730

Public Access

According to Maine state law, no person can be denied access over unimproved land to a great pond, *unless* the land is owned by a water district and the pond serves as a public water supply. For many surface water bodies in Maine where the land is not utility-owned, recreation is perceived as the primary use. This can create conflict when the lake or pond also serves as a drinking water supply. Recreational activities such as swimming, boating, snowmobile and ATV use, hunting, fishing, ice-fishing, and general public access all pose potential threats to a water supply and must be managed accordingly.

Under Maine Statute, Title 22, Sections 2648 ("Protection of intake of public water supply") and 2649 ("Protection of public water supplies over winter"), a utility can restrict access to the intake zone and regulate vehicles on ice. The Warden Service of the Department of Inland Fisheries and Wildlife has jurisdiction over surface activities on lakes, so even if a public water system has charter rights to limit access to the intake zone, it is the Warden's job to enforce restrictions. If you are concerned about recreational activity on the pond and security issues, check your utility's charter for what rights you have to limit access. If the charter does not provide protection, work with your Board and local legislators to amend the charter.

Posting signs at road crossings and access points can raise awareness that the water body is a drinking water supply. Gate private access roads. Work with local law enforcement, snowmobile and ATV groups, and game wardens so they understand the risks to the supply.

Any public access, but especially boating, could introduce invasive aquatic species to the water supply by way of plant fragments on boat trailers and motors, bilge water, anchor lines, and bait boxes. Of principal concern here is the non-native plant Eurasian Water Milfoil, although other invasives are also of concern. While Maine is one of the few states without a significant invasive aquatic plant problem, the threat is great enough that the State is aggressively working to prevent invasion through laws (Chapter 434, An Act to Prevent Infestation of Invasive Aquatic Plants, and Chapter 722, An Act to Prevent the Spread of Invasive Aquatic Plants), education, boating stickers and inspections.

Water Quality Problems

Pathogens

Turbidity

Oil & hazardous material spills

Solutions

Town cooperation and ordinance is necessary to ensure existing laws are enforced.

Landowner education raises awareness of potential threats to water quality**.** Boaters, anglers, and other recreational users are potential allies in conservation and water quality protection efforts. See **Watershed Groups and Lake Associations** for ways to work with stakeholders.

Security measures should include spill and emergency response. If the utility owns land around the water body, restrict access.

Resources

ME Department of Inland Fisheries and Wildlife 287-8000
www.state.me.us/ifw/index.html
To reach a game warden 24-hours a day, call the Maine State Police:
Augusta 800-452-4664 Houlton 800-924-2261
Skowhegan 800-452-4664 Orono 800-432-7381
Thomaston 800-452-4664 Gray 800-482-0730

ME Snowmobile Association 622-6983 www.mesnow.com

Recreational Vehicles http://www.state.me.us/ifw/rv/rec.htm

Maine snowmobile laws http://www.state.me.us/ifw/rv/snowlaws.htm

DEP invasive aquatics program: contact the DEP Lakes program 287-3901
or the VLMP 225-2070 www.state.me.us/dep/blwq/topic/invasive.htm

Beach management http://www.state.me.us/dep/blwq/beach.htm 287-2070

Maine Law
Title 17, Section 3860. Great Pond; access or egress
http://janus.state.me.us/legis/statutes/17/title17sec3860.html

Title 22, Chapter 601, Section 2648. Protection of intake of public water supply
http://janus.state.me.us/legis/statutes/22/title22sec2648.html

Title 22, Chapter 601, Section 2649. Protection of public water supplies over winter
http://janus.state.me.us/legis/statutes/22/title22sec2649.html

Watershed Solutions

The following pages describe various management approaches that can be included as part of a source water protection plan. It is unlikely that any one system will be able to employ all of these methods, but a combination of many or several can greatly improve water quality protection efforts.

Underlying the source water protection concept is this fundamental premise: *The protection of drinking water supplies must happen at the local level.* All of the watershed solutions require communication with various stakeholders in the watershed: landowners, farmers, foresters, citizens, schools, and local and state officials. In order to be successful, stakeholders in the watershed must work toward a common water quality goal.

Security

There are many threats to the security of public water supplies. Examples of threats include vehicle accidents on roadways near the water body, leaks from underground and aboveground fuel storage tanks, discharges of hazardous materials from nearby factories and industries, and intentional contamination. Responding to emergencies and security threats requires planning and preparedness.

Planning for contamination threats:

- Protect the intake.

- Encourage minimum stormwater management practices (see the EPA Phase I/II Stormwater Management regulations) to reduce the chance of hazardous materials traveling to the water supply.

- Planning involves knowing whom to call in an emergency, but also making sure the local sheriff, state police dispatcher, and County Emergency Planning Commissions know to notify the utility if and when spills occur near the water supply.

When unusual, suspicious, or threatening activity occurs, follow the Security Response Protocols developed by the Drinking Water Program in July 2002. Contact the Security Coordinator at the Drinking Water Program for more information.

When a spill occurs:

1. Call 911.

2. Call the Drinking Water Program (287-2070 weekdays 8-5, or 557-4214 nights and weekends) and Maine DEP Emergency Response:
   www.state.me.us/dep/rwm/emergenc.htm.
   Oil Spills
   Calls within Maine (24 hours) 800-482-0777
   Calls from outside Maine (8 a.m. - 5 p.m.) 207-822-6300
   Calls from outside Maine (nights, weekends, holidays) 207-657-3030
   Hazardous Material Spills
   Calls within Maine (24 hours) 800-452-4664
   Calls from outside Maine (24 hours) 207-624-7000

Resources

EPA's *Model emergency response guidelines*
www.epa.gov/safewater/security/er-guidance or call 800-426-4791
Security information www.epa.gov/safewater/security/index.html

A Model Emergency Contingency Plan for Water Systems
Maine Rural Water Association 729-6569 www.mainerwa.org/page9.html

A Handbook for Water Supply Emergencies
Massachusetts DEP 617-338-2255 www.state.ma.us/dep/brp/dws/files/emerhadbk.doc

Northeast Rural Water Association has security resources, including a *Security Vulnerability Self-Assessment Guide for Small Drinking Water Systems* available at www.neruralwater.org/security.html or call 800-556-3792.

Land Acquisition and Conservation

Outright ownership of shorefront and watershed lands by the public water supply is ideal but not always feasible. Your best argument is that the cost of land is often less than remediating pollution (for example, with alum treatments). Creation of a land acquisition policy and fund is a good place to start.

Steps in land conservation and acquisition:

1. View or obtain tax maps from town offices and identify large and shorefront tracts of land and prioritize parcels for acquisition. Large lots and agricultural properties are especially vulnerable to subdivision and development. Shorefront lots are usually placed in highest priority, with surrounding lots and land along tributaries next in priority. Geographic Information Systems can be helpful in this step.
2. Contact landowners who might be interested in conservation (see **Landowner Education**). Discuss the land's importance to water quality. There are many incentives for landowners to place acreage under conservation easement, including tax breaks.
3. If the town has a land acquisition program, talk to the town planner about coordinating efforts.
4. Contact area real estate agents to request first purchase option when properties are listed.
5. Work with other stakeholders interested in conserving land, such as **watershed organizations** and land trusts. Land that is valuable to these groups is often also valuable for water quality protection.
6. Convince the Board to set aside a percentage (for example, 5%) of funds each year towards land acquisition. By doing this, when land becomes available there will already be money for purchase.

Resources

Maine State Planning Office www.state.me.us/spo
287-3261 or 800-662-4545

Maine Land Trust Network www.mltn.org 729-7366

Permanently Protecting Water Supply Lands with Conservation Easements is an excellent guide to conservation easements, and includes model easements. The report is available from the Society for the Protection of New Hampshire Forests at www.spnhf.org/explor/library/Research/watersupply.pdf or by calling 603-224-9945.

Public water systems with experience in land protection include Auburn, Augusta, Bangor, Bath, Camden-Rockland, and Portland.

See Resources in **Appendix B**.

Watershed Organizations and Lake Associations

These groups can be your greatest allies. They can help with monitoring, surveying the watershed, educating landowners, and land conservation. If there is an active watershed or lake group, ask to meet with them or attend a few meetings. Be sure to introduce yourself and make it clear that you have a common interest. If the group works on a nearby pond or stream in the watershed, see if they would be interested in your pond or stream. For monitoring, it can be less expensive to contribute money to a watershed group (for example, the Cobbossee Watershed District) that already does monitoring on other water bodies, because the organization has the necessary equipment, staff, and other resources. If there is no watershed or lake group, or a group is not active, try to identify key individuals in the watershed who have been interested or involved in the past. Convince residents of the threats to water quality, and the costs of declining water quality. Just one concerned resident can be an enormous asset. See also **landowner education** and **schools**.

Resources

Maine Congress of Lake Associations www.mainecola.org
877-254-2511

DEP lakes program 287-3901
www.state.me.us/dep/blwq/lake.htm

Contact the Volunteer Lake Monitoring Program at 225-2070 or www.state.me.us/dep/blwq/doclake/vm.htm to find out if there is a volunteer monitor for your pond.

UM Cooperative Extension 800-287-0274 www.umext.maine.edu

See a listing of watershed organizations in **Appendix B.**

Schools

Schools are another place to turn for help with monitoring and surveying the watershed. Contact science teachers at the local high school and/or middle school to let them know of your needs and the opportunity for the students. Use the basic monitoring recommendations provided in this guide, and be sure to set up an organized framework for data collection and recording. Some science classes may already be doing work on another pond or stream in town, and many schools have equipment and resources to obtain sampling equipment. If possible, offer a tour of the treatment plant. Establishing a relationship with schools is an opportunity to educate students about their lakes and streams, and to provide environmental awareness that will be taken home to their parents.

Resources

Watershed Protection grants for schools are available from ME DEP 287-3901
www.state.me.us/dep/blwq/grants.htm#watershed

Maine schools on the web
juniormc.tripod.com//Maine.html

Maine Lakes Conservancy Institute www.mlci.org 563-6529

UM Cooperative Extension 800-287-0274 www.umext.maine.edu

Project WET is a national education program for students and educators. Contact the Maine Project WET Coordinator, Dr. Mary Ann McGarry, at 581-3244.
www.umaine.edu/waterresearch/Educational%20Partnerships/projwet.html

Landowner education

See also **Watershed Organizations and Lake Associations** and **Schools**.

Letters sent to shorefront and/or watershed landowners can help determine the level of interest in water quality protection. Letters can also be included with water bills to convince customers that even though they may not live in the watershed, water quality protection keeps their costs down. Informational materials and brochures can be obtained from state and federal agencies. A sample letter to landowners is also included in **Appendix A**.

Resources

A Public Education Strategy to Protect Drinking Water. ME State Planning Office www.state.me.us/spo/lwrc/Smart%20Growth%20Coordinating%20Committee/publicedu cation.htm 287-3261

UM Cooperative Extension 800-287-0274 www.umext.maine.edu
Water Quality office 581-3241 www.umaine.edu/waterquality
Administers educational programs such as the Watershed Stewards Program and can supply materials such as Lake*A*Syst, an educational booklet for waterfront landowners www.umaine.edu/waterquality/lake_a_syst.htm.

Watershed and Shoreline Surveys

In order to identify the potential watershed sources of water quality problems, you have to get out into the watershed and on the water to see what's going on. **Lake associations, watershed groups, landowners, and schools** can organize and/or participate in watershed surveys, so refer to those sections for more information.

The purpose of annual watershed surveys and periodic watershed inspections (weekly, biweekly, monthly) is to check roads, stream crossings, culverts, farms, forestry, steep slopes, large areas of impervious surfaces, recreational areas, and new construction for soil erosion, manure runoff, herbicide/pesticide spraying, and other potential hazards. When conducting inspections and surveys, it is important to document all observations and keep records. See **Appendix A** for an example watershed inspection form.

In a more comprehensive watershed survey, the watershed is divided up into sections based on roads and other features, and each section is surveyed by small groups of people for sediment erosion, usually during or after a rainstorm. Problem areas are identified and recorded for follow-up with the landowner. It is helpful when contacting landowners to remind them that the survey is not for enforcement purposes and any land use changes are voluntary.

Shoreline surveys are usually performed by boat to check shorefront properties, wetlands, and public access points for erosion and other problems.

Resources

DEP has numerous publications that can help in identifying threats to water quality and in finding solutions once threats are identified. 287-3901
www.state.me.us/dep/blwq/doclake/publake.htm

UM Cooperative Extension 800-287-0274 www.umext.maine.edu

See Watershed Organizations in **Appendix B**.

Town Cooperation and Ordinance

In addition to surveying the watershed and contacting landowners and other concerned citizens, it is beneficial to develop a relationship with town officials. Contact selectmen, planning board and conservation commission members, and code enforcement officers. Communicate the vulnerability of surface water supplies, and the costs of source protection versus remediation. Explain your source water protection efforts and why they benefit the town as a whole. Sponsoring events such as school science fairs, civic fairs, earth day festivals, farmers markets, and athletic events can increase visibility and raise awareness of drinking water issues. Developing relationships with media like your local newspaper can help publicize source protection efforts and reach out to citizens.

Find out if the town has a comprehensive plan, and if it is active. Comprehensive plans assess the effects of future buildout (maximum development of zoned areas) and are a master vision for the town. If one is in the process of being written, make sure there is a section on water resources protection. What are the permitted uses in the watershed (zoning)? Identify zoned uses that could be potential threats. Could the town have stricter shoreland zoning or create a public water supply zone?

There are various zoning ordinances that attempt to

- prohibit the use of septic cleaners (which can also contaminate private wells);
- restrict certain recreational activities, although this may be more difficult if activities currently take place on the water body;
- prohibit bulk fuel storage and other hazardous land uses;
- encourage phosphorus management;
- promote conservation of natural, cultural, and historic resources.

Resources

Model ordinances are available from the State Planning Office and Maine Rural Water Association. Some example ordinances are located in **Appendix A**.

A University of Maine study documented the economic benefits of protecting water quality. The study is available online at
www.umaine.edu/WaterResearch/Research/greatpond.html
To obtain a complete version of REP 473 - *Great Ponds Play an Integral Role in Maine's Economy*, send your request in writing with $5 (address checks to University of Maine) to: Kim Junkins, Department of Resource Economics and Policy, 5782 Winslow Hall, University of Maine, Orono, ME 04469

Shared Watersheds

If the watershed is shared with another town or towns, or extends into bordering New Hampshire or Canada, outreach must also extend to those areas. In areas where relations between towns are strained, **watershed organizations** and state agencies can be of help.

Resources

Canadian resources

Canadian Water and Wastewater Association 613-747-0524 www.cwwa.ca

Environment Canada 819-997-2800 www.ec.gc.ca/envhome.html
Atlantic Office (New Brunswick and Maritimes) 902-426-7231
Water Issues Branch 819-953-6161 www.ec.gc.ca/water/index.htm

Government of New Brunswick, Environment & Local Government 506-453-2690
http://www.gnb.ca/0009/index-e.asp

Environment Quebec 418-521-3830 www.menv.gouv.qc.ca/index-en.htm

St. Croix International Water Commission 506-466-7550
www.asf.ca/orgsnb/sciwc/index.html

New Hampshire resources

NH Division of Water Supply Engineering (Department of Environmental Services)
www.des.state.nh.us/wseb/ 603-271-2513

New Hampshire Rivers Council www.nhrivers.org 603-228-6472

See watershed organizations in **Appendix B**.

Development Review

Public Law 761, enacted in 2000, requires that public water suppliers be notified of certain activities being proposed within the source water protection area (direct watershed) of the water supply. Public water suppliers are essentially treated as an abutter in cases where abutters are notified. This gives you the chance to attend public hearings and comment on proposed development.

Here are some suggestions when reviewing and commenting on development:

- At the very least, introduce yourself at the hearing and make it clear that you are representing the interests of public health and water supply protection.

- Promote construction best management practices and erosion controls (silt fencing, haybales, covering or seeding stockpiled soil, etc.).

- Request stormwater best management practices in residential and urban development, including deep sump catch basins, grassed swales, buffers, etc. Under Maine's 1997 Stormwater Management Law, a construction project may require a permit from the DEP if the project includes 20,000 square feet or more of impervious area or 5 acres or more of disturbed area and is located in the watershed of a public water supply. Contact the Bureau of Land & Water Quality at 287-3901. Stormwater management regulations are available at www.state.me.us/dep/blwq/stormwtr/index.htm.

- Promote vegetative buffers and other landscape controls on non-point source pollution.

- Pursue land conservation and easement options on undeveloped portions of lots and subdivisions.

Drinking Water Program Source Protection Section 287-6196
www.state.me.us/dhs/eng/water/Source%20Protection.htm

Informational brochures about P.L. 761 are available from the Senator George J. Mitchell Center at the University of Maine 581-3254 www.umaine.edu/WaterResearch

Maine Municipal Association 623-8428 www.memun.org

UM Cooperative Extension 800-287-0274 www.umext.maine.edu

Soil and Water Conservation Districts (see **Appendix B**)

National Stormwater BMP Database
www.bmpdatabase.org/

Appendix A

Example Documents

WATERSHED INSPECTION SURVEY*

DATE _____ TIME _____ INSPECTOR _____

WEATHER CONDITIONS_____ AREAS COVERED _____

Drive all major roads/walk trails in watershed and note observations of the following: Litter, watershed signs, culverts, ditches, fence line conditions, construction activity, agricultural activity, forestry activity, recreational activity, animals, potential contaminant threats, flow conditions of streams, etc.

_____
_____
_____
_____
_____
_____
_____

Please indicate activities of concern on map below:

Map of watershed that shows major roads, supply, and other landscape features (e.g., USGS topographic map).

Other notes:

**Adapted from Augusta Water District and York Water District survey forms.*

LETTER TO LANDOWNERS*

WATER DISTRICT
ADDRESS
PHONE

DATE

Dear Neighbor,

The ____ Water District is working to improve protection for ____ Pond and its watershed. ____ Pond is the source of drinking water for residents of _____ served by the public water system. There are many activities, on and around the pond and in the watershed, that can impact water quality.

In checking town tax maps, your property appears to lie adjacent to the Pond or within the watershed. We would like to involve stakeholders, especially shorefront landowners, in future water quality protection efforts, because any effort to preserve the supply of clean drinking water will also ensure that the ____ Pond area remains a nice place to live. Please note that this project is not for enforcement or regulation purposes. If you would like more information about ____ Pond or water quality protection, or would like to be involved in future activities, please return the enclosed postcard.† Do not hesitate to contact us if you have any questions or concerns.

We look forward to working with you to protect ____ Pond.

Sincerely,

Water District Manager

**Adapted from Augusta Water District and Newport Water District letters.*

† Postcard should be paid and addressed to water district. Ask for name, address, phone, and watershed protection interests. Also consider enclosing a water quality brochure, such as those available from Maine DEP, Maine Cooperative Extension, or Soil & Water Conservation Districts, or a brochure about the water district.

WATERSHED ATV PERMIT APPLICATION*

The undersigned agrees to the following terms and conditions set forth as a privilege to operate a motorized All Terrain Vehicle (ATV) on certain property of the ___ Water District located in ____ . The ATV is to be used only on designated logging (tote) roads and trails. Roads and trails that have been closed off to ATVs will be blocked with boulders or logs and signs will be present. Water-related activities are strictly prohibited. No swimming, fishing, boating, ice skating, or ice fishing are allowed on the District's public water supply, ___ Pond. Foot travel only is permitted within 250 feet of the normal high water mark of ___ Pond, unless you are on an approved ATV trail. Other prohibited activities include tree cutting, burning of fires of any kind at any time, camping and any other activity that would in any way degrade the land or water supply. There is a "carry in, carry out" policy and littering is prohibited. This privilege to pass across the property of the District with an ATV is non-transferable and revocable at the will of the District, and shall expire ***June 30th of each year*** (unless previously revoked by the District). The District reserves the right to limit the number of permits issued for any reason. ***The District also reserves the right to close the watershed properties anytime it feels the water quality could be in danger of contamination.*** For a complete list of rules please contact the District.

The undersigned assumes all risks associated with operating an ATV on the District's properties, with the understanding that operating an ATV on unpaved roads and trails is an inherently dangerous activity, and that the District has made no representation that the roads and trails are safe for such use.

I hereby agree to follow these terms and conditions set forth by the ___ Water District and in no way will hold the District liable for bodily injury or property damage resulting from my presence on the District's properties.

_____

THIS PERMIT MUST BE KEPT WITH THE ATV WHILE ON WATERSHED PROPERTY

This permit expires June 30th of each year

Name of primary user:_____ **Permit number:**_____

Mailing address of primary user:_____

_____

Telephone number of primary user:_____

ATV Plate Number:_____ **State:**_____

Please list the names of people other than the primary user who may be using this ATV on the watershed property:

Applicant's signature:_____ **Date:**_____

Water District Superintendent Approval:

Signature:_____ **Date:**_____

**Adapted from York and Kittery Water Districts.*

PHOSPHORUS CONTROL ORDINANCE (PCO)*

A. Purpose

The purpose of the following Ordinance is to provide protection against additional phosphorus export to ___ Pond from new land uses and changes in existing land uses by ensuring that development within the Watershed does not generate more phosphorus than the water body can handle and by eliminating or reducing existing sources of phosphorus. Phosphorus, a nutrient, stimulates algal growth, the main cause of water quality decline. The primary source of new and increasing phosphorus loading in Maine lakes is land development - residential, commercial and industrial.

B. Boundaries and Definitions

_____ Pond – The _____ Pond Watershed regulated by this Ordinance is all land areas within the direct watershed of ____ Pond as defined on the attached map.

Direct Watershed – Any land area which contributes storm-water runoff by either surface or subsurface flow to ____ Pond without such runoff first passing through an upstream lake.

Phosphorus Export Coefficient (F) – The amount of phosphorus export from the watershed each year that will produce a 1 ppb increase in the lake's phosphorus concentration.

Acceptable Increase in Lake Phosphorus Concentration (C) – is based upon water quality and the selected level of protection.

Future Area to be Developed (D) – This is an estimate of the acreage in Town of ___'s share of the direct watershed that will be developed during the planning period of 50 years.

Per-Acre Phosphorus Allocation (P) – This is the acceptable increase of phosphorus export per acre in the watershed as determined by solving the following equation (P) = (FC)/(D).

C. Applicability

This Ordinance shall apply to all land areas within the direct watershed of ___ Pond. The following land uses shall be required to obtain a phosphorus control permit and conform to the standards contained in this Ordinance.

1. Any new building or structure with more than 575 square feet of ground floor area.

2. Any expansions or series of expansion of ground floor area of any existing building which increases the area of the ground floor by more than 30 percent of that which exists at the time of adoption of this Ordinance.

3. Any earth moving, brush and tree cutting which impacts 10,000 square feet or more whether accomplished as a single activity or as a series of activities beginning on the date of adoption of this Ordinance shall only meet the criteria contained in Section 5.7.F.

4. Road or driveway construction and reconstruction and parking area construction which affects more than 1,500 square feet of land area whether accomplished as a single activity or as a series of activities beginning on the date of adoption of this Ordinance shall only meet the criteria contained in Section 5.7.F.

5. All projects for which Special Exception, Site Plan and Subdivision Review is required.

D. This Ordinance shall not apply to:

1. Changes of use within an existing structure where no ground floor expansion and/or road, driveway and parking area expansion is planned.

2. Timber management or harvesting operations conducted according to a management plan prepared and supervised by a registered forester or the _____ Water District.

3. Agricultural uses conducted according to a soil and water conservation plan approved by the _____ County Soil and Water Conservation District.

E. Best Management Practices

Agriculture, silviculture, mining, chemical use and storage and waste disposal activities should be conducted in accordance with the Best Management Practices (BMPs) as recommended by the Department of Environmental Protection, the Maine Soil and Water Conservation Commission, the Cooperative Extension Service or other appropriate public service agency. New roads and the reconstruction of existing roads, driveways, drainage diversions, ditches and roadside buffers should be designed for the worst storm conditions in accordance with the Best Management Practices (BMPs) recommended by the Department of Environmental Protection, the Maine Soil and Water Conservation Commission, the Cooperative Extension Service or other appropriate public service agency.

F. Erosion and Sedimentation Controls

A comprehensive erosion and sedimentation control plan, including a proposed program for the maintenance and periodic inspection of all control facilities which will remain after the project is completed and a designation of the responsible party, shall be submitted as follows:

1. **_____ Pond Watershed** – A plan designed in accordance with the applicable sections of Chapter 8 of the DEP Phosphorous Control and Lake Watersheds: A Technical Guide to Evaluating New Development, the latest edition of the Maine Erosion and sediment Control Handbook.

G. Submission Requirements

All projects subject to review under the provisions of this Ordinance shall submit a phosphorus control plan and maintenance provisions meeting the standards set forth in the manual "Phosphorus Control and Lake Watersheds A Technical Guide to Evaluating New Development" (Maine DEP et-al., September 1989 with the Simple Review Method revised in May 1990).

1. **Plan Submission**

   Plans shall be submitted and process in accordance with Article 7 of this Chapter. In addition to the requirements for submission under this Article, the following instruction shall be provided:

   a. A long-term maintenance plan for all phosphorus control measures including provisions for inspection and repair, designation of responsible parties, contractual obligations and proposed deed restrictions.

   b. Hydrologic soil class of all areas to be cleared or where clearing will be permitted, with the area indicated in square feet of each lot using the appropriate method as described in the Phosphorus Control Manual.

   c. All calculations and worksheets in the format of those contained in the Phosphorus Control Manual and detailed construction specifications and diagrams for all control measures.

d. A comprehensive erosion and sedimentation control plan, designed in accordance with the Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices, March 1991.

2. **Review Method**

a. All projects shall use the Standard Review Method and shall conform to the Phosphorus Allocation standard set forth in this Ordinance including the following:

(1) Expansions of four (4) lot subdivisions which were previously approved using the Simple Review Method.

b. Projects meeting the following criteria may employ the Simple Review Method:

(1) Minor Subdivisions with four (4) or fewer lots provided that these developments contain less than 200 feet of new or upgraded roads and/or all driveways serving residential uses are less than 150 feet in length.

(2) Activity which includes less than 200 feet of new or upgraded road construction;

(3) Commercial and industrial development and expansions of commercial and industrial developments and the expansion of multi-family dwelling units, which involve less than 15,000 square feet of disturbed area.

c. All other subdivisions including expansions of previously approved 4-lot subdivisions which were reviewed using the Simple Review Method and all other projects shall utilize the Standard Review Method.

* Adapted from the Town of Auburn

WATERSHED PROTECTION ORDINANCE *

A. Purposes

The purpose of this ordinance is to provide for orderly development in the ____ Lake watershed for the health, safety and welfare of the people of _____. The Town of _____ recognizes the need to protect the water quality of _____ Lake, therefore land uses within the watershed to the maximum extent possible shall assure no sediment or dissolved nutrient shall enter, pollute or degrade the water quality of the lake thereby retaining its suitability for water supply and recreational purposes.

B. Applicability

These provisions apply to any land uses occurring on single lots or on subdivisions whose boundaries fall wholly or partially within the _____ Lake watershed. The _____ Lake watershed is defined by the attached map.

C. Requirements

1. Erosion and Sediment Control Plan.

Any proposed activity which takes place within the watershed involving the disturbance of existing ground cover due to excavation, grading or filling of an area in excess of 50 sq. ft. shall require the preparation of an Erosion and Sediment Control Plan. This plan shall meet the standards of Section VII, Erosion and Sediment Control Plans, Environmental Quality Handbook, Maine, Revised, March 1986, as amended. The Plan shall be prepared by a soil scientist, geologist or engineer and provide for permanent controls. The plan must provide for temporary controls if permanent controls will not be in place within 10 days. The plan must assure, to the maximum extent possible, there will be no increase in the volume of sediment or dissolved nutrients reaching the waters of Lake _____. No excavation, grading, or filling in excess of 500 sq. ft. shall begin between November 1 and March 15.

2. Land Use Permit.

A land use permit shall be required for any land use activities which require the preparation of an Erosion and Sediment Control Plan under this section. The City of _____ will notify the _____ Water Company, in writing, within (5) five days of receipt of an application for a land use permit under this section. This notice is to allow only for the _____ Water Company to make comments on the application due to their unique concern and important advice on this valuable resource area. A decision on the land use permit shall be made within (30) thirty days of submission of the application. It may be approved with conditions or denied by the Code Enforcement Officer. No permit will be issued and no site activity may occur until the plan is submitted and approved.

3. Temporary Controls.

Temporary measures shall be at least as effective as the following; In accordance with Table 7, Guide to Mulch Materials, Environmental Quality Handbook, all areas where ground cover is removed due to excavation, grading or filling shall be mulched with hay or straw at a rate of not less than ninety pounds or two bales per one thousand sq. ft. Such mulch shall be placed as soon as possible but no later than 10 days from the removal of ground cover and/or placement of fill. Temporary controls shall be maintained over all unvegetated areas until permanent provisions are completed. All drainageways shall be provided with hay or straw bale barriers or other equally effective means of retarding erosion within 10 days of the start of construction.

4. Permanent Controls.

Permanent seeding or other permanent measures shall be placed as soon as practical. In no event shall permanent seeding or sodding of grassed areas be placed later than September 15th of the year the land use begins. Permanent measures shall be in place no later than November 1st of the year the land use begins.

D. Performance Guarantee

A performance guarantee equal to the cost of meeting the provisions of the Erosion and Sediment Control Plan shall be arranged with the City Finance Officer prior to issuance of a permit and the beginning of any site activity. Withdrawals from this account to cover the costs of meeting provisions of the plan may be made as provisions of the plan are completed.

E. Exceptions

1. Erosion and Sediment Control plans necessary for one or two family dwellings, structures accessory there to, and normal home maintenance need not be completed by a soil scientist, geologist or engineer, but shall meet other requirements of Section 19-304-14.

2. For excavations, filling or other disturbance of groundcover within 15' from the center of any drainageway, no temporary controls are acceptable. Permanent Controls must be in place as soon as possible and no later than (10) days after the land use has begun.

3. Existing normal household gardening activity is exempt from these regulations.

4. New household gardening activity in excess of 500 sq. ft. is exempt from these provisions but shall meet the following conditions:

a. Have an Erosion and Sediment Control Plan prepared meeting the standards as described in C. Requirements of this Section but need not be completed by a soil scientist, geologist or engineer.

b. The erosion and control plan shall be designed to minimize sediment and dissolved nutrient runoff from use and reuse of the gardening activity. The emphasis of the plan shall be on permanent landscaping or other features that can effectively reduce and minimize the dissolved nutrients and sediment associated with the perennial garden activity.

c. No gardening activity shall occur within 15' from the center of any drainageway.

d. Performance Guarantee provisions stated in this Ordinance apply.

*Adapted from Town of Rockland

Appendix B

References and Resources

Federal Government
Army Corps of Engineers
New England Division http://www.nae.usace.army.mil/ 978-318-8111
Coast Guard, First District (Northeast) http://www.uscg.mil/d1/ 800-848-3942
Department of Agriculture
Maine Rural Development http://www.rurdev.usda.gov/me/index.html 990-9100
Natural Resources Conservation Service Maine http://www.me.nrcs.usda.gov/ 990-9100
Environmental Protection Agency
Drinking Water Home http://www.epa.gov/safewater/ 800-426-4791
New England Region Office http://www.epa.gov/region1/ 888-372-7341 Drinking Water Program http://www.epa.gov/region1/eco/drinkwater/index.html
Stormwater Program (NPDES) http://cfpub1.epa.gov/npdes/index.cfm?program_id=0
Federal Highway Administration http://www.fhwa.dot.gov/ Maine Division http://www.fhwa.dot.gov/mediv/maine.htm 622-8350
Federal Railroad Administration http://www.fra.dot.gov/site/index.htm 617-494-2302
Forest Service http://www.fs.fed.us/ 202-205-8333
Geological Survey Maine District Office http://me.water.usgs.gov/ 622-8201
National and Regional Organizations
American Farmland Trust http://www.farmland.org 413-586-9330
Association of Metropolitan Water Agencies http://www.amwa.net/
Association of State Drinking Water Administrators http://www.asdwa.org/ 202-293-7655
National Association of State Foresters http://www.stateforesters.org/
National Drinking Water Clearinghouse http://www.nesc.wvu.edu/ndwc/ndwc_index.htm 800-624-8301
National Extension Water Quality database http://hermes.ecn.purdue.edu:8001/server/water/water.html
National Rural Water Association http://www.nrwa.org/
New England Interstate Water Pollution Control Commission (NEIWPCC) http://www.neiwpcc.org/ 978-323-7929
New England Water Works Association http://www.newwa.org/ 508-893-7979
North East Foresters Association

http://nefa.conknet.com/
Northeast Rural Water Association http://www.neruralwater.org/ 800-556-3792
Society for the Protection of New Hampshire Forests http://www.spnhf.org/ 603-224-9945
Society of American Foresters http://www.safnet.org/index.shtml 301-897-8720
Canadian Government and Organizations
Canadian Water and Wastewater Association www.cwwa.ca 613-747-0524
Environment Canada http://www.ec.gc.ca/envhome.html 819-997-2800 Water page: http://www.ec.gc.ca/water/index.htm 819-953-6161 Atlantic Office (New Brunswick and Maritimes) 902-426-7231
Environment Quebec http://www.menv.gouv.qc.ca/indexA.htm 418-521-3830
New Brunswick, Environment & Local Government http://www.gnb.ca/0009/index-e.asp 506-453-2690
St. Croix International Water Commission http://www.asf.ca/orgsnb/sciwc/index.html 506-466-7550
Maine State Government
Agriculture, Department of http://www.state.me.us/agriculture/homepage.htm 287-3871
Maine Board of Pesticides Control http://www.state.me.us/agriculture/pesticides/ Augusta 287-2731; Presque Isle 764-2039
Soil and Water Conservation Districts http://www.state.me.us/agriculture/oanrr/soil3.htm Androscoggin & Sagadahoc Counties 753-9400 Central Aroostook 764-4770 Southern Aroostook 532-2087 Cumberland County 839-7839 Franklin County 778-4279 Hancock County 664-7496 Kennebec County 622-7847 Knox-Lincoln County 273-2005 Oxford County 743-5789 Penobscot County 990-3676 Piscataquis County 564-2321 St. John Valley 834-3311 Somerset County 474-8324 Waldo County 338-1964 Washington County 255-3995 York County 324-7015
Drinking Water Program

http://www.state.me.us/dhs/eng/water/index.html or www.medwp.com 287-2070
Environmental Protection, Department of http://www.state.me.us/dep/ 287-7688
Forest Service, State Forester http://www.state.me.us/doc/mfs/mfshome.htm 800-367-0223 or 287-2791
Geological Survey http://www.state.me.us/doc/nrimc/mgs/mgs.htm 287-2801
Inland Fisheries and Wildlife, Department of http://www.state.me.us/ifw/index.html 287-8000
Land Use Regulation Commission (LURC) http://www.state.me.us/doc/lurc/lurchome.htm 287-2631
Marine Resources http://www.state.me.us/dmr/ 624-6550
Planning, State Office of http://www.state.me.us/spo/ 287-3261 or 800-662-4545
Public Utilities Commission http://www.state.me.us/mpuc/ 287-3831
Testing Laboratory http://www.state.me.us/dhs/etl/homepage.htm 287-2727
Transportation, Department of www.state.me.us/mdot 624-3000
Wastewater & Plumbing Control http://www.state.me.us/dhs/eng/plumb/index.html 287-5689
State Resources ~ Maine
Augusta Water District http://www.augustawater.org/ 622-3701
Bangor Water District http://www.bangorwater.org/ 947-4516
Bath Water District http://www.bathwd.org/ 443-2391
Berwick Water Department http://www.berwickmaine.org/ 698-1231
Biddeford & Saco Water Company http://biddefordsacowater.com/index.html 282-1543
Boothbay Region Water District http://home.gwi.net/~bbhwater/ 633-4723
Consumers Maine Water Company http://www.suburbanwater.com/ 800-287-1643
Gulf of Maine Council on the Marine Environment http://www.gulfofmaine.org/ 603-225-5544
Kennebec Water District http://www.kennebecwater.org/ 872-2763
Maine Environmental Policy Institute http://www.meepi.org/ 622-9766
Maine Rural Water Association http://www.mainerwa.org/ 729-6569

Maine Snowmobile Association http://www.mesnow.com/ 622-6983
Maine Water Utilities Association http://www.mwua.org/ 832-2263
Natural Resources Council of Maine http://www.maineenvironment.org/index.html 622-3101
Portland Water District http://www.pwd.org/ 774-5961
Resource Conservation and Development Agencies http://www.mint.net/HOMRCD/maine_rcd.html Aroostook, St. John Valley 764-4126 Piscataquis, Penobscot, Somerset 368-4460 Hancock & Washington 368-4460
Waldo, Knox, Lincoln, Sagadahoc, Androscoggin, Kennebec 622-7847
York, Cumberland, Oxford, Franklin 657-3131
Senator George J. Mitchell Center for Environmental & Watershed Research www.umaine.edu/WaterResearch 581-3254
Small Woodland Owners Association of Maine http://www.swoam.com/ 626-0005 or 877-467-9626
University of Maine Cooperative Extension http://www.umext.maine.edu 800-287-0274 (call for County Office information) Water Quality http://www.umaine.edu/waterquality/ 581-3241
Forestry http://www.umext.maine.edu/topics/forestry.htm 581-2892
Agriculture http://www.mac.umaine.edu 800-648-0597 or 581-3204
State Resources ~ New Hampshire
NH Division of Water Supply Engineering (Department of Environmental Services) http://www.des.state.nh.us/wseb/ 603-271-2513
New Hampshire Rivers Council http://www.nhrivers.org/ 603-228-6472
State Resources ~ Other States
Connecticut Department of Public Health, Water Supplies Section http://www.dph.state.ct.us/BRS/WSS/water_supplies.htm 860-509-7333
Massachusetts Drinking Water Program http://www.state.ma.us/dep/brp/dws/dwshome.htm 617-292-5770
New York City Watershed Protection Program http://www.ci.nyc.ny.us/html/dep/html/watershed.html 718-337-4357
Rhode Island Office of Drinking Water Quality http://www.healthri.org/environment/dwq/home.htm 401-222-6867
Vermont Water Supply Division http://www.vermontdrinkingwater.org/ 802-241-3400
Watershed Organizations
Androscoggin River Watershed Council http://www.andro-watershed.org/ 824-4627

Casco Bay http://www.cascobay.org/ 799-8574
China Region Lakes Alliance http://www.kennebecwater.org/China%20Region%20Lakes%20Alliance.htm 445-5021
Cove Brook Watershed Council http://www.mainesalmonrivers.org/cove/home.html
Dennys River Watershed Council http://www.mainesalmonrivers.org/Dennys/home.html
Ducktrap River Coalition, Coastal Mountains Land Trust http://www.coastalmountains.org/htm/duckt_coalition.htm 236-7091
East Penobscot Bay http://www.eastern.penbay.org/ EPBEA PO Box 482 Deer Isle, Maine 04627
Machias River Watershed Council http://www.mainesalmonrivers.org/east_machias/home.html 255-4659
Narraguagus River Watershed Council http://www.mainesalmonrivers.org/Narraguagus/home.html PO Box 406 Cherryfield, ME 04622
Pleasant Pond - Four Towns Watershed Association http://www.ftwa.org/ PO Box 1166 Gardiner ME 04345
Presumscot River http://www.presumpscotriver.org/
Sheepscot River Watershed Council http://www.mainesalmonrivers.org/sheepscot/home.html 622-7847
Taunton Bay http://www.acadia.net/tauntonbay/
Lakes
DEP lakes program http://www.state.me.us/dep/blwq/lake.htm 287-3901
Lakes Environmental Association http://www.mainelakes.org/ 647-8580
Maine Congress of Lake Associations http://www.mainecola.org/ 877-254-2511
Maine Lakes Conservancy Institute http://www.mlci.org/ 563-6529
Maine Lakes Database (PEARL) http://pearl.spatial.maine.edu/
North American Lake Management Society http://www.nalms.org/ 608-233-2836
Understanding Lake Ecology http://wow.nrri.umn.edu/wow/under/primer/index.html
Volunteer Lake Monitoring Program http://www.state.me.us/dep/blwq/doclake/vm.htm 225-2070
Streams and Rivers
American Rivers

http://www.americanrivers.org/ Northeast Field Office 860-652-9911
Atlantic Salmon Federation http://www.asf.ca/ 725-2833
Maine Atlantic Salmon Commission http://www.state.me.us/asa/homepage.htm 287-9972
Maine Rivers http://www.mainerivers.org/ 800-287-2345
Maine Salmon Rivers, Downeast Salmon Federation http://www.mainesalmonrivers.org/ 483-4336
Maine Stream Teams Program http://www.state.me.us/dep/blwq/docstream/team/streamteam.htm 888-769-1036
River Network http://www.rivernetwork.org/
Saco River Corridor Commission http://www.srcc-maine.org/ 625-8123
Climate, Floods, & Drought
Climate Prediction Center http://www.cpc.ncep.noaa.gov/ 301-763-8000
Climate-At-A-Glance http://lwf.ncdc.noaa.gov/oa/climate/research/cag3/ME.html
Drought Outlook http://www.droughtoutlook.com/
Federal Emergency Management Agency www.fema.gov New England Office 617-223-9522
Maine Emergency Management Agency http://www.state.me.us/mema/homepage.htm 800-452-8735 or 626-4503
Maine State Climate Office http://www.umaine.edu/maineclimate/default.htm 581-3441
National Drought Mitigation Center http://enso.unl.edu/ndmc/watch/watch.htm
National Weather Service http://www.nws.noaa.gov/ Caribou Office http://www.erh.noaa.gov/er/car/ 496-8931 Portland Office http://www.erh.noaa.gov/er/gyx/ 688-3216
NOAA's Drought Information Center www.drought.noaa.gov
Pew Center on Global Climate Change www.pewclimate.org
U.S. Global Change Research Program www.usgcrp.gov New England Regional Assessment http://www.necci.sr.unh.edu/
USGS Maine drought information http://me.water.usgs.gov/droughtme.html

Land Planning, Development, & Conservation
Center for Watershed Protection http://www.cwp.org/ 410-461-8323
Maine Land Trust Network www.mltn.org 729-7366
Maine Office of Community Development http://www.meocd.org 624-7484
Maine Municipal Association http://www.memun.org/ 623-8428
Maine Stormwater Management http://www.state.me.us/dep/blwq/stormwtr/index.htm 287-3901
National Center for Smart Growth Research & Education http://www.smartgrowth.umd.edu/ 301-405-6788
National Stormwater BMP Database http://www.bmpdatabase.org/
National Trust for Historic Preservation http://www.nthp.org/
Planners Web, Planning Commissioners Journal http://www.plannersweb.com/
Project NEMO, an educational program for local land use officials http://nemo.uconn.edu/ Jodi Castallo, Maine NEMO Coordinator, 771-9020 jcastall@maine.rr.com
Regional Planning Councils http://www.state.me.us/spo/cpip/regional/region.htm
Androscoggin Valley Council of Governments http://www.avcog.org/ 783-9186
Kennebec Valley Council of Governments http://www.kvcog.org/kvcog.phtml 453-4258
Midcoast Regional Planning Commission http://www.midcoast.com/~planning/ 594-2299
Northern Maine Development Commission http://www.nmdc.org/
Greater Portland Council of Governments http://www.gpcog.org/ 774-9891
Eastern Maine Development Corporation http://www.emdc.org/ 942-6389
Hancock County Planning Commission 667-7131
Washington County Council of Governments 255-8686
Southern Maine Regional Planning Commission http://www.smrpc.maine.org/ 324-2952
Smart Growth Network http://www.smartgrowth.org/
Sprawl Watch Clearinghouse http://www.sprawlwatch.org/frames.html
Stormwater Management Center http://www.stormwatercenter.net/

Funding sources
Drinking Water Program: State Revolving Loan Funds Source Water Protection Planning Grant Program
State Planning Office: Land for Maine's Future land acquisition grants
Department of Environmental Protection: 319(h) Non-point source pollution grants Watershed Protection grants for schools
Maine Office of Community Development: Community Development Block Grants
Maine Department of Transportation: Surface Water Quality Protection Program grants
US EPA Catalog of Federal Funding Sources for Watershed Protection (EPA 841-B-99-003) http://www.epa.gov/owow/watershed/wacademy/fund.html 800-490-9198 Source Water Assessment or Protection grants for priority watersheds Public Works and Development Facilities Program grants for facilities and infrastructure improvements Watershed Assistance Grants Tribal Drinking Water Capacity Building Clean Water Act Section 604 (b) Grants
USDA Rural Economic and Community Development grants to develop water systems

Appendix C

Federal & State Laws Pertaining to Public Water Supplies

U.S. Environmental Protection Agency

- Clean Water Act, including National Pollution Discharge Elimination System Permit Program (Phase I/II Stormwater rules), and wetlands protection (with Army Corps of Engineers and U.S. Fish & Wildlife Service)
- Safe Drinking Water Act

Maine Department of Environmental Protection
Title 38

Bureau of Land & Water Quality
- Stormwater Management Law
- Wastewater Discharge Laws
- Erosion and Sedimentation Control Law
- Site Location of Development Act
- Natural Resources Protection Act
- Maine Dam Inspection, Registration, and Abandonment Act
- Maine Waterway Development and Conservation Act (w/LURC)
- Mandatory Shoreland Zoning Act (w/ LURC)
- Act to Prevent Infestation of Invasive Aquatic Plants
- Act to Prevent the Spread of Invasive Aquatic Plants

Bureau of Remediation and Waste Management
- Solid Waste Management Rules
- Agronomic Utilization of Residuals (agricultural sludge application)
- Septage Management Rules
- Hazardous Waste
- Aboveground and Underground Storage Tanks

Maine Department of Agriculture, Food, and Rural Resources
Title 7

- Nutrient Management Rules
- Pesticides Control

Maine Department of Human Services
Title 22

Bureau of Health, Drinking Water Program
- Safe Drinking Water Act
- Protection of Water Sources

Bureau of Health, Wastewater & Plumbing Control Program
- State Plumbing Code
- Subsurface Wastewater Disposal Rules

Maine State Police, Local Law Enforcement
Title 17

- Trespassing, Section 3860. Great pond; access or egress

Maine Department of Inland Fisheries & Wildlife
Title 12, Part 10

- ATV Regulations
- Snowmobile Regulations
- Boating Regulations
- Hunting, Fishing, Trapping

Bibliography

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