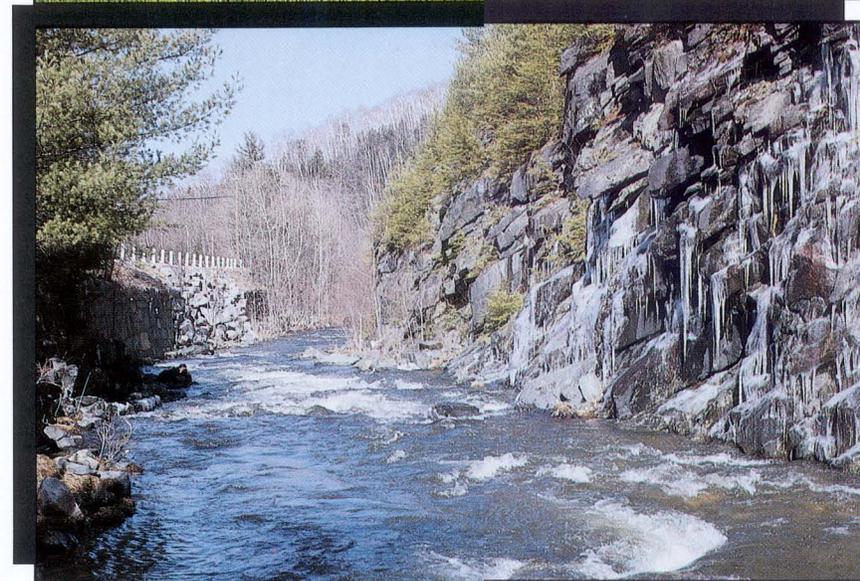
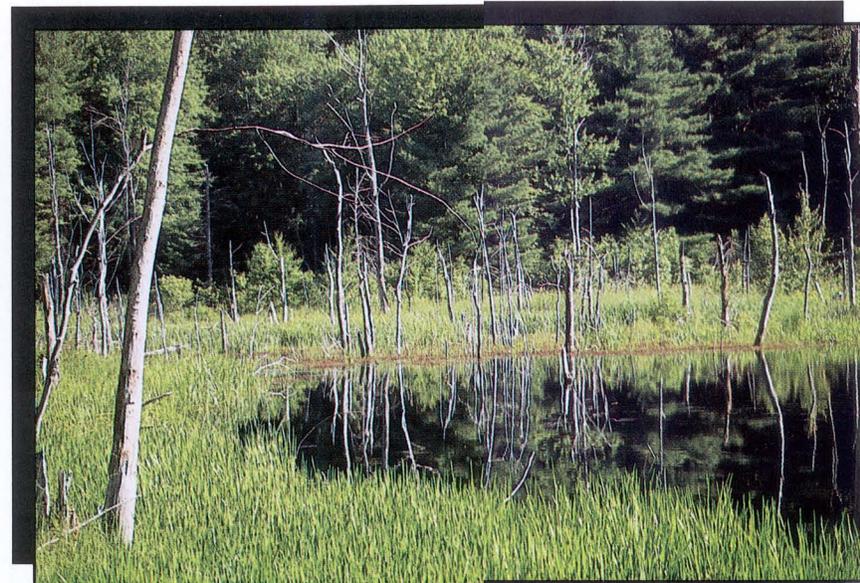
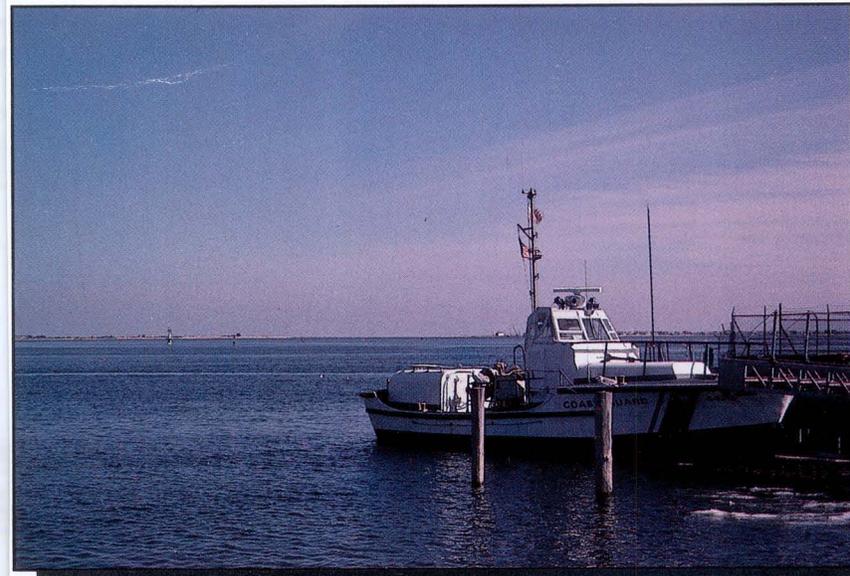
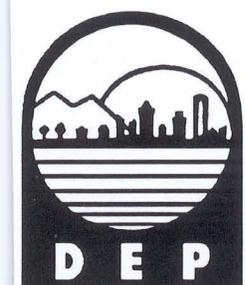


NONPOINT SOURCE MANAGEMENT MANUAL

"THE MEGAMANUAL"



A GUIDANCE DOCUMENT FOR MUNICIPAL OFFICIALS



Commonwealth of Massachusetts
Executive Office of Environmental Affairs
**Department of
Environmental Protection**

Regulations in Massachusetts (Title 5 of the Environmental Code) require that the septic tank be located at least 10 feet from the cellar or foundation of the house. In addition, the tank must have at least one foot of cover material. Your local board of health should have a copy of the plans for your system. Check with them for this information before you start digging or paying someone to locate it to save yourself some time and money.

If you still can't find it, call in a septic system contractor. An experienced contractor will find the tank within half an hour eighty-percent of the time.

KEEPING YOUR SEPTIC SYSTEM WORKING

Tips and suggestions for keeping your septic system problem free:

DON'T treat your septic tank with chemicals, enzymes, or bacteria additives, even though they're heavily promoted. Acids and chemicals can contaminate the groundwater. Acid treatment may resuspend solids which will eventually end up in the leachfield, and it can even corrode the concrete of a septic tank.

DON'T use a garbage disposal. Fibrous waste material breaks down very slowly and overburdens the septic system.

NEVER pour toxic liquids (paint thinners, bleaches, disinfectants, pesticides, etc.) down the sink drain or flush them down

the toilet. Limit the use of drain cleaners. Toxic substances can kill the bacteria in the septic tank.

USE detergents that don't contain phosphates. Read the label on the container. It will tell you how much phosphate the detergent contains.

DON'T pour fats and oils down the drain. They solidify quickly and can clog pipes.

NEVER flush disposable diapers or sanitary napkins down the toilet. They decompose slowly, if ever.

DON'T use colored toilet paper. The dyes are toxic. Single thickness white paper is best. Keep from flushing facial tissue or paper of any color down the toilet.

DON'T connect a basement sump pump to the household drain.

DON'T allow heavy vehicles to be driven over the leachfield.

DON'T put a swimming pool, a patio, or a driveway over the tank or the leachfield.

KEEP trees and shrubs at least ten (10) feet from the leachfield.

CONSERVE water. Fix leaks and replace wornout washers. Use faucet aerators, watersaving shower heads, restrict the amount of water that enters toilet tanks.

MAKE SURE roof gutters and downspouts don't drain onto the leachfield.

KEEP a record of the dates on when the tank was pumped out or some other service was performed. If you sell the house, give the record to the new owner.

MAKE a sketch to show the tank location. If you have a basement, tape the sketch to the wall where the sewer pipe leaves the house.

Written by the

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF WATERSHED MANAGEMENT

R.I. COASTAL RESOURCES MANAGEMENT COUNCIL

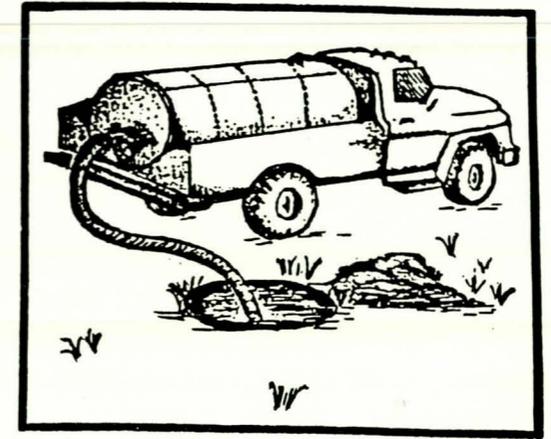
SOUTH COUNTY PLANNERS

Reprinted and revised for Massachusetts by the MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF WATERSHED, NONPOINT SOURCE PROGRAM, NORTH GRAFTON, MA (508) 792-7470.

For more information about septic systems contact the DEP, Division of Water Pollution Control at (617) 292-5663 or 292-5912. The Division also has a brochure on the subject entitled "What You Should Know in Order to Identify and Maintain Your Sewage System." Call to request copies.

The Massachusetts Department of Environmental Protection, Nonpoint Source Program, gratefully acknowledges the R.I. Coastal Resources Management Council for permission to reprint information contained in this brochure.

YOUR SEPTIC TANK



AND THE

REASONS TO PUMP IT OUT

- * How Septic Systems Work
- * Why Septic Systems Fail - and What To Do
- * Finding the Septic Tank - Not Always Easy
- * How Not To Worry Any More - Keeping Your Septic System Working

THE REASONS TO KEEP YOUR SEPTIC SYSTEM CLEAN

Many areas in Massachusetts do not have sewer systems and must depend on individual septic systems for disposal of household wastewater. Septic systems are regulated by DEP and the local board of health under 310 CMR 15 - Title 5 of the State Environmental Code. The owners of homes with septic systems are responsible for their maintenance. One contractor tells homeowners, "This is your waste. You've got to deal with it--and do it right or you'll be sorry."

Why be sorry? There are several reasons:

One good reason is that repair of a septic system is expensive. The average cost of repairing/replacing a leachfield today is in excess of \$4,000.

If you have a well, you risk polluting it and may not be able to drink the water safely. Many diseases, including hepatitis, cholera, dysentery, typhoid fever, paratyphoid fever, and gastroenteritis can be spread by the germs in domestic wastewater.

You can contribute to pollution of nearby ponds and streams. Bacterial contamination from faulty septic systems has impaired swimming in both fresh and saltwater and resulted in numerous shellfish bed closures in coastal Massachusetts. Even worse, sewage reaching a body of water contains nutrients that fertilize aquatic plants, stimulating their growth. They inevitably die, and the process of decomposition consumes large amounts of

oxygen in the water. The water becomes murky and brownish. It gives off a rotten-egg smell. In the next stage, which is extreme, the water loses all or practically all of its oxygen. Fish and shellfish die.

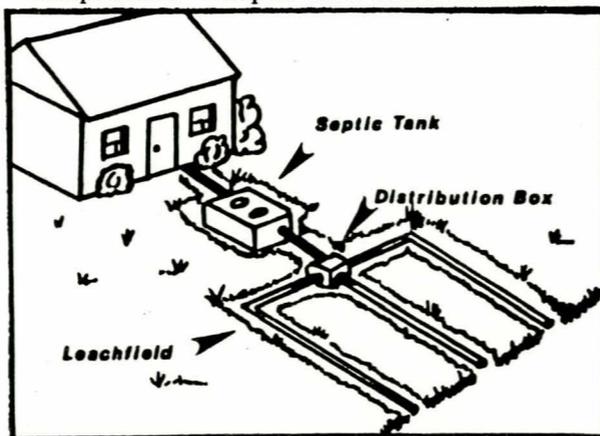
A surface "breakout" of untreated sewage may occur in your yard. This condition may result in people and pets actually coming into contact with the sewage - a direct public health concern.

You might have a persistent foul odor in your yard. The ground might become soggy and grass and other vegetation excessively lush and green.

Toilets and sinks may drain slowly. Wastewater may back up into them.

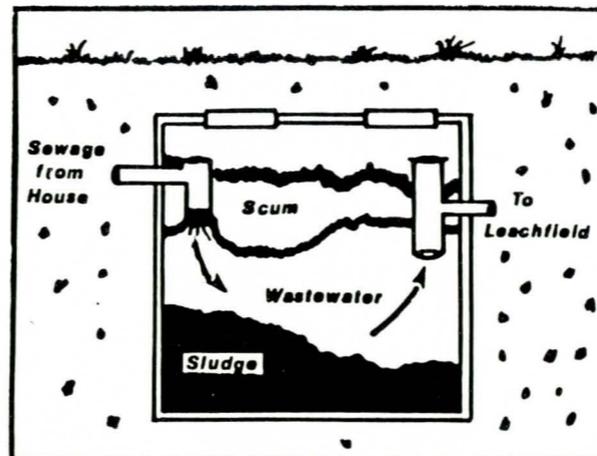
HOW SEPTIC SYSTEMS WORK

Septic systems consist of two basic components: a septic tank and a leachfield.



Septic System

Cesspools (a tank with perforated sides and no bottom) do not meet Title 5 standards and are not permitted in Massachusetts. A septic tank, a watertight concrete box, is connected to a distribution box and a leachfield. The leachfield is made of perforated pipe laid in trenches filled with small stones.



Septic Tank

Wastewater enters the tank, and the heavy solids sink to the bottom. Grease, oils, and lighter solids rise to the top, where they form a layer of scum. Bacteria, which are naturally present, help decompose the organic matter. Liquids flow through a pipe into a distribution box where it is routed into the leachfield, from there it passes into the soil. A good purifying medium, the soil removes bacteria and viruses as well as phosphorus from the wastewater. The system/soil interface is where the majority of the treatment of dissolved contaminants is achieved.

WHY SEPTIC SYSTEMS FAIL AND WHAT TO DO

Septic systems fail because solids and scum build up in the tank and enter the leach pipes, clogging the soil and biological mat in the leachfield, and eventually the leach pipes themselves so that water can't flow through them freely. Drainage can also be affected by poor soil conditions and tree and shrub roots.

An essential step in keeping a septic system working is to have the tank inspected and pumped out regularly. It is generally recommended that this be performed every two to three years.

If you don't know whether your septic tank needs to be pumped out, have it inspected by a contractor. Some contractors will do this free if the home owner removes the cover from an access hole. (If you do remove the cover, don't put your head over the hole. The gasses that will escape can be toxic, even explosive.)

FINDING THE SEPTIC TANK

You can't pump it out until you know where it is - and finding it isn't always easy. However, if a house has a basement or crawl space, you should be able to see where the sewer pipe goes through the wall. The septic tank will probably be straight out from that point. (In some cases, particularly when the house has a basement toilet, the tank might be seven or eight feet down.)

MASSACHUSETTS NONPOINT SOURCE MANAGEMENT MANUAL

"THE MEGAMANUAL"

A GUIDANCE DOCUMENT FOR MUNICIPAL OFFICIALS

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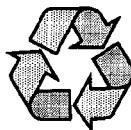
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DISCLAIMER

The contents of this manual do not necessarily represent the policies or recommendations of referenced agencies or organizations. Nonpoint source pollution abatement strategies are constantly changing and are based on current understanding of the problems and the available technology. This manual presents the most current information about nonpoint source pollution. The manual will be updated periodically as the information changes and new technologies develop. The mention of trade names, products or companies does not constitute an endorsement.



Commonwealth of Massachusetts
Executive Office of Environmental Affairs

Department of Environmental Protection

William F. Weld
Governor

Daniel S. Greenbaum
Commissioner

Dear Municipal Official:

As the obvious point sources of pollution into our water resources are being controlled, citizens of the Commonwealth are finding that the protection and clean up that had been envisioned for these resources are still not being realized. Swimming beaches and shellfishing areas are still being closed, drinking water supplies still are being contaminated, fish and wildlife habitat continues to be degraded, and the aesthetic quality of our lakes, rivers, wetlands, and coastal waters remains threatened. In fact, since the mid-late 1980s DEP water quality data has shown that nonpoint pollution sources are contributing more pollution than point sources.

It is well known now that, in order to restore and maintain the chemical, physical, and biological integrity of our water resources, a real effort must be made to control the diffuse, largely unregulated, *nonpoint* sources of pollution such as run-off and erosion.

Nonpoint source pollution affects us all, whether we reside in a rural or urban community. It results from unwise, uncontrolled uses of the land, and although these land-uses are often localized, resultant pollutant impacts on our water resources are widespread and devastating to public health and the environment.

Through the efforts of the Department of Environmental Protection and other state and federal agencies, as well as many regional and local groups, steps are being made to curb nonpoint source pollution. However, much more needs to be done to protect our valuable water resources, especially at the local level where most land-use decisions are made.

Municipal officials in Massachusetts have the authority to enact local controls and provide the leadership needed to combat nonpoint sources of pollution in their community. I hope that this manual will serve not only as guidance, but as an incentive to communities to begin and continue to reach toward the goal of clean surface and groundwater resources.

Sincerely,

Arleen O'Donnell
Assistant Commissioner
Bureau of Resource Protection

PREFACE

Nonpoint source pollution is not a new problem. What is new, however, is the growing awareness and recognition of what it is and, more specifically, how land use activities contribute to the problem. Nonpoint source pollution is a "people problem" arising from human activities; activities that reflect the way we choose to live. By understanding the relationship of our activities and resultant impacts on the environment, people can begin to modify their actions so that they do not damage water resources that are critical to ourselves, other species, and the future.

The purpose of this manual is to provide basic information to local officials on how to identify, inventory, and control nonpoint source pollution sources through environmental planning, local bylaws, and regulations. It is hoped that this manual will help guide and encourage local officials to use their authority to take effective action to protect natural resources. For more technical information about design, standards, and specifications for various BMPs consult references in Appendix C. Municipal officials seeking technical assistance with nonpoint source pollution problems are also encouraged to contact the appropriate state, federal, and/or local agencies and organizations listed in Appendix A.

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A NOTE ON REFERENCING AND CROSS-REFERENCING

References are cited by the standard method of: (author, editor, or agency, date of publication). These references are listed alphabetically in Appendix B.

Appendix C contains a more comprehensive listing of NPS literature and technical publications not necessarily cited in the text of the manual. The user is encouraged to consult this section for further reading and/or if technical information about specific BMPs is desired.

Notations in the outside margin of a page beginning with "BMP" such as "**BMP-LW**" indicates that the Best Management Practice (BMP) for Lined Waterways (LW) is an appropriate practice for the topic being discussed in the adjacent text. There is an acronym sheet found at the beginning of Chapter 4 - Best Management Practices that lists all the BMPs in alphabetical order by acronym along with the BMP category and page where they can be found in that chapter.

Notations in the right hand margin of a page beginning with "RES" such as "**RES-FED 2**" indicates that there is a Federal agency that can serve as a resource for more information or has a program relative to the topic being discussed in the adjacent text. For this example, consult Appendix "A" of the manual under the Resource-Federal section to find reference number "2" - the U.S.D.A., Soil Conservation Service.

EXAMPLE

BMP-LW

RES-FED 2

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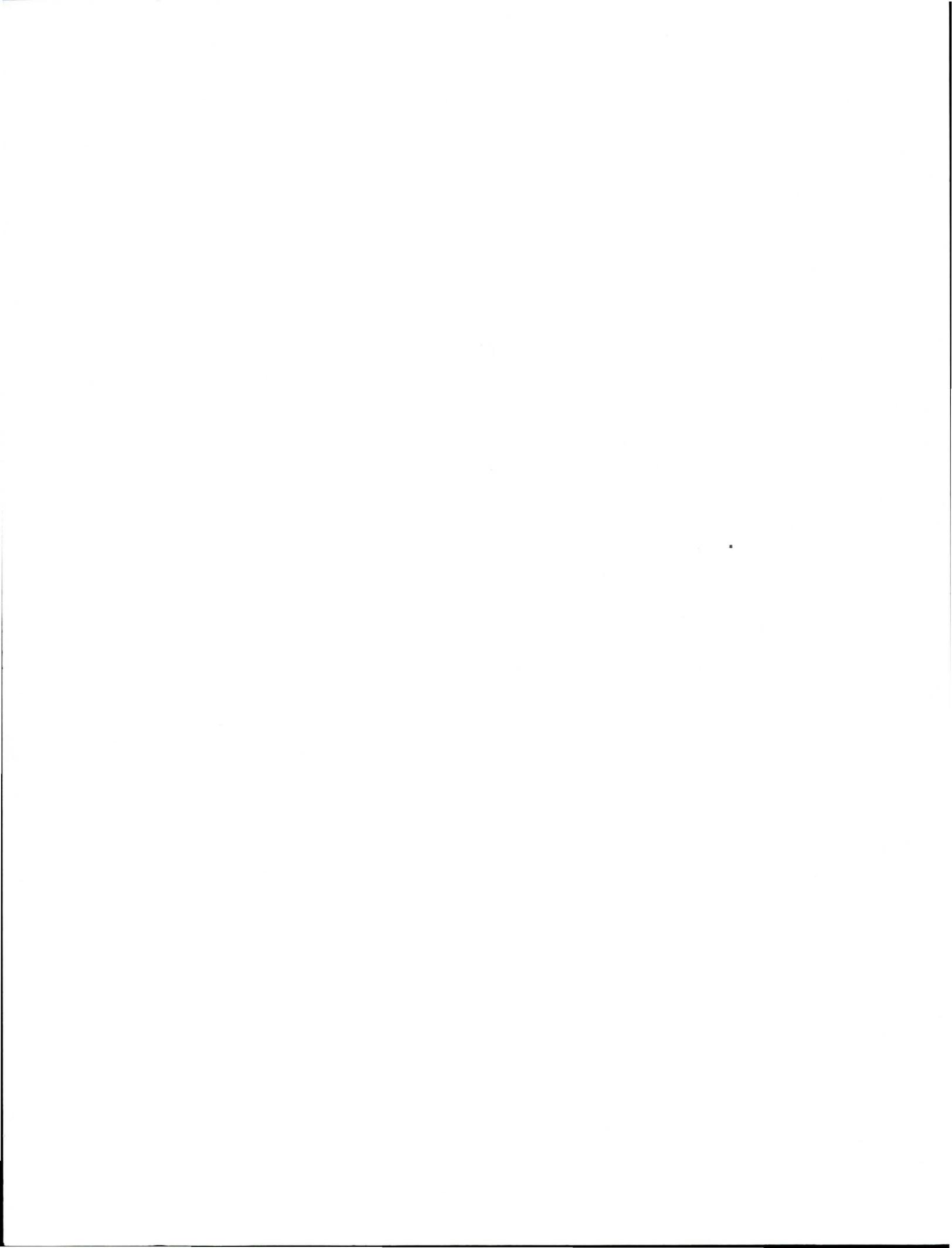
Bastian, Terry (p.4-89);

Massachusetts Department of Environmental Protection, Office of Watershed Management
 (pp. 4-80, 81, 91, 92, 116a, 147, 148, 150-152, 154, 155);

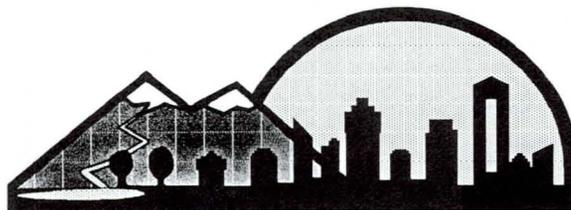
North Carolina Division of Natural Resources (pp. 4-25, 26, 29-31, 37, 40-42, 44, 45, 47-55, 57, 60, 62-65);

U.S.D.A., Soil Conservation Service, Massachusetts Office (pp. 4-8, 10, 12, 18, 21, 27, 28, 32, 33-36, 38, 39, 43, 58, 59, 61, 87, 90, 101, 103, 112-116);

U.S. Forest Service (pp. 4-16, 17, 19, 56)



CHAPTER 1



NONPOINT SOURCE POLLUTION

INTRODUCTION

Nonpoint source pollution is a pervasive problem, affecting surface and groundwater quality in both urban and rural areas. It is diffuse and largely unregulated, and is caused primarily when rain water and snowmelt flow over (and through) ground that has been disturbed by some sort of land use, such as farming, logging operations, urban development, land disposal, and construction activities. This "runoff" carries contaminants from these sites and deposits them in nearby surface waters and/or washes them into the groundwater. Nonpoint source pollution can also come from sediments deposited in streams, lakes, or coastal waters as well as from atmospheric (dry and wet) deposition and leaking underground storage tanks. In short, nonpoint source pollution comes from a wide variety of sources, most of which are directly related to uses of the land. The Environmental Protection Agency (EPA) defines nonpoint source pollution as **"pollution of surface water or groundwater supplies originating from land-use activities and/or the atmosphere, having no well-defined point of entry"**.

As this definition implies, nonpoint source pollution does not (usually) come from a pipe, or "point" source. Point sources of pollution are generally from man-made processes which discharge through a pipe, such as industrial discharges and sewage outfalls from municipal waste treatment facilities. Since the enactment of the Clean Water Act in 1972, the EPA began controlling most of these point sources through a permitting and monitoring program. Following the regulation and cleanup of many major point sources in Massachusetts, it was soon realized that water pollution problems still existed in many areas. Controlling only the obvious point sources of pollution was not doing enough to achieve and maintain the quality of water everyone expected.

RES-FED 8

Unfortunately, nonpoint sources are often difficult to control (largely due to the fact that they are not always easily identified), however they have been estimated to be responsible for seventy-five percent of all water pollution problems in the United States. **In Massachusetts, nonpoint source pollution accounts for: 99 percent of all sediment; 88 percent of all nitrates; and 84 percent of all phosphates entering Massachusetts' ponds, lakes, streams, brooks, and coastal estuaries!(DWPC, 1989a)**

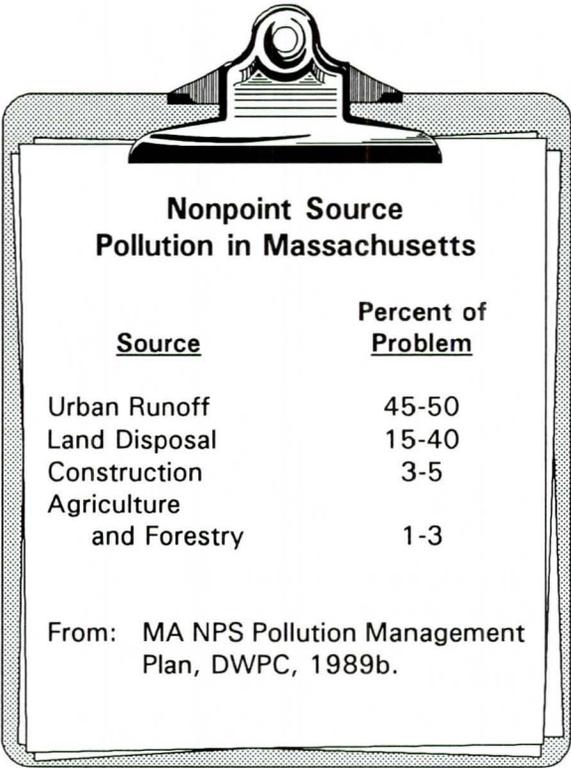
Nonpoint source pollution arises from human activities; activities that reflect the way we choose to live. One of the most powerful strategies to control this type of pollution is public awareness through education. We can learn to live in better relation to our environment by using common sense and conducting our activities in ways that do not damage water resources critical to ourselves and other species. This manual offers



suggestions and guidance to help communities reach that goal.

THE MASSACHUSETTS NONPOINT SOURCE POLLUTION PROGRAM

In order to meet the national goal of "fishable and swimmable" waters, it was realized that something must be done to control the nonpoint sources of pollution. Subsequently, in 1987 Congress amended the 1972 Clean Water Act (Section 319 of the Clean Water Act [P.L.92-500]) to include a national Nonpoint Source Management Program. The federal Nonpoint Source Management Program provides assistance to each state for nonpoint source management. In Massachusetts, the Nonpoint Source Program is administered by the Department of Environmental Protection, Bureau of Resource Protection, Office of Watershed Management.



<u>Source</u>	<u>Percent of Problem</u>
Urban Runoff	45-50
Land Disposal	15-40
Construction	3-5
Agriculture and Forestry	1-3

From: MA NPS Pollution Management Plan, DWPC, 1989b.

RES-STATE 46

Resource Protection, Office of Watershed Management.

In 1989 the Division of Water Pollution Control, the agency administering the program at the time, produced a comprehensive nonpoint source management plan (DWPC, 1989b) designed to address the various nonpoint sources of pollution in Massachusetts. The management plan, based on an assessment report that identified nonpoint source generated water quality problems in the state (DWPC, 1989a), recommends a dynamic combination of long- and short-term strategies to prevent or reduce pollution at the source.

Major elements of the management plan include:

- **Best Management Practices (BMPs)** are recommended to reduce or eliminate the nonpoint source problems in waters identified in the assessment report as degraded.
- **Short-term strategies** are proposed that rely largely upon existing programs and regulations to control nonpoint sources. This element requires communication and cooperation between government agencies. It also stresses the role of state agencies in providing education, technical assistance, and training to local governments to control the various nonpoint sources.
- **Long-term strategies** are outlined to evaluate and, if necessary, adjust certain programs and procedures to control nonpoint sources of pollution. New statutory programs are proposed to address soil erosion and sedimentation and to provide a grant program to clean up nonpoint sources. Another long-term strategy is proposed to incorporate effective nonpoint source controls into the state's Subdivision Control Law and the local approval system. The Management Plan also identifies possible funding sources to carry out these elements.

Additional legislation, passed in 1990 under the reauthorization of the Coastal Zone Management Act, created the Coastal Nonpoint Source Pollution Control Program (Section 6217). The legislation requires states to implement measures to restore and protect coastal waters. In Massachusetts, the Coastal Nonpoint Source Program is administered by the Coastal Zone Management Office within the Executive Office of Environmental Affairs. Similar to the Massachusetts Nonpoint Source Program described above, the coastal program must identify nonpoint sources of pollution, identify coastal areas where water quality standards are not being met or are threatened by nonpoint source pollution, and develop measures to control these sources.

WHAT IS NONPOINT SOURCE POLLUTION?

The contaminants that arise from nonpoint sources are as varied and numerous as the sources themselves, and cause many of the same water quality problems as point sources. Runoff from streets, parking lots, lawns, etc., can contain heavy metals, nutrients, sediment, toxics, and bacteria. Agricultural activities contribute runoff laden with sediment, pesticides, herbicides, nutrients, and bacteria. Leachate from landfills, septic tanks, and underground storage tanks may contaminate ground and surface waters with toxic pollutants, nutrients, and bacteria. Airborne pollutants from automobiles and industries contribute to acid precipitation that may destroy forests and aquatic habitats in sensitive areas.

Nonpoint source pollution is not a new phenomenon; in fact, a certain amount may result from natural processes. It is when man's activities cause an increase in the quantity and rate of pollutant runoff that water quality problems occur. These problems have often occurred because of a lack of understanding of the relationship between the water resource and its surrounding watershed.

A watershed is the drainage area that contributes water to the waterbody. For example, the boundaries of a lake watershed can be identified by connecting points of highest elevation around the lake and its tributaries. Groundwater drainage divides usually occur approximately beneath surface watershed divides. Occasionally, however, the groundwater divide does not follow the surface watershed boundary. All rain and snow falling within the watershed will eventually flow into the surface waterbody or groundwater aquifer. This also means any pollutants, such as sediments, nutrients, bacteria, and toxics will also eventually drain into the water resource.

Human activity that results in nonpoint source pollution can have enormous impact on the economic and recreational assets of a community. These impacts can be expressed in terms of lower property values, loss of fisheries, loss of wildlife habitat, loss of flood control potential, closed swimming beaches, expensive treatment of drinking water--in short, loss of valuable natural resources.

Table 1.1 lists some of the most common nonpoint source contaminants and their potential water quality impacts.



TABLE 1.1 - CONTAMINANTS AND IMPACTS FROM NONPOINT SOURCES
(EPA, 1984 and DWPC, 1987)

POLLUTANT/ASSOCIATED LANDUSE	IMPACTS
<p>Sediment</p> <p>construction, urban runoff, gravel operations, agriculture, logging, hydrologic modification</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --decrease in transmission of light which effects: plant production (food and cover), behavioral activities (nesting, feeding, mating), respiration, digestion, reproduction --increase in surface water temperature which decreases dissolved oxygen concentration in water --decreases spawning habitat (fills pools and nest sites)
	<p>On Water Supply:</p> <ul style="list-style-type: none"> --damages water treatment pumps, equipment --increases treatment costs --reduces reservoir storage capacity --toxic substances may adhere to sediment --nutrients(phosphorus)increase, stimulating algae growth --decreases river bottom infiltration, reducing well yields
	<p>On Wetlands:</p> <ul style="list-style-type: none"> --reduces flood storage --increases peak discharges --alters habitat
	<p>On Recreation:</p> <ul style="list-style-type: none"> --decreases clarity of water (public health and safety risks) --reduces aesthetic value --reduces sport fishing populations(see above) --decreases boating and swimming areas
<p>Nutrients-Phosphorus and Nitrogen</p> <p>urban development, gravel operations, agriculture, land disposal(sludge and septic systems)</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --promotes algae blooms which reduces light transmission which may inhibit aquatic plant growth important for food and cover --favors survival of less desirable species over more desirable (commercially and recreational) species --reduces dissolved oxygen levels via increased productivity and decay of organic matter



TABLE 1.1 (continued)

POLLUTANT/ASSOCIATED LANDUSE	IMPACTS
<p>Nutrients-Phosphorus and Nitrogen (continued)</p> <p>urban development, gravel operations, agriculture, land disposal (sludge and septic systems), illegal waste disposal</p>	<p>Water Supply:</p> <ul style="list-style-type: none"> --promotes algae blooms which cause noxious odors and objectionable taste --increases treatment costs --increases nitrate concentration (safe limit is 10 mg/l)
	<p>On Wetlands:</p> <ul style="list-style-type: none"> --alters wetland vegetation/habitat
	<p>On Recreation:</p> <ul style="list-style-type: none"> --promotes eutrophication of lakes and rivers --increased algae and weed growth may create public health risks --decreases aesthetic value --increased algae and weed growth reduces fishing and boating activities --reduces tourism and property values
<p>Metals</p> <p>urban runoff, mining, land disposal, natural deposits</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --accumulates in sediments, posing risk to bottom feeding organisms and their predators --bioaccumulates in fish tissue --affects reproductive rates and life spans of aquatic organisms --hinders photosynthesis in aquatic plants
	<p>On Water Supply:</p> <ul style="list-style-type: none"> --increases treatment costs --forms deposits in pipes, reducing carrying capacity --colors water, leaves stains on fixtures, clothing --possible health hazard from toxic metals
	<p>On Wetlands:</p> <ul style="list-style-type: none"> --bioaccumulates in existing food web --hinders photosynthesis in aquatic plants --affects reproductive rates and life spans of wetland organisms
	<p>On Recreation:</p> <ul style="list-style-type: none"> --restricts sport fishing if metals are found in fish tissue

TABLE 1.1 (continued)

POLLUTANT/ASSOCIATED LANDUSE	IMPACTS
<p>Pesticides and Herbicides</p> <p>agriculture, urban runoff, hydrologic/habitat modification, lawn and golf course care</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --accumulates in sediments, posing risk to bottom feeding organisms and their predators --bioaccumulates in fish tissue --as poisons, may kill fish and other aquatic organisms --affects reproductive rates and life spans of fish and other aquatic organisms --hinders photosynthesis in aquatic plants
	<p>On Water Supply:</p> <ul style="list-style-type: none"> --causes odors in water supplies --some pesticides/herbicides are carcinogens --increased public health risks
	<p>On Wetlands:</p> <ul style="list-style-type: none"> --adversely impacts the survival of wetland plants and animals
	<p>On Recreation:</p> <ul style="list-style-type: none"> --reduces waterfront property values --restricts sport fishing if contamination is found in fish tissue
<p>Pathogens-Bacteria and Viruses</p> <p>agriculture, urban runoff, land disposal, septic tanks (or illegal waste disposal), sludge</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --introduces disease bearing organisms to aquatic life
	<p>On Water Supply:</p> <ul style="list-style-type: none"> --increases public health risks --increases treatment costs for drinking water supplies
	<p>On Wetlands:</p> <ul style="list-style-type: none"> --results in loss of wetland recreational areas --introduces disease-bearing organisms to aquatic life and food web
	<p>On Recreation:</p> <ul style="list-style-type: none"> --closed swimming areas --closed shellfishing areas

TABLE 1.1 (continued)

POLLUTANT/ASSOCIATED LANDUSE	IMPACTS
<p>Thermal Energy</p> <p>construction, mining and gravel operations, logging, agriculture, urban runoff, hydrologic/habitat modification</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --reduces vigor and growth of fish --reduces resistance to disease --reduces dissolved oxygen as stream temperature increases --changes cold water sport fishery to warm water fishery
	<p>On Water Supply:</p> <ul style="list-style-type: none"> --increased water temperature accelerates corrosive action in pumps and equipment --promotes biological activities, producing odors and objectionable taste --conditions more favorable for pathogens (bacteria, viruses, parasites)
	<p>On Recreation:</p> <ul style="list-style-type: none"> --If nutrients are present, stimulates growth of algae and aquatic plants which: <ul style="list-style-type: none"> reduces water clarity, reduces aesthetic value, reduces sport fishing populations, decreases boating and swimming, reduces tourism
<p>Salts</p> <p>mining, urban runoff, construction, road de-icing</p>	<p>On Fisheries:</p> <ul style="list-style-type: none"> --favors salt tolerant species --fluctuations in salinity create stressful environment --destroys habitat and food source plants for some species --alters species composition of affected area
	<p>On Water Supply:</p> <ul style="list-style-type: none"> --reduces drinking water quality-one of the major causes of public well closures in Massachusetts
	<p>On Wetlands:</p> <ul style="list-style-type: none"> --alters wetland vegetation/species composition --destroys habitat and food sources for wetland animals
	<p>On Recreation:</p> <ul style="list-style-type: none"> --may cause skin/eye irritations

WHAT CAUSES NONPOINT SOURCE POLLUTION?

Land-use activities are the major "nonpoint source" contributors to pollution. This section lists (alphabetically) and describes many of the major land-use activities in Massachusetts. The significance of each activity will depend, naturally, on the individual character of your community. Information presented in this section was taken from the Cape Cod Aquifer Management Project Document, "Guide to Contamination Sources For Wellhead Protection" (Noake, 1989). Other references are noted, where appropriate.

Consult table 1.2 for a summary of all EPA defined categories and sub-categories of land-use activities.

TABLE 1.2 - MAJOR NONPOINT SOURCE CATEGORIES AND SUB-CATEGORIES
(EPA, 1987)

<p>Agriculture</p> <ul style="list-style-type: none"> Non-irrigated Crop Production Irrigated Crop Production Speciality Crop Production (orchards) Pasture Land Range Land Feedlots Aquaculture Animal Holding/Management Areas 	<p>Land Disposal (Runoff/Leachate from Permitted Areas)</p> <ul style="list-style-type: none"> Sludge Wastewater Landfills Industrial Land Treatment On-site Wastewater Treatment Systems (septic tanks) Hazardous Waste
<p>Silviculture</p> <ul style="list-style-type: none"> Harvesting, Reforestation Residue Management Forest Management Forest Road Construction/Maintenance 	<p>Hydraulic Habitat Modification</p> <ul style="list-style-type: none"> Channelization Dredging Dam Construction Flow Regulation Bridge Construction Removal of Riparian Vegetation Streambank Modification
<p>Construction</p> <ul style="list-style-type: none"> Highway/Road/Bridge Land Development 	
<p>Urban Runoff</p> <ul style="list-style-type: none"> Storm Sewers Combined Sewers Surface Runoff 	<p>Other</p> <ul style="list-style-type: none"> Atmospheric Deposition Waste Storage/Storage Tank Leaks Highway Maintenance and Runoff Spills In-place Contaminants Natural Marinas Boat Discharge
<p>Resource Extraction/Exploration</p> <ul style="list-style-type: none"> Surface Mining Subsurface Mining Placer Mining Dredge Mining Petroleum Activities Mill/Mine Tailings 	<p>Source Unknown</p>

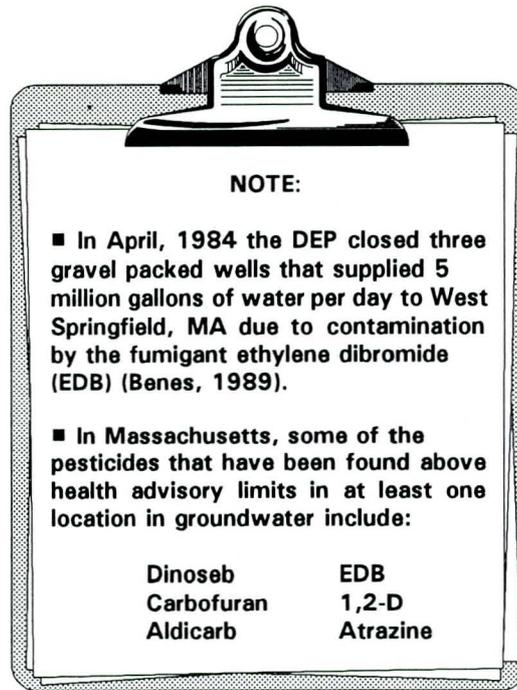


AGRICULTURE

■ Irrigated and Non-irrigated Cropland

Pesticide contamination may result from the use of approved materials for production of crops. Major contaminants are herbicides, fumigants, and land-incorporated insecticides and nematocides. Once applied, pesticides can dissolve and be carried over the ground with runoff from heavy rains or irrigation and enter the groundwater via man-made conduits such as drainage ditches, filtration basins and wells. Pesticides can also leach from the soil into the groundwater.

Nutrient contamination results mostly from applications of inorganic and organic sources of **nitrogen** and **phosphorus**. Nitrogen is of particular concern with respect to groundwater quality. Nitrogen that is not taken up by the plants leaches out of the soil



RES-FED 1
RES-STATE 22
RES-STATE 33

BMP-AMP
RES-FED 2

RES-STATE 37

BMP-AMP

PESTICIDES

Contamination Evidence:

- Detection of pesticides in well water tests
- Ill effects on animals drinking water from nearby wells, springs or surface water
- Ill effects on plants watered with nearby well water
- Ill effects on aquatic life

Causes:

- Excessive or ill timed application
- Improper storage
- Leaching through the soil
- Improper disposal of excess pesticides and rinsewater

Prevention:

- Follow use instructions
- Compliance with pesticide certification requirements
- Reduce pesticide use in recharge areas for water wells
- Encourage alternative pest control methods
- Public information/ education

as **nitrate nitrogen** which is highly soluble and mobile in soils and groundwater.

Cropland is subject to sheet, rill, and gully **erosion** when runoff is not properly managed resulting in **sediment deposition** and **phosphorus enrichment** in downstream waterbodies.

■ **Pasture Land**--Pollution may result due to overgrazing, grazing too close to waterways, removal of vegetation, and the direct discharge of animal manures beyond that needed for crop production.

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BMP-SP
BMP-VTP

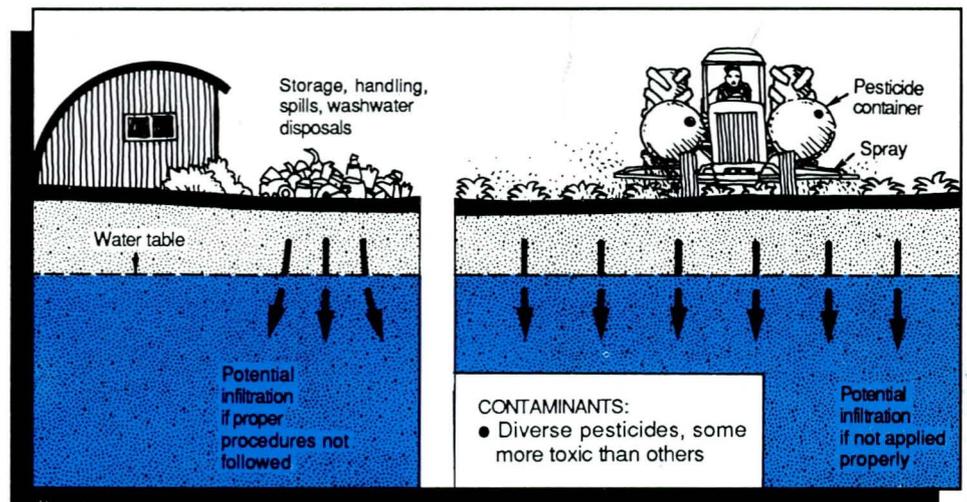


Figure 1.1 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.



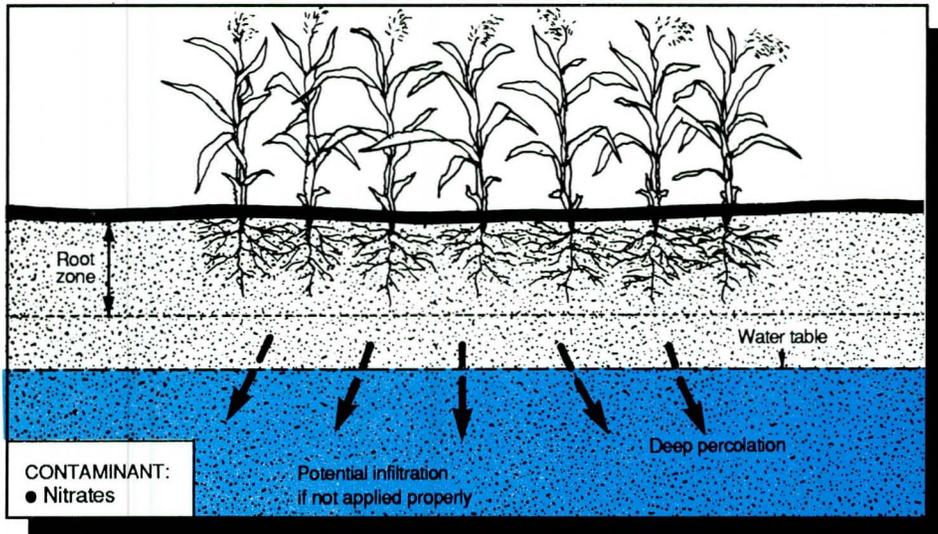


Figure 1.2 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

FERTILIZERS

Contamination Evidence:

- High nitrate level in well water tests

Causes:

- Overfertilization
- Ill-timed application

Prevention:

- Careful adjustment of fertilizer application to plant needs and timing for maximum growth benefit
- Storage of animal manure to facilitate land spreading at appropriate times

BMP-VTP
BMP-SP
BMP-AMP

■ **Hayland**--The potential exists for contamination due to surface runoff or infiltration of nutrients from applied fertilizers and manures.

BMP-SP

■ **Stables, Feedlots, Kennels, Piggeries, and Manure Pits**--Typically, feedlots are areas in which a large number of cattle, poultry, sheep or hogs are confined in concentrated spaces. Wastes generated by feedlot operations include manure, chemicals and debris. Precipitation falling on the feedlot infiltrates the accumulated animal wastes and produces leachate containing concentrations of bacteria, viruses, nitrate-nitrogen (soluble form), phosphate and sodium. Leachate or runoff from the feedlot may enter the groundwater system by infiltrating the soil cover. Groundwater contamination may also result from leachate produced when animal wastes are collected from the feedlot and applied directly to the land or disposed of in an improperly designed manure pit. Although usually generated in smaller quantities than feedlot wastes, animal wastes from kennels and stables are also potential groundwater contaminants.

RES-STATE 19

BMP-AMP

RES-SPEC
PUR 29

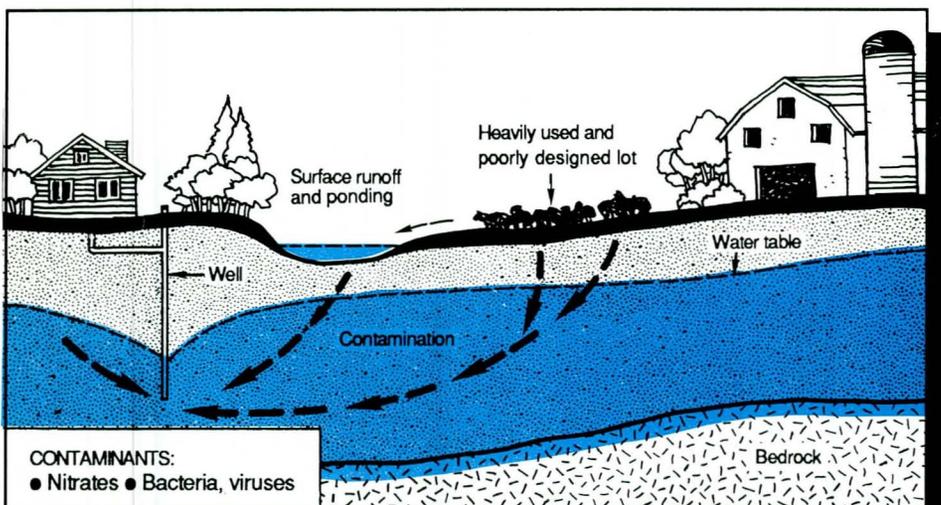


Figure 1.3 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

ANIMAL LOTS

Contamination Evidence:

- High bacteria, nitrate levels in well water

Causes:

- High animal density
- Shallow depth to water table
- Poor lot drainage
- Failure to regularly clean lot

Prevention:

- Proper siting and design
- Control animal density
- Regular cleaning of lot



■ **Waste Application Areas**--This applies to areas specifically identified for application of liquid agricultural waste such as milk room wastes, lagoon effluent, and liquid manures. There is potential for contamination by runoff and/or infiltration of bacteria, nutrients, and chemicals.

BMP-SP
BMP-AMP

AIRPORTS

Maintenance facilities for aircraft and other airport vehicles generate wastes that are potential ground and surface water contaminants including waste oil, gasoline, hydraulic fluid, cleaning lubricants, degreasing solvents, used batteries, tires, and broken or junk metal airplane parts. Some common maintenance practices include: spraying degreasing solvents on aircraft engines, changing oil, hydraulic fluid and lubricants and replacing batteries. Fuel trucks refuel many of the planes at the loading gates. Jet fuel is also drained and replaced in the maintenance hangars. During cold weather runways and planes are routinely deiced for safety. Chemicals used on the planes for this purpose include propylene glycol and ethylene glycol. Runways are kept ice free with urea, a nitrogenous compound which could contribute to the eutrophication of surface waters (MA Audubon, 1987).

BMP-HMB
RES-FED 8

BMP-PP
BMP-RP

To train fire crews at airports, gasoline/petroleum products are sometimes poured onto the ground and set ablaze. Once in contact with the ground, these contaminants can migrate down through the soil into the groundwater. Airport workers apply pesticides and herbicides to areas surrounding the runways to control plant and weed growth.

RES-STATE 22

Storage areas for the petroleum products, solvents, pesticides and road salt used by the airport workers are a potential threat to surface water and groundwater quality. Underground storage tanks (UST) containing jet fuel, gasoline, diesel fuel, heating oil, and solvents are a major threat to groundwater if they are old, rusting or leaking.

BMP-USTR
RES-STATE 45
RES-STATE 44
RES-STATE 17

ASPHALT PLANTS

Asphalt plants are generally located near sand and gravel pits. The aggregate from these pits is sorted, dried in a kiln and sorted again to meet the size specification. Oil and asphalt emulsions are then blended with the sorted aggregate to produce asphalt. Soil contaminated with oil from leaking underground storage tanks is used as aggregate by some plants. The oil and the asphalt emulsions used in the batching process and the fuel oil used to fire the kiln that are stored in underground tanks, above ground tanks or 55 gallon drums may be a threat to ground and surface water quality. Another threat can arise if the underground tanks are old or leaking or if the storage areas for the above ground tanks and drums do not have impervious floors, roofs, or berms to contain spills.

RES-STATE 45
RES-STATE 44
BMP-USTR
BMP-UIC

ATMOSPHERIC POLLUTANTS

Atmospheric pollutants are airborne contaminants carried and deposited during rain and snow storms. The most well known result of atmospheric pollution is **acid rain**. Caused primarily by NO_x and SO_x compounds reacting with water in the air, it is the name given to various forms of precipitation including snow, dew, and fog with abnormally low pH. Acid precipitation presents a significant threat to water resources and aquifer life, agriculture, forest, and direct and indirect threats to human health. The Interim Report on

RES-STATE 13



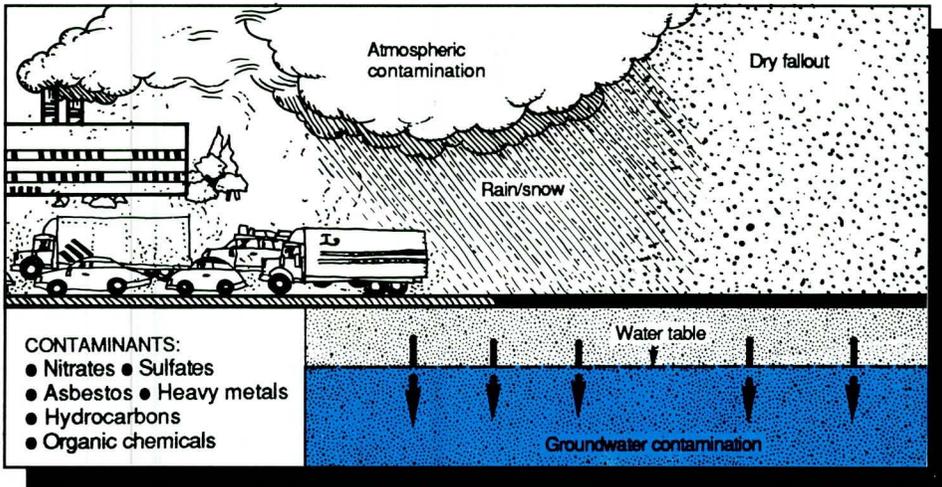


Figure 1.4 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

ATMOSPHERIC POLLUTANTS

Contamination Evidence:

- Detection of elevated levels of sulfates, nitrates, heavy metals, asbestos, hydrocarbons, other chemical compounds in well water tests

Causes:

- Emissions from motor vehicles, power plants, industries

Prevention:

- Federal and state emission controls

the Findings of the Massachusetts Acid Rain Research Program (in Manasewich, 1988) stated that Massachusetts' precipitation is among the most acidic in the country with an average pH of 4.2. Individual storms have had acidity levels as low as pH 2.5 -- more acidic than vinegar. As a result, acid precipitation has affected land and water resources all over the state.

RES-SPEC
PUR 38

Over 82 percent of all surface waters surveyed in Massachusetts are vulnerable to the adverse effects of acid rain; particularly, northern Worcester County, where 55 percent of the lakes, ponds, and streams are acidified or are showing signs of becoming acidified, and Barnstable and Bristol Counties, where more than 38 percent of the surveyed surface waters are acidified or are showing signs of becoming acidified (Manasewich, 1988).

BOAT YARDS/BUILDERS/MARINAS/BOATS

RES-STATE 2

Routine maintenance performed on boat motors generates waste engine oil, antifreeze, batteries and spent gasoline/oil mixtures. Hydrochloric and phosphoric acid solutions may be used to clean and polish metal fixtures on the boats. The raw materials used in these procedures and the resulting wastes are potential ground and surface water contaminants.

RES-SPEC
PUR 27
RES-FED 8

BMP-HMB

Typical materials required to repair or build wooden and fiberglass boats that may contribute to nonpoint source pollution include: fiberglass, resins, treated lumber, solvents and paints. The use of antifouling paints containing toxic organotin compounds (TBT) may be a concern in some coastal marine environments. Currently, the use of paints containing TBT is restricted, depending on the size of the vessel; however, sediments (and some organisms) in some areas may have already become contaminated. Other wastes generated during the repair process are spent resins, stained, painted, or treated wood, used paint thinner, stripper, paint brushes, rollers, spray equipment, and paint sludge. These wastes are potential contaminants due to the phenols contained in resins, heavy metals in paints, solvents in thinners and strippers, and wood preservatives such as creosote, pentachlorophenol, and chromated copper arsenate (CCA) in the lumber.

Overboard waste disposal by boats has been identified as a source of bacterial contamination in coastal and inland waters. In particular, problems may occur if boat sewage is released in the vicinity of shellfish beds or into enclosed or constricted waterways with limited flushing. Federal regulations (**33 CFR 159.7**) require that boats with permanently installed heads be equipped with approved marine sanitation devices (MSDs). On non-navigable inland waters all boats with permanently installed heads must be equipped with holding tanks and no discharge is permitted. In coastal waters, discharge of improperly treated waste is prohibited within three miles of the coast, and in some sensitive areas, no discharge is permitted. These regulations are difficult to enforce. Often shorebased pumpout stations are unavailable; and even when they are, many boaters do not use them. Other problems may arise from the disinfectants used to treat the sewage discharged from approved MSDs.

RES-STATE 17

RES-FED 8

CAR WASHES

Automatic car wash operations are equipped with large, rotating brushes and high pressure soap, rinsewater, and wax spigots. Soap solutions used by car wash businesses usually contain a degreasing solvent such as methylene chloride or trichloroethylene (TCE) to enhance the cleansing ability of the soap solution.

The Massachusetts Department of Environmental Protection no longer grants discharge permits to new car washes in unsewered areas; however, wastewater from existing car wash operations is a potential threat to ground and surface water quality. Car washes generate a significant quantity of wastewater contaminated with sodium and chloride from road salt; oil, gasoline, and grease from the undercarriage of the vehicle; solvents from the soap solutions; trace metals; and detergents.

BMP-UIC

CEMETERIES/ANIMAL BURIALS

Leachate from cemeteries may contaminate groundwater if non-leak-proof or no caskets were used. Pesticides and fertilizers applied to trees, shrubs and grass during routine landscaping and maintenance operations may leach into the

BMP-AMP
BMP-UF

CEMETERIES and ANIMAL BURIALS

Contamination Evidence:

- Detection of high bacteria levels in nearby well water tests

Causes:

- High water table

Prevention:

- Avoid high water tables for burial sites
- Use watertight caskets in cemeteries with high water tables

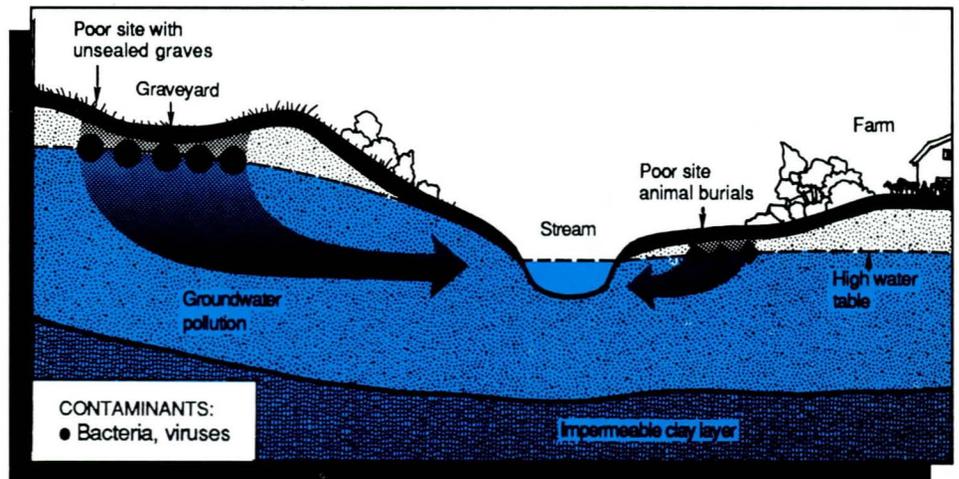


Figure 1.5 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.



groundwater. Formaldehyde from the embalming process can also be a source of contamination.

Several site specific factors affect leachate production including the soil type, depth to water table, and amount of precipitation.

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Cemeteries located in areas that have a high water table and receive high amounts of precipitation may release contaminants to the groundwater system. According to the EPA, few actual cases of groundwater contamination due to cemeteries have been documented. In most instances, contamination due to cemetery leachate would be highly localized.

CHEMICAL MANUFACTURE

BMP-HMB

Businesses that manufacture industrial organic and inorganic chemicals, plastics, pigments, pesticides, synthetic rubber and fibers, explosives, or gum and wood chemicals are some examples from the chemical land use category. A discussion of the wide range of processes and products used by these industries is beyond the scope of this manual. However, some generalizations can be made concerning the types of wastes generated by these businesses.

Typical wastes produced by these plants include wastewater treatment sludges, spent solvents, emission control sludges, container residues, distillation residues, unused chemicals, waste heavy metal catalysts from plastic materials and strong acid or base solution wastes.

RES-STATE 12
RES-STATE 45

Table 1.3 lists some common wastes generated by chemical manufacturing plants. Check with the DEP, Division of Hazardous Waste for more information on any of these or other chemical manufacturing wastes.

TABLE 1.3 - POTENTIAL CONTAMINANTS FROM CHEMICAL MANUFACTURING
(From: Noake, 1989)

SPENT SOLVENTS	ACID/BASE WASTES	SPENT CATALYSTS
Benzene	Hydrochloric Acid (HCl)	Heavy metal sludges containing cadmium, cobalt, manganese, and/or zinc
Toluene	Nitric Acid (HNO ₂)	
Xylene	Sulfuric Acid (H ₂ SO ₄)	
1,1,1-Trichloroethane	Sodium Hydroxide (NaOH)	
Perchloroethylene	Potassium Hydroxide (KOH)	
Trichloroethylene		
Tetrachloroethylene		
Vinyl Chloride		

CONSTRUCTION

Each time a new building, roadway, or other project is constructed, the potential for erosion and sedimentation exists.

■ **Development (Urbanization)**-- Most construction activities begin by first removing all trees, brush, shrubs, and vegetation from the project site. The removal of the canopy allows rain water direct access to the soil below, increasing stormwater runoff volume and velocity. Sheet, rill, and gully erosion may result from these changes. Besides the removal of vegetation, actions such as smoothing of the land surface, compaction of soils, filling of wetlands, and creation of impervious surfaces combine to increase the amount of water running off the land as surface runoff. Base flow volumes are also frequently affected by extensive development of watershed areas. The effect of this is increased erosion and water-suspended sediments with their nutrients and other pollutants such as herbicides, construction wash water, oil/gasoline spills from heavy equipment, and a variety of chemical leachate from miscellaneous stockpiled construction materials that can now run off the site.

Unless careful precautions are taken to divert runoff or to maintain buffer strips of absorptive vegetation, many of these pollutants may eventually reach the water resource. For example, excess sediments can affect wetland flood control functions and change wetland vegetation which provides important wildlife functions.

BMP - All
Construction
BMPs
BMP-E-SCS
BMP-SPR
BMP-ISL

RES-FED 2
RES-STATE 1

RES-STATE 15

CONSTRUCTION EXCAVATION

Contamination Evidence:

- Spills
- Changes in color, taste, odor, turbidity of water in nearby wells

Causes:

- Fuel, chemical spills
- Road dust control runoff
- Excessive and/or improper use of chemicals

Prevention:

- Spill containment and cleanup procedures
- Follow recommended practices for safe use of fuels and other hazardous substances

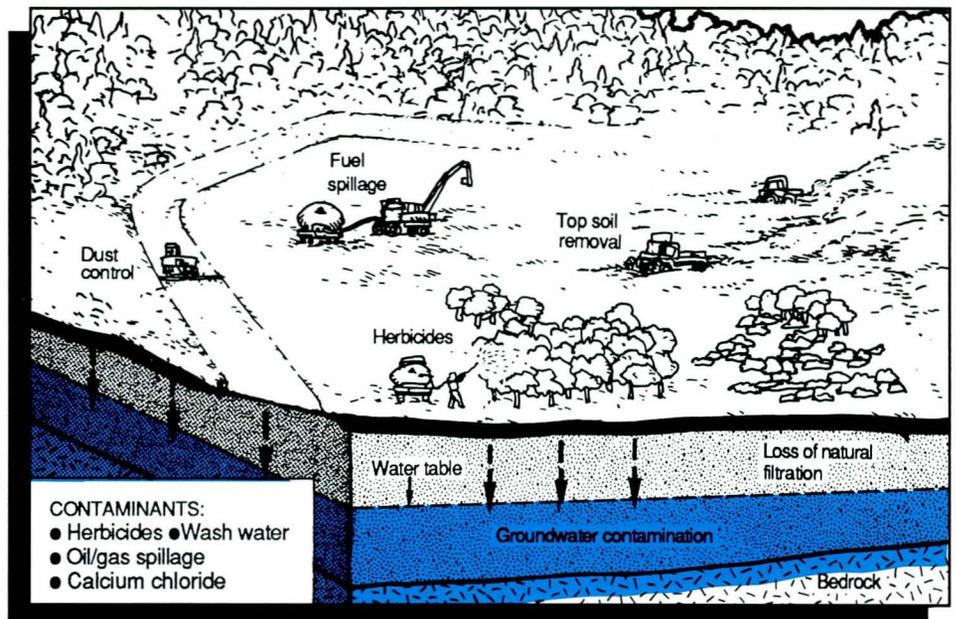


Figure 1.6 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

■ **Highways, Bridges, Roads**-- New road construction frequently crosses or comes close to drainage ways, streams, and other water bodies.

RES-SPEC
PUR 21
RES-STATE 41

Erosion of soil from disturbed areas may directly enter waters. Road reconstruction activities, including surfacing, ditching, and slope maintenance can result in runoff of petroleum products and erosion of soil from disturbed areas (Morehouse, 1988).



DRY CLEANING AND LAUNDROMATS

RES-STATE 11

Dry cleaning businesses use solvents as degreasers and cleaning agents to launder clothing. Improper storage of barrels and tanks containing solvents may result in accidental spills or leaks. Lint filters, lint and sludge saturated with solvents are also a threat to groundwater quality when carelessly discarded.

BMP-USTR
BMP-HMB

Most dry cleaning businesses store their solvents in 55 gallon drums or in storage tanks. The drums and tanks may be kept either inside or outside the building. One of the most commonly used solvents is tetrachloroethylene, also known as perchloroethylene. Other solvents which may be used are trichloroethylene, trichloroethane, and methylene chloride.

The cleaning machines are large rotary washers that use solvents rather than soap and water. In most cases, the solvent is filtered through a cartridge and recycled. Used solvent can be purified on site through distillation if the dry cleaning facility has the proper equipment.

Cleaning machines, dryers and the distillation equipment are connected to exhaust vents. The condensate from these vapor exhaust systems contains some amount of solvent and is a potential groundwater contaminant.

Neighborhood laundromats are equipped with washers, dryers and in some facilities, self-service dry cleaning machines. Laundromats generate a significant quantity of wastewater contaminated with detergents, solvents, and pathogens (viruses and bacteria). Other waste includes spent lint cartridges and cleaning solvents from the self-service dry cleaning.

FORESTRY

RES-STATE 8
RES-STATE 46

The cutting and harvesting of trees can promote erosion, especially in areas of steep slopes, creating excessive sedimentation in nearby waterbodies.

BMP - All
Forestry
BMPs

■ **Harvesting** - Most of the nonpoint source forestry pollution comes from timber harvesting operations. Erosion from access and skid roads, stream crossings, and log landings ends up as suspended or bed load sediments in streams, ponds, lakes, and reservoirs.

RES-STATE 33

■ **Reforestation** - Site preparation may result in the temporary loss of cover, resulting in sheet and rill erosion. Use of herbicides to suppress existing vegetation may result in water contamination (Morehouse, 1988).

FURNITURE STRIPPING AND REFINISHING

Furniture stripping operations generate solid wastes and wastewaters that have a wide pH range and contain high concentrations of metals and solvents.

BMP-HMB

The principal solvent in most stripping solutions is methylene chloride dissolved in a mixture of methanol or isopropyl alcohol and water. Smaller quantities of solvents such as acetone, perchloroethylene and toluene may also be present in the stripping solution.

Most shops conserve and recycle their stripping solution. However, the solution that adheres to the work piece is carried into rinsing tanks and contaminates the water with solvents, alcohols, and metals.

In the actual stripping process, the piece of metal or wood is soaked in a tank containing the methylene chloride stripping solution. After the work piece has soaked, it is removed and the loosened paint, varnish, lacquer and/or wax is scraped, wiped, or brushed off. The final solution tank contains phosphoric or muriatic acid which neutralizes the work piece. After the acid dip, the work piece is rinsed with water. These practices generate paint solids and rags soaked with solvent as well as wastewater contaminated with solvents, alcohols, and heavy metals from paint residue.

Groundwater contamination due to furniture stripping operations can result from the improper storage and disposal of rinsewater and dipping solutions. The untreated wastewater, if discharged into a septic system, may be toxic to septic system bacteria. Rinsewaters usually contain very high concentrations of methylene chloride along with alcohols, metals and other solvents. The two most common metals found in rinsewaters contaminated by paint residue are lead and zinc.

GOLF COURSES

During golf course construction large amounts of soil may be disturbed at one time, increasing the likelihood of erosion and possible sedimentation of nearby waterbodies. Tree removal may also cause increased erosion and sedimentation as well as habitat destruction. If trees are removed from areas near streams, increased potential for bank erosion and water temperature increases may result.

Grounds keepers tending golf courses use pesticides and fertilizers to enhance the growth and appearance of the fairways, greens and other turf. Runoff from sloping land can carry these compounds quickly into nearby surface waters. If soils are permeable, some pesticides and nitrogen may also migrate into the groundwater.

HAZARDOUS MATERIALS: STORAGE/TRANSFER/TRANSPORT

The storage, transfer, and transport of hazardous materials can be a **serious threat** to groundwater quality. Accidents that occur during the transport of materials can result in the release of significant quantities of petroleum products, pesticides, solvents, or radioactive wastes from damaged drums and tanks. If spills or leaks occur at transfer stations and are not immediately contained and cleaned up, contaminants enter the soil and may migrate to the groundwater or be carried overland to the surface water system. (See Figure 1.7.)

HIGH TECHNOLOGY INDUSTRIES

In general the term "high technology" refers to industrial enterprises which utilize state-of-the-art technological innovation and development. Producers of electronic components and semiconductors, computers, optical and scientific instruments, and communications equipment are examples of industries in this land use category. Despite common perception that these industries are "clean" compared to traditional industries,

BMP-UIC

RES-STATE 17

BMP - See
Construction
BMPs

RES-FED 1

RES-FED 2

BMP-UF

BMP - See
Urban Runoff
BMPs

BMP-AMP

BMP-NLS

RES-STATE 22

RES-STATE 17

RES-STATE 33

RES-STATE 45

RES-STATE 44

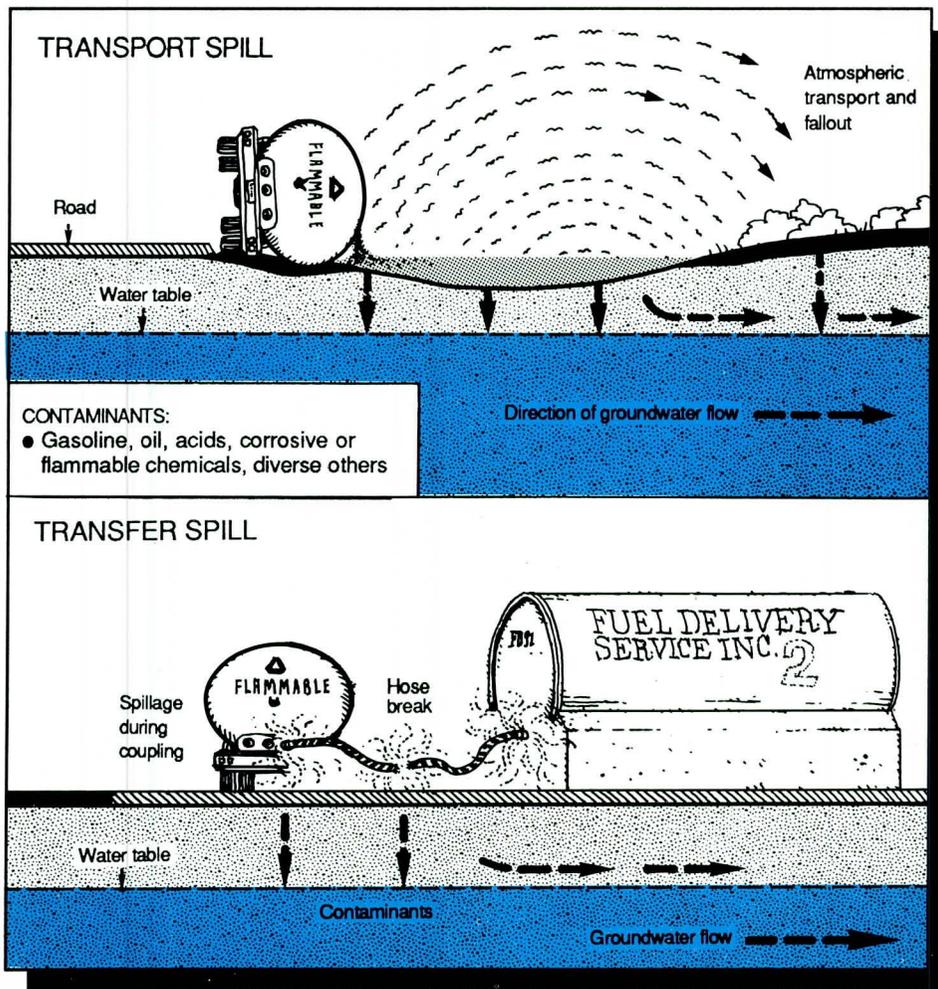
RES-STATE 12

RES-FED 8

BMP-HMB

RES-STATE 18





TRANSPORT and TRANSFER SPILLS

Contamination Evidence:

- Spills

Causes:

- Accidents
- Inadequate maintenance
- Lack of proper training
- Inadequate provisions for spill containment
- Inadequate spill cleanup procedures

Prevention:

- Proper design, installation and maintenance of transfer facilities
- Adequate spill containment and cleanup procedures
- Compliance with permit requirements
- Training programs

they utilize and generate a variety of hazardous materials that may cause contamination if not used, stored, and disposed of properly. Table 1.4 lists some of the more

Figure 1.7 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

TABLE 1.4 - COMMON COMPOUNDS USED IN THE ELECTRONICS INDUSTRY
(From Noake, 1989)

SOLVENTS	ACIDS	BASES	METALS
acetone	chromic acid	ammonium hydroxide	antimony
n-butyl acetate	hydrogen chloride	potassium hydroxide	arsenic
tetrachloroethylene	hydrogen fluoride	sodium hydroxide	barium
1,1,1-trichloroethane	nitric acid		beryllium
trichloroethylene	phosphoric acid		cadmium
isopropanol	sulfuric acid		chromium
2-ethoxyethanol			lead
toluene			manganese
freons			nickel
xylene			silver

common compounds used in the electronics industry.

The most common source of public well contamination in Massachusetts has been from the release of organic solvents.

Threats to groundwater from the high tech industries include illegal hazardous waste disposal, leaking storage tanks and containers, accidental spills and contaminated wastewater discharges. Hazardous liquids and degrading solid wastes may seep into the ground from landfills, waste ponds, septic systems and leaching fields. Poor housekeeping and inappropriate storage of materials may result in undetected leaks or spills from storage areas and tanks. Discharges of chemical-laden wastewater into sewer systems can corrode pipes and leak contaminants into water supplies.

HOUSEHOLD ACTIVITIES AND HOME LAWN AND GARDEN PRACTICES

Normal everyday household chores involve a wide variety of potential surface water and groundwater contaminants. Some of the materials that we use daily are paint thinners, chemical cleaning compounds, floor care products, poisons, polishing and degreasing compounds, automotive products, acids and bases, and other toxic substances. Quite often we dispose of these items down the various household drains or out in the backyard in the washwater. These wastes are a threat to local groundwater supplies and to surface waters from storm water runoff.

BMP-WSPZ

RES-STATE45

RES-STATE 11

BMP-HMB
BMP-USTR

RES-FED 8
BMP-PE

RES-STATE 12
RES-STATE46
RES-STATE 18
RES-STATE 6

IMPROPER DISPOSAL OF HOUSEHOLD HAZARDOUS WASTE

Contamination Evidence:

- Petroleum odor in well water
- Other chemical odors
- Detection of chemicals in well water tests

Causes:

- Improper disposal of chemicals, oil, pesticides, other wastes and used containers
- Lack of disposal facilities for small amounts of hazardous wastes

Prevention:

- Public information/ education
- Disposal facilities for small hazardous waste generators
- Enforcement against improper waste disposal

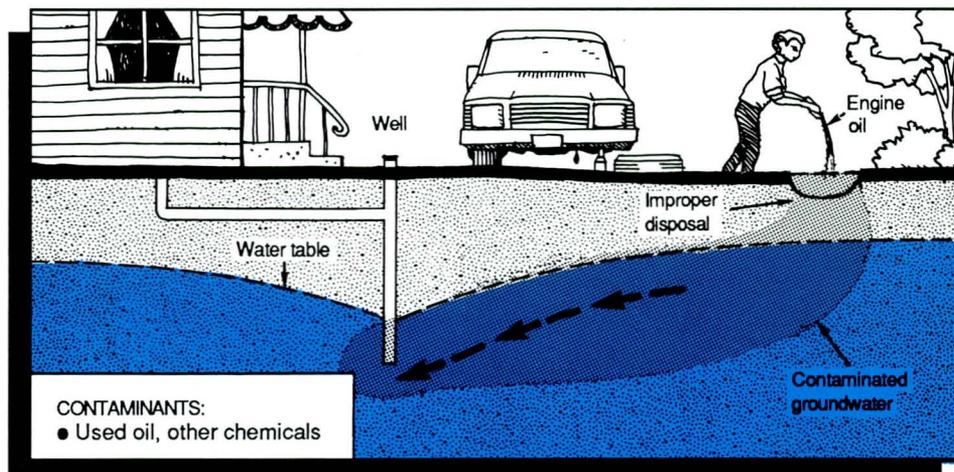


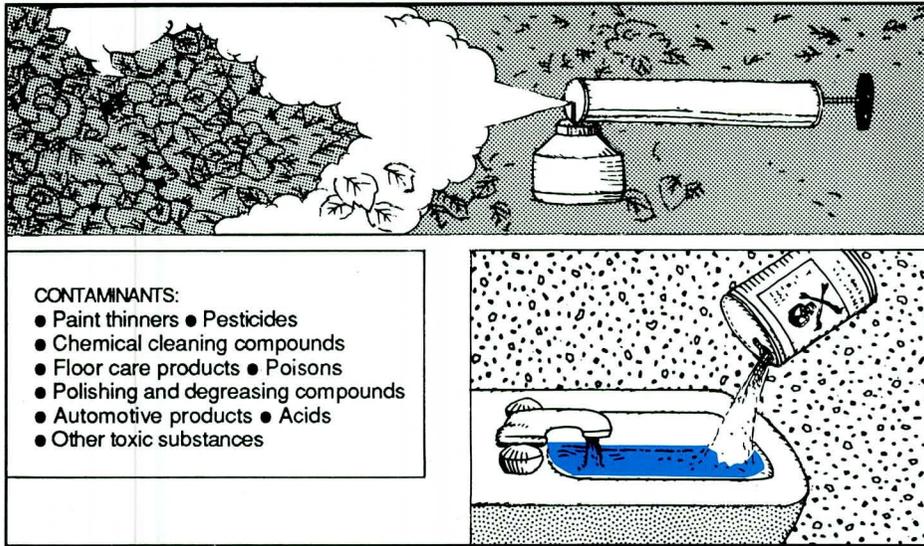
Figure 1.8 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

Home owners apply pesticides, herbicides and fertilizers to their lawns generally during the spring and fall seasons to enhance growth, discourage weeds, and to remove destructive insects. Some home owners hire a lawn service company to achieve the "perfect" lawn. Pesticides and commercial fertilizers are also used in abundance in flower and vegetable gardens.

Many home owners feel that "more is better" and have the tendency to over apply beyond the recommended application rates as listed on the product containers.

BMP-AMP
RES-STATE33

RES-STATE 37



HOUSE and GARDEN CHEMICALS

Contamination Evidence:

- Detection of chemicals in well water tests

Causes:

- Improper use and storage
- Improper disposal in backyard, ditches, low ground, septic systems, overgrown areas

Prevention:

- Proper use
- Public information/ education
- Provide local disposal facilities for unused chemicals and chemical containers
- Encourage use of less hazardous products

- CONTAMINANTS:**
- Paint thinners • Pesticides
 - Chemical cleaning compounds
 - Floor care products • Poisons
 - Polishing and degreasing compounds
 - Automotive products • Acids
 - Other toxic substances

Figure 1.9 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

This excess amount of fertilizer (or pesticide) has a tendency to run off sloping residential lots or to infiltrate groundwater on more level lots or lots with shallow distances to the water table.

HYDROLOGIC/HABITAT MODIFICATION (Morehouse, 1988)

■ **Channel Modification** - Maintenance or construction of ditches, channels, rivers, etc., may result in direct discharges of soil and sediment to flowing waters. Non-stable channels, slopes, and spoil material may erode releasing sediments to water. Removal of vegetation may cause temperature increases in water. Channel modification may cause quicker concentration and release of water to downstream areas resulting in stream scouring or even increased flows and flooding.

■ **Dam Construction/Reconstruction** - Earth moving and construction activities may result in soil erosion and sediment delivery to waters. Thermal and hydrologic modifications frequently occur where reservoir area or storage is large.

■ **Earth Fills** - Illegal filling of wetlands and other natural storage areas may displace flood storage and increase peak downstream flows. Erosion of unstable fills may cause sedimentation in streams and lakes.

JEWELRY AND METAL PLATING

Jewelry and metal plating operations perform several different processes including machining, grinding, buffing, polishing, lettering, enameling, cleaning, electroplating, and painting.

Highly acidic or basic plating wastewaters from electroplating operations generally

RES-FED 3
RES-STATE 46

BMP - See
Hyd/Hab
Mod BMPs

RES-STATE 15

RES-FED 8



contain high concentrations of heavy metals. Acid plating solutions usually contain copper, nickel, zinc and cadmium; while basic plating solutions may contain zinc. Sludges contaminated with heavy metals are also a waste product from tank clean-out during the electroplating process. Detergents and degreasing solvents are used to clean machinery and processed metal. Most jewelry and metal plating businesses generate waste oil from cutting or lubricating procedures. Table 1.5 lists some common waste types found in the jewelry and metal plating industry.

BMP-HMB
BMP-WSPZ

TABLE 1.5 - COMMON WASTES FROM JEWELRY AND METAL PLATING
(From: Noake, 1989)

SPENT SOLVENTS	ACID/BASE SOLUTIONS	HEAVY METAL WASTEWATER/SLUDGES
benzene	hydrofluoric acid	copper
toluene	nitric acid	cadmium
xylene	phosphoric acid	nickel
1,1,1-trichloroethane	potassium hydroxide	zinc
trichloroethylene	sodium hydroxide	

JUNKYARDS

Junkyard businesses buy or accept discarded, wrecked and abandoned automobiles, trucks, busses and trailers. Generally, junk vehicles remain in the junkyard for a specified time period (6 months - 1 year) during which all useful parts are removed and offered for sale.

RES-STATE 11

Some junkyard operators collect brake and transmission fluids, antifreeze, batteries, gasoline and motor oil from junk vehicles. Waste fluids are generally stored on-site in 55 gallon drums or in tanks. Storage areas for waste fluids are a potential threat to groundwater quality.

RES-STATE 45

LAND DISPOSAL

■ **Landfills** - Landfills include both operating and closed private and municipal landfills used for disposal of garbage and other residential, commercial, and industrial wastes. Landfill leachate is highly variable in its composition and may be laden with a wide range of organic and inorganic contaminants. Hazardous waste generated from typical household garbage may include toxic cleaning compounds, pesticides, fertilizers, paint, solvents and waste oil. Landfills pollute not only nearby streams, but also may pollute groundwater.

RES-STATE 16

RES-STATE 17
RES-STATE 18

Groundwater contamination problems from landfills are quite common. As rain and melting snow infiltrate the landfill material and percolate down through the decomposing waste, contaminants are dissolved into water through a process called leaching. The

BMP-WSPZ



resulting contaminated water, called leachate, moves downward through the landfill to the water table and migrates in the direction of groundwater flow. The amount of infiltrating water and length of time it is in contact with landfill elements are two factors controlling leachate formation. Frequently, septage pits and lagoons are located at a landfill site which may increase the amount of water infiltrating the area.

Another problem associated with landfills is groundwater mounding due to the lack of sufficient vegetation and increased permeability of landfill surfaces. Precipitation infiltrates the soil cover and refuse instead of flowing as surface runoff. The addition of this infiltrating water may result in a local mounding or rise in water table elevation under the landfill. This may extend the contact period between the groundwater and the refuse, increasing contamination. According to the EPA, improperly designed landfills and old dump sites are among the five most serious threats to groundwater quality.

RES-FED 8

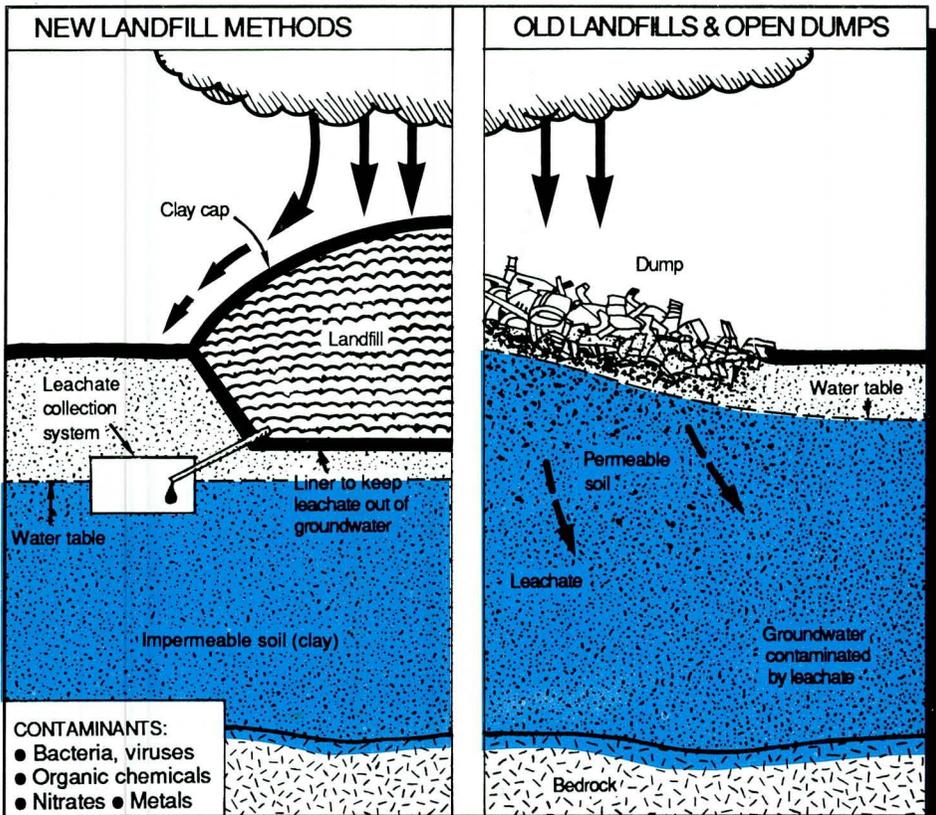


Figure 1.10 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

RES-STATE 45
RES-STATE 16
BMP-PE

■ **Illegal Dumping Areas** - The illegal dumping of household, commercial, and industrial wastes generally occurs along utility rights-of-way, in abandoned sand and gravel pits, in our own backyards, or in isolated areas made accessible by roads. The disposal of waste in this manner can be a **serious threat** to groundwater quality due to the wide range of liquid and solid waste that can be dumped. Liquid waste may be poured onto the ground or left in unlabeled drums. Although the type of wastes disposed are extremely varied and not easily categorized, some examples include demolition debris, household hazardous wastes or wastes not accepted by municipal landfills.

LANDFILLS

Contamination Evidence:

- Observed leachate runoff
- Seepage into nearby surface water
- High levels of bacteria, organic chemicals, metals, nitrates in well water tests

Causes:

- Lack of control over leachate movement
- Permeable soil
- Leaky landfill cover
- No liner or liner failure
- Poor management
- Lack of control over hazardous wastes disposal

Prevention:

- Proper design, maintenance, and operation
- Avoid sensitive groundwater areas
- Regular inspection and groundwater monitoring
- Ban hazardous wastes from landfill unless designed for this purpose
- Reduce waste by promoting recycling



SMALL DISPOSAL PITS

Used for dumping or burning wastes by businesses and households

Contamination Evidence:

- Petroleum odor in well water
- Other chemical odors
- Detection of chemicals in well water tests

Causes:

- Improper disposal of chemicals, oil, pesticides, other wastes and used containers
- Lack of disposal facilities for small amounts of hazardous wastes

Prevention:

- Public information/ education
- Disposal facilities for small hazardous wastes generators
- Enforcement against improper waste disposal

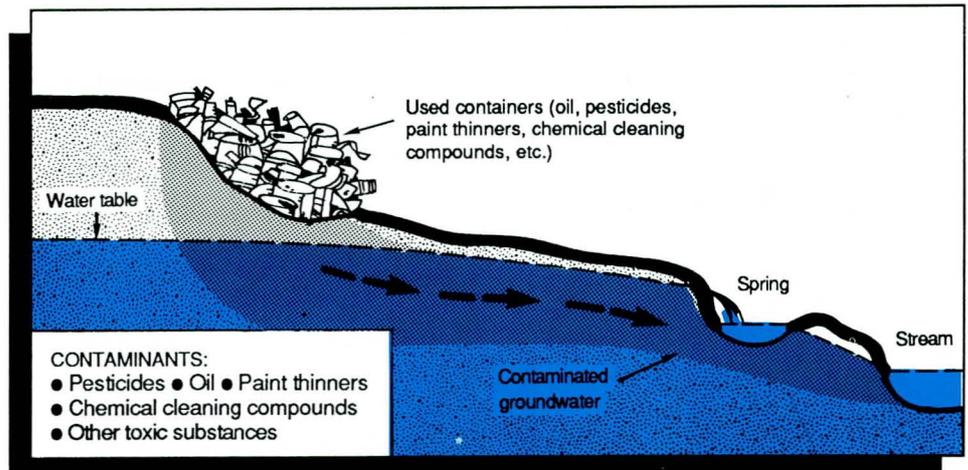


Figure 1.11 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

This type of disposal occurs daily in our residential neighborhoods. Landfills and resource recovery plants will not accept certain materials such as used motor oil and antifreeze, surplus paint, paint thinners, and solvents generated by the do-it yourself homeowner. Some of these materials are dumped into the storm drain or buried in the backyard. Local contamination of groundwater is highly likely with this practice.

■ **Industrial Lagoons and Pits** - Industries, farms and municipalities use lagoons and pits to store, treat and/or dispose of wastewater, sludge and solid waste. Industrial waste is a serious threat to groundwater quality when placed in unlined lagoons and pits located in permeable

soils. The function of these lagoons and pits is to allow the wastewater and other liquids to evaporate or percolate down through the soil (See figure 1.12).

Industrial lagoons and pits may contain many types and combinations of groundwater contaminants. With the inflow of fluid waste and precipitation, the toxic constituents of solid wastes and sludges can leach out and seep through the unlined lagoons and pits and enter the groundwater. Some facilities have a constructed overflow area to allow storm flows to pass through the system without damaging or breaching the lagoon. This passage of storm water runoff carries with it contaminants from the lagoon to the adjacent surface water or groundwater system.

■ **Septic Systems/Cesspools** - In the absence of a community sewage collection and treatment system, septic systems provide for on-site disposal of household sanitary waste as well as sanitary wastewater generated by a variety of commercial operations. The effluent from failed or failing septic systems is a heavy contributor to the contamination of surface waters (ponds and lakes) and to groundwater. Many Massachusetts ponds and lakes are being rendered unsafe for fishing and swimming by the people who live along their shorelines. This type of nonpoint source pollution is growing rapidly due to ever-increasing development and the associated installation of on-site septic systems and as seasonal camps, often with insufficient on-site systems,

RES-STATE 12

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RES-STATE 17
BMP-SP

RES-STATE 12

BMP-HMB
BMP-WSPZ

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RES-STATE 17
RES-FED 8
BMP-SEW
BMP-O-SDS



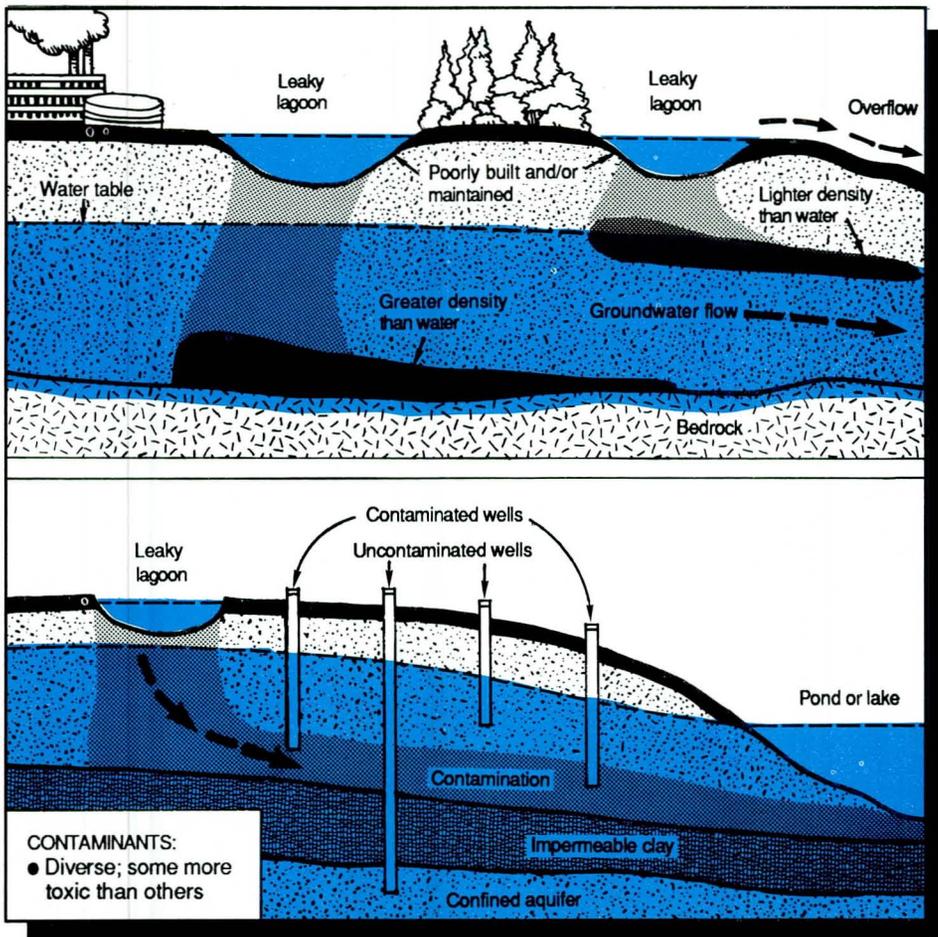


Figure 1.12 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

STORAGE LAGOONS

Used by industries, farms, municipalities, mining operations, oil/gas producers

Contamination Evidence:

- Spills
- Changes in color, taste, odor of well water
- Unhealthy or dead vegetation near lagoon
- Greener and more vigorous plant growth near lagoon
- Detection of excessive bacteria, chemicals in well water tests

Causes:

- Poor installation and maintenance
- Overflows
- Seepage
- Liner failure
- Structural collapse
- Location in sensitive groundwater area

Prevention:

- Proper installation and maintenance
- Locate away from sensitive groundwater areas

are converted to year-round homes.

A **septic system** consists of two units - a watertight septic tank and a leaching system. After the raw sewage enters the septic tank, the heavier solids settle to the bottom and the lighter solids, greases and scum rise to the top. See figure 1.13. Bacteria in the **anaerobic** (lack of oxygen) environment of the septic tank decompose the solid material. Gradually, a layer of sludge forms at the bottom of the tank and a layer of scum/grease forms in the upper part of the tank. The sludge, grease and scum (called **septage**) must be removed periodically to prevent clogging of the leaching system. Effluent from the septic tank flows into the leaching system which may consist of a field, pit, trenches, chambers, or galleries that release the effluent to the soil. As the effluent percolates downward through the unsaturated zone of the soil some pollutants may be filtered, sorbed or undergo **aerobic** (presence of oxygen) biodegradation.

Although most domestic wastewater is relatively generic, the capability of the soils to treat certain contaminants is limited. Heavy metals, pathogens and phosphates are immobilized in the soil. However, soil attenuation mechanisms are limited by the number of available exchange sites on silt, clay, and organic soil particles. Once the exchange capacity of the soil is reached, these contaminants will move through the soil relatively unaffected.

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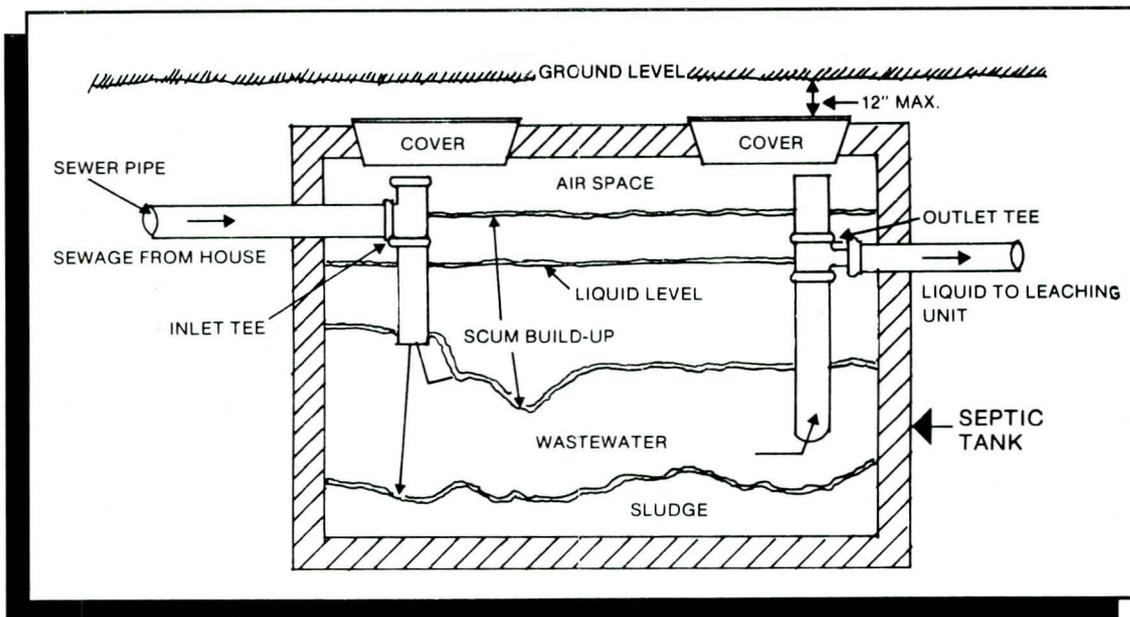


Figure 1.13 - Cross Section View of a Septic Tank

Nitrate (NO_3) is the most common groundwater contaminant associated with septic systems. Once nitrate enters the groundwater system, it moves with minimal transformation. Nitrate is as mobile as the groundwater and may travel long distances from input areas if the aquifer materials are highly permeable. Excess concentration of nitrate in drinking water gives it a bitter taste. The maximum allowable concentration of nitrate in drinking water in Massachusetts is 10 mg/l.

BMP-NLS

RES-STATE 18
BMP-WLB

Cesspools are perforated concrete or stone chambers. Raw sewage flows into the cesspool, solids settle to the bottom of the chamber and the liquids seep out through openings in the side and bottom. Cesspools provide very little treatment of sewage and are more likely to fail and create public health problems than septic tanks equipped with leaching fields. Although the installation of a cesspool is no longer permitted in Massachusetts, many older homes and summer cottages still discharge their sanitary waste into cesspools. **Cesspools do not meet Massachusetts Title 5 Standards and in this state are, without exception, illegal and should be replaced with an approved system.**

RES-STATE 17

Of particular concern is the presence of toxic organic solvents in domestic wastewater, seepage, and discharged effluent. The improper disposal of household hazardous wastes contribute solvents, petroleum products, and pesticides to the on-site system. Commercially sold septic tank additives can be a source of toxic organic compounds. **The septic system cannot treat these wastes!** The effluent entering the underlying soils will therefore contain varying concentrations of these contaminants.

BMP-PE

Not only is groundwater contamination a concern. Often septic system failures result in above-ground breakouts of untreated leachate which may contaminate surface waters with nutrients and bacteria.

■ **Septage Lagoons and Sludge** - In the Commonwealth of Massachusetts there are approximately 600,000 residential and commercial septic systems. **Septage** is the residual scum, sludge and other solids that accumulate in the bottom of the septic tank. For the septic system to function properly, septage must be periodically pumped from the

RES-STATE 17



tank and disposed of. Common constituents of septage that are potential groundwater contaminants include pathogenic bacteria and viruses, heavy metals, nitrate, sodium and chloride. Sometimes hazardous organic compounds (benzene, toluene, 1,1,1- trichloroethane, and 1,1,2-trichloroethane) are present in domestic raw sewage and septic system septage and effluent. The presence of these toxins can be attributed to the improper disposal of household hazardous waste, such as paint thinner, turpentine, old gasoline, acetone, wax strippers, and grease removers in the septic system. The use of some toilet bowl cleaners may also contribute toxic organic solvents to the on-site system.

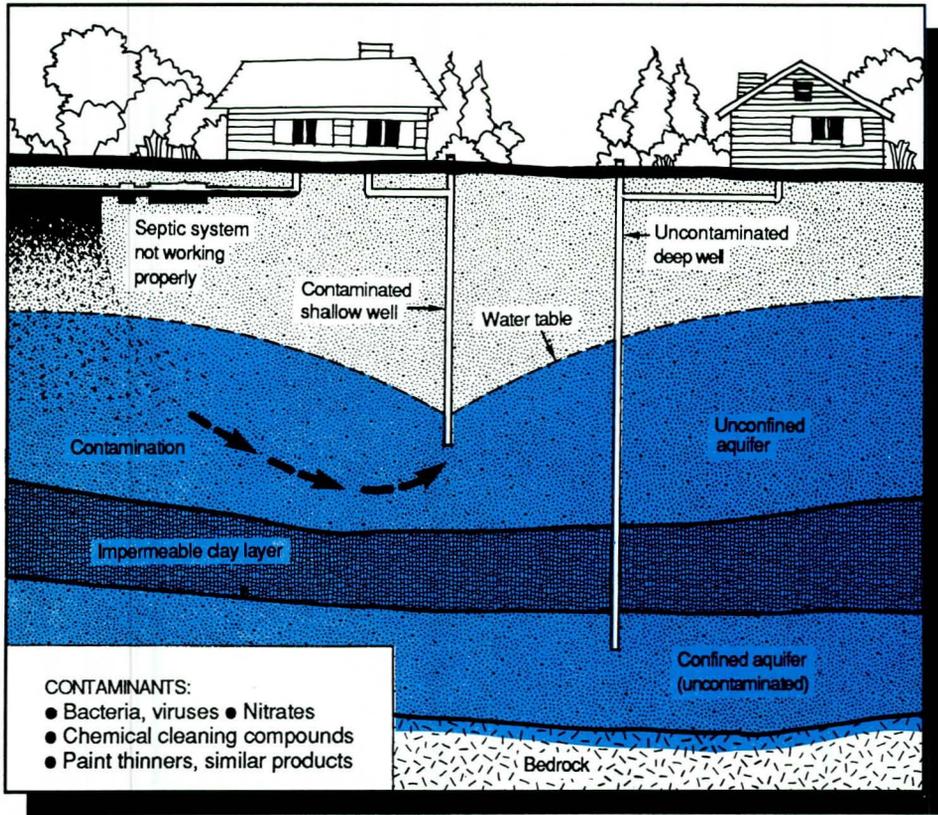


Figure 1.14 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

SEPTIC SYSTEMS

Contamination Evidence:

- Wastewater shows above ground
- Detection of excessive bacteria, chemicals in well water tests

Causes:

- Poor installation and/or maintenance
- Disposal of household chemicals, such as paint thinners, into the system
- Overloading the system with a garbage disposal unit
- Use of septic tank cleaning additives
- Too many closely-spaced septic systems in a limited area

Prevention:

- Proper installation
- Inspection and cleaning every 2-4 years, annually if garbage disposal unit is used
- Do not dispose of household chemicals into the system
- Ban hazardous cleaning additives for septic systems
- Develop local septic system codes
- Public sewers when feasible
- Public information and education

NOTE:

- The annual volume of commercial and domestic septage generated in Massachusetts is estimated to be approximately 400 million gallons! (Allen and Pare, 1987)
- The DEP-Division of Water Supply Source Approval Regulations (310 CMR 22.21) require that towns prohibit the landfilling of sludge and septage in the Zone II of a new well pumping greater than 100,000 gallons of water per day.

■ Lagoons and pits provide a system for the dewatering of septage. They are usually unlined and sited in well-drained, permeable soils. Liquid effluent percolates through the soil and the solid portion is retained. Lagoons are slightly more sophisticated than open, unlined pits which are no more than holes dug into the ground. When a pit is full, it is usually covered with fill and buried; however, lagoons equipped with sand filter beds facilitate the percolation of the liquid effluent. Once the septage is sufficiently dewatered, the settled solids are removed from the lagoon and disposed of in a sanitary landfill or spread on the land (usually on agricultural or forested land). New septage is then added to the lagoon.

RES-STATE 17
RES-STATE 16
BMP-VTP

Unlined pits and lagoons provide little or no treatment of septage. As the effluent percolates through the sand filter beds and soil, some of the bacteria, viruses, and phosphorus may be adsorbed, and the solids are retained. In addition, some microbial degradation of the septage occurs in both lagoons and pits; however, many groundwater contaminants including nitrate and toxic organic solvents are not removed by this treatment process. The disposal of septage in unlined lagoons and pits is a **serious threat** to groundwater quality.

■ **Sludge and Organic Waters** - This includes treated and untreated plant and animal residues from food processing facilities as well as approved sludge from waste treatment plants.

Over 200,000 tons of sludge, a residual by-product of the treatment process, are generated by wastewater treatment plants in Massachusetts each year. Typical municipal sludges contain a large number of potential groundwater contaminants including nitrate, bacteria, viruses, metals and toxic organic compounds. Prior to disposal, sludge is dewatered and stabilized. Disposal options for municipal and industrial sludge include incineration, landfilling, and land application.

Since sludge contains varying concentrations of nitrogen, phosphorus and potassium, it can be used to supplement agricultural fertilizer and to condition crop soil; however, land application of this waste may be detrimental to water quality. If the site has coarse textured soils and a shallow depth to groundwater (high water table), the toxic constituents of the waste, such as nitrate, metals, or hazardous chemicals, can leach through the permeable soil and enter the groundwater. Concentration of these materials

BMP-SP

RES-STATE 17
BMP-SDPR

RES-STATE 17

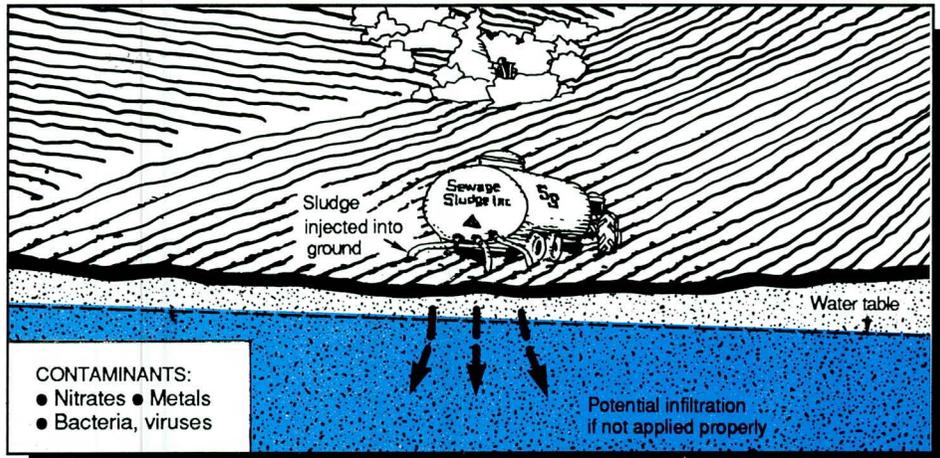
BMP-VTP
RES-FED 2
RES-STATE 19
RES-STATE 37

NOTE:

- In 1986, the DEP conducted a statewide inventory of septage disposal practices. The following results were obtained:
- 56** Operational municipal and private lagoon sites were found
- 10** of these sites have been given permission to operate on a "temporary" basis; the remainder have no permit.
- 0** of the sites have a valid discharge permit
- All** of the sites are located in towns that depend on groundwater for their drinking water supply
- Many** of the sites are located within the recharge area (Zone II) of the water supply wells.

From: Noake, 1989

in stockpiles or applications to the soil also present a potential for runoff to surface waters. In Massachusetts, approximately 80% of the sludge is disposed of in municipal, commercial and on-site landfills.



LAND APPLICATION Sludges and Wastewater

Contamination Evidence:

- High bacteria, nitrate levels in well water tests

Causes:

- Improper application methods
- Inappropriate soils for application

Prevention:

- Compliance with permit requirements

Figure 1.15 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

RES-STATE 45
RES-STATE 12
BMP-WSPZ

■ **Hazardous Waste Areas** - These may be located over defined or non-defined areas where hazardous wastes of chemical, biological, or mineral material are stored, have been stored, or spread on the land. Contamination of surface and groundwater may result from runoff or percolation of water through the area.

RES-FED 2

RES-STATE 16

■ **Stump Dumps** - The clearing of land for agricultural use and commercial, residential, or other development projects produces quantities of trees, brush, leaves, stumps, and other woodwastes which are commonly referred to as "bulky wastes". Generally, the operators of municipal and commercial landfills are reluctant to allow the disposal of large quantities of woodwastes because they very quickly reduce the capacity of the landfill and its ability to handle normal refuse.

BMP-WSPZ

Even with large, properly supervised woodwaste disposal sites, the potential may exist for future contamination of groundwater from the organic acids, (i.e., tannic acids) produced as the woodwastes decompose. The threat to groundwater is much greater from unmonitored stump dumps, especially those sited for convenience in abandoned sand and gravel pits or other sensitive aquifer recharge areas.

MACHINE SHOPS AND METAL WORKING

Machine shops and metal working operations perform many different processes including turning, grinding, drilling, cutting, stamping, buffing, and polishing to alter metal stock, usually steel, into a wide range of products.

During the metal grinding process, a recirculating water bath captures the grinding dust which settles out in a tank. Periodically the water bath must be changed. The grinding sludges and waste water are potential groundwater contaminants and must be stored and disposed of properly.

Shavings and metal chips coated with oil from metal machining or stamping processes

are usually disposed of in a dumpster or in drums. If these receptacles lack covers, precipitation collects and mixes with the oil. This liquid is a potential groundwater contaminant and may leak from drums or dumpsters or spill during pick-up and transport. Storage areas for waste oil and solvents are also a potential threat to groundwater. Most machine shops use degreasing solvents for routine maintenance on machinery and for cleaning metal parts. Typical aromatic hydrocarbon solvents used in these operations are benzene, toluene, and xylene. The common halogenated hydrocarbons used are trichloroethylene and 1,2-dichloroethylene.

BMP-UIC
RES-STATE 12
BMP-WSPZ

BMP-HMB

Metal heat treating is a process by which a metal's tensile strength, density, electric resistivity, ductility and hardness can be changed. After heat treating, the parts are first dipped in tanks which may contain molten cyanide or non-cyanide salts and then they are immersed in a tank filled with quenching oil and/or an acid solution. The parts are rinsed in water and then dipped in oil for rust protection. Wastes generated by the metal heat treating process include waste oil and spent cyanide and acid solutions.

NATURAL SUBSTANCES

Among the many naturally occurring contaminants found in waters of the Commonwealth are; sulfur, salt, arsenic, iron, manganese, barium, and radon. Naturally occurring deposits can have an effect on our use of groundwater and surface water for drinking water and recreation.

RES-FED 6
RES-STATE 17
RES-STATE 18

NATURAL SUBSTANCES

Contamination Evidence:

- Bad taste or odor in well water
- Stains on water fixtures
- Detection in well water tests

Causes:

- Natural origin

Prevention:

- Avoid areas where natural groundwater problems exist, if feasible
- Use water treatment devices
- Change to public water supply, if feasible

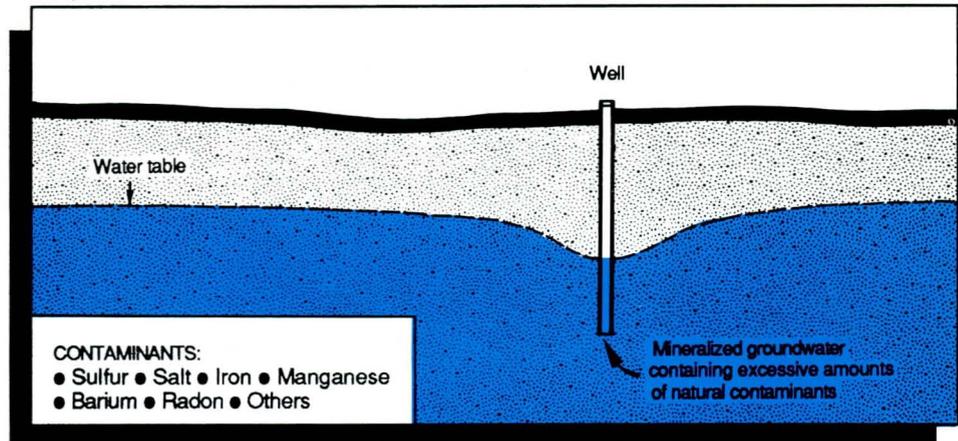


Figure 1.16 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

PIPELINES

One area that is often overlooked is the nonpoint source pollution threat from the many miles of underground pipes in towns and cities.

These pipes carry a wide variety of substances such as gasoline, oil, sewage, storm water runoff, and commercial and industrial chemical supplies. These pipelines can become damaged or rupture from a variety of causes such as: age, corrosion from soil and water, tree roots, frost heaves, construction, use beyond design limits, defective materials, poor maintenance, and improper installation.

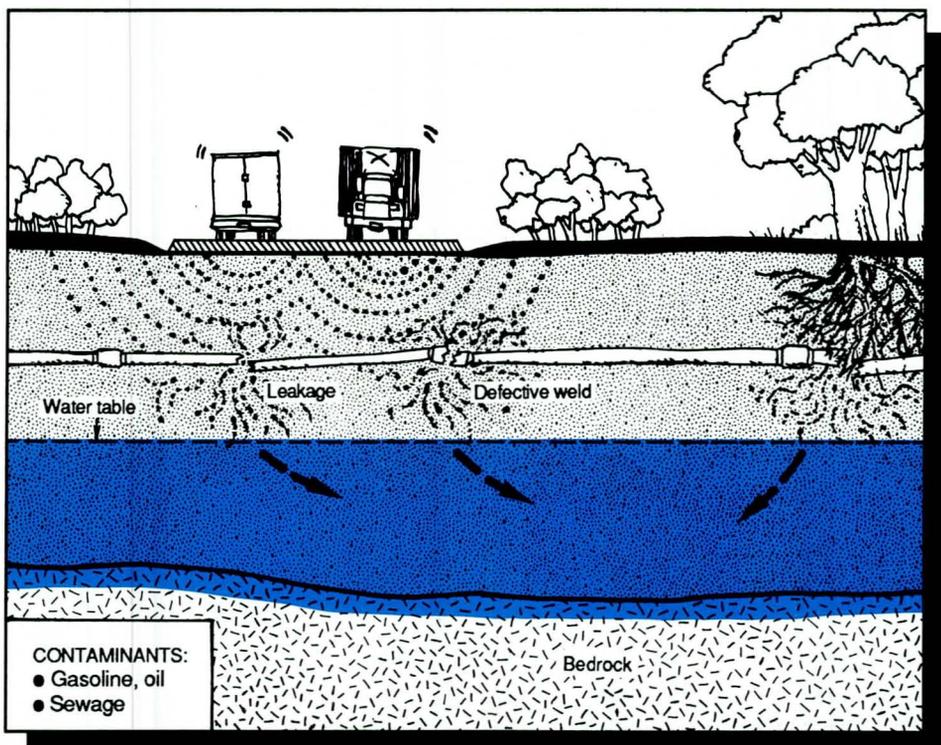


Figure 1.17 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

PIPELINES

Contamination Evidence:

- Odors in basement or well water
- Pipeline flow losses
- Detection of pipeline leaks through inspection
- Detection of excessive bacteria in well water tests

Causes:

- Corrosion
- Defective welds
- Vibrations from heavy vehicles
- Displacement by tree roots
- Poor installation
- Poor maintenance and inspection

Prevention:

- Proper installation
- Regular inspection and maintenance

PHOTOGRAPHIC PROCESSING/PRINTING

■ **Photographic Processing** - Commercial film developing and processing operations run the film through various process baths and stations. The wash station baths run continuously and produce the major daily discharge of wastewater. Typically, this wastewater has a neutral to alkaline pH and contains various concentrations of acetate, formaldehyde, butyl alcohol, and thiosulfate carried over from the process baths. The processing solutions, fixing baths, developers and stabilizers contain organic compounds that are biodegradable in a sewage treatment plant. Table 1.6 lists some of these compounds.

BMP-HMB

TABLE 1.6 PHOTOGRAPHIC PROCESSING/PRINTING CHEMICALS
(From: Noake, 1989)

CHEMICAL	SOURCE
2,4-dinitrophenol	developer dye
benzylalcohol	color developer
elon (p-methylaminophenol)	black/white developer
hydroquinone	black/white developer
thiosulfates and sulfites	fixing baths

■ **Printing** - Wastes generated by printing operations include spent ink and ink sludges that may contain heavy metals and solvents. Not all waste inks and ink sludges are potential groundwater contaminants; however, those that contain heavy metals and solvents are a threat to groundwater quality.

BMP-WSPZ

Both commercial photographic processing laboratories and printing businesses generate large quantities of spent developer and fixer. Printers also generate significant quantities of spent cleaning solvents which may contain 1,1,1-trichloroethane, trichloroethylene, or ethyl benzene. These products are potential contaminants and may enter the groundwater through leaking storage tanks or improper land disposal of wastes.

RAILROAD TRACKS AND YARDS/MAINTENANCE STATIONS

Maintenance facilities for railroad cars provide a number of routine services and generate wastes that contain several different groundwater contaminants. Workers use degreasing solvents and strongly acidic or basic cleaning fluids to remove oil and grease from engine parts and to clean other freight car equipment. Strong acid and base solutions are also used to remove rust. Polychlorinated biphenyls (PCBs) have been used to flameproof diesel and electric locomotive transformer oil. Railroad maintenance facilities store new and used oil, solvents and fuel in underground storage tanks, 55 gallon drums, or above ground tanks. Underground storage tanks are a serious threat to groundwater quality if they are improperly installed, old, rusty, or leaking.

BMP-USTR
RES-STATE44

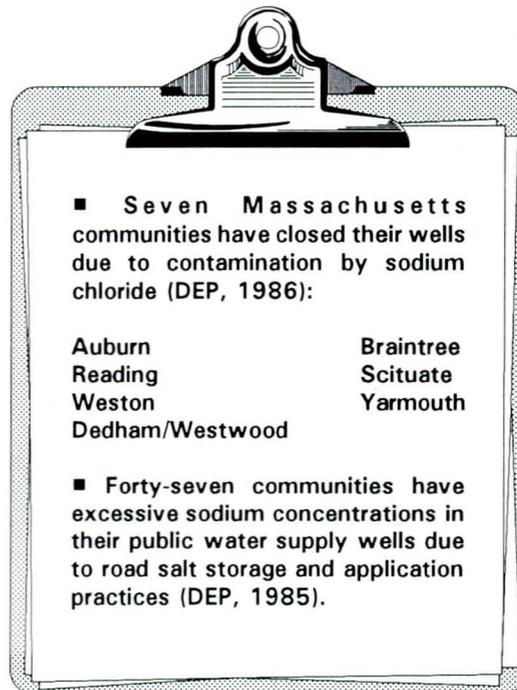
RESEARCH LABORATORIES/UNIVERSITIES/HOSPITALS

The solid wastes and wastewaters generated by **research laboratories** and **university laboratory** facilities vary depending upon the current work being done; however, some typical wastes generated by these facilities include radioactive wastes, spent solvents, acidic and basic solutions, tissues and cultures containing pathogenic viruses/bacteria and other wastes contaminated with phenols, nitrates, and trace metals.

Hospitals generate wastes similar to those listed for the research and university labs. In addition, x-ray facilities produce spent fixers and developers that contain silver and other trace metals as well as solvents. The solvent xylene is generally used in tissue preparation. Hospitals also use radioactive materials as tracers and dyes. In addition, disinfectants and other industrial detergents are used for cleaning and sterilization purposes.

ROAD AND MAINTENANCE DEPOTS/ROAD DE-ICING

Municipal Departments of Public Works (DPW) and Highway Departments use petroleum products and degreasing solvents during routine maintenance procedures on all



RES-SPEC
PUR 21
RES-STATE41



BMP-USTR
 BMP-WSPZ
 RES-STATE 44

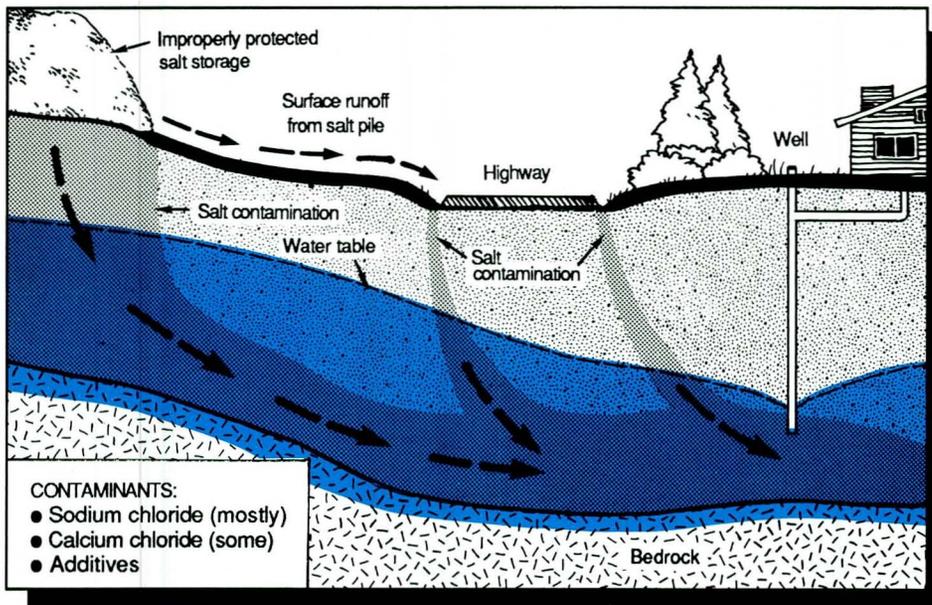
heavy equipment. These facilities store new and waste motor oil, antifreeze, brake fluid, hydraulic fluid, and solvents in 55 gallon drums, above ground or underground tanks. Most garages store gasoline and diesel fuel in underground storage tanks in order to provide on-site refueling of town vehicles. These storage tanks and the piping systems are a threat to groundwater quality if they are old, rusty, or leaking. Often DPW yards are located near municipal wells; they should therefore be managed very carefully especially regarding underground storage tanks.

BMP-AMP
 RES-STATE 22
 RES-STATE 37

Municipal Park Departments spray pesticides and herbicides on the trees, shrubbery, and grass in public parks, gardens and forest to kill insects and weeds. DPW's may also use herbicides to control weed growth along roadways and municipal rights-of-way. Groundwater may become contaminated due to spills that occur when pesticide/herbicides are mixed and loaded into the application equipment.

BMP-RRSP
 BMP-RSMP
 BMP-RSSF

DPW and Highway Department trucks may apply sand and sodium chloride (road salt) to de-ice roads during the winter months. Storage areas for road salt are a major threat to groundwater quality if the salt pile is not completely covered and resting on an impermeable surface. Sodium is very soluble in water and highly mobile. With the addition of precipitation, salt from uncovered piles will leach into the soil and groundwater.



DE-ICING SALTS

Contamination Evidence:

- Salty taste in well water
- High chloride level in well water tests

Causes:

- Runoff from salt storage piles and highways

Prevention:

- Proper protection of salt storage piles
- Minimize use
- Use alternative de-icing materials

Figure 1.18 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

**SAND AND GRAVEL PITS:
 MINING/WASHING**

RES-FED 2

■ **Sand and Gravel Extraction** - The extraction of sand and gravel is the principal surface mining operation in Massachusetts. Generally, sand and gravel pits are located in permeable glacial outwash deposits that supply recharge to the groundwater system. The presence of water in these pits is usually a sign that they are hydraulically connected to the water table. In most cases these pits lack a significant soil and vegetative cover which acts as both a buffer and a filter to incoming contaminants. Exposed soil and

mineral resources are subject to wind and water erosion. Both surface and groundwater hydrology may be changed due to these land use changes.

Due to their permeability, location in aquifer recharge areas, proximity to the water table, and lack of soil cover, sand and gravel pits make groundwater especially vulnerable to contamination. These pits can act as large conduits to the groundwater system.

The use and storage of diesel fuel, motor oil, hydraulic fluid and solvents in these sensitive areas can result in groundwater contamination if spills/leaks occur or if the spent products are disposed of improperly. Contamination can also occur during the normal maintenance of heavy equipment or during refueling.

■ **Abandoned Pits** - Another major threat to groundwater quality is from the unregulated dumping or disposal of wastes in abandoned excavation pits. A wide variety of materials have been found in abandoned pits including junked automobiles, tires, garbage, salt-laden snow, used motor oil, septage, and other liquid wastes. Leachate from the wastes can easily percolate down through the remaining soil, sand and gravel layers into the groundwater system.

BMP-LSM
BMP-E-SCS
BMP-CAP

BMP-WSCB
BMP-WSPZ

RES-STATE45

RES-STATE 11

INACTIVE MINING SITES

Contamination Evidence:

- (Potential) Dumping of wastes in inactive mining pits

Causes:

- Rapid infiltration of contaminants due to loss of topsoil filtering capacity

Prevention:

- Close unused mining pits by restoring topsoil cover
- Vigilance against waste dumping in inactive mining pits

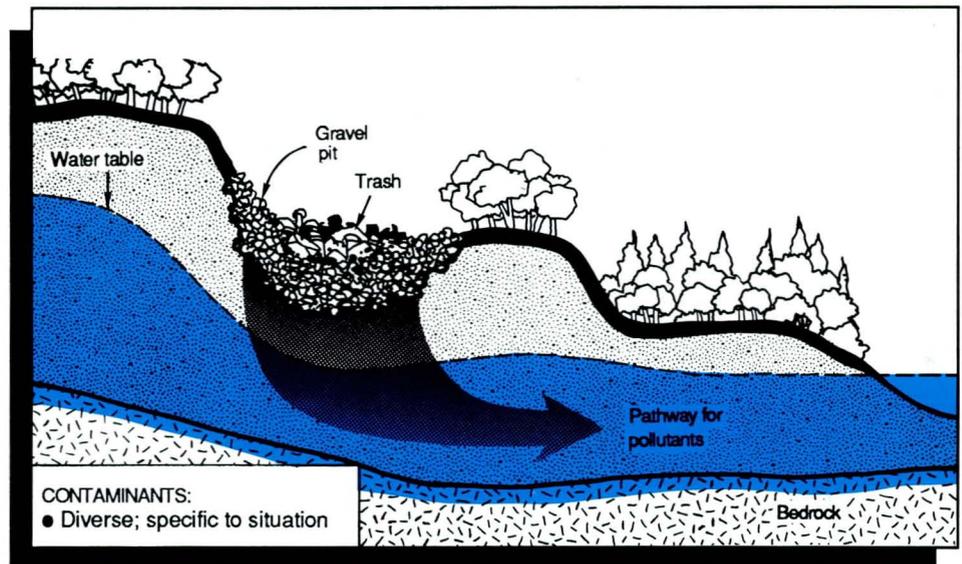


Figure 1.19 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

■ **Processing Facilities** - Sorting, washing, and other processes or storage of extracted and waste resources may contribute dusts and solids to nearby waterways.

UNDERGROUND STORAGE TANKS (USTs)

Underground storage tank systems (USTs) are used widely throughout the state to store a variety of materials including; gasoline and other fuels, heating oil, solvents, raw materials for processing, and hazardous wastes. Fuels, such as gasoline, diesel fuel and heating oil are by far the most common materials stored in USTs. These tank systems are used not only by business and industry, but by public and private institutions such as



municipal facilities, hospitals, schools, libraries, and private residences.

RES-STATE 44

There are approximately 32,000 registered USTs in Massachusetts and thousands of underground heating oil tanks. According to Massachusetts Department of Public Safety records, about 75% of all registered USTs are unprotected steel and vulnerable to corrosion. Recent surveys estimate that 10-35% of all USTs are leaking. The exact age, condition and location of many existing tanks are unknown, making it extremely difficult to predict or prevent leaks.

BMP-USTR

Many older USTs were designed and manufactured from bare carbon steel and have no protection against the corrosive action of the soil and water (the installation of bare steel tanks is now illegal). Corrosion of these bare steel tanks is by far the most serious cause of leaks threatening groundwater quality. Buried piping of above ground tanks can also pose a serious threat to groundwater, since it is also susceptible to corrosion. However, any UST system whether old or new, can pose a threat to the environment. UST leaks can result from defects in tank and piping materials, improper installation, mechanical failure of pipes and fittings, or improper maintenance, and any protected steel tank can corrode if the corrosion protection is not properly installed and/or maintained.

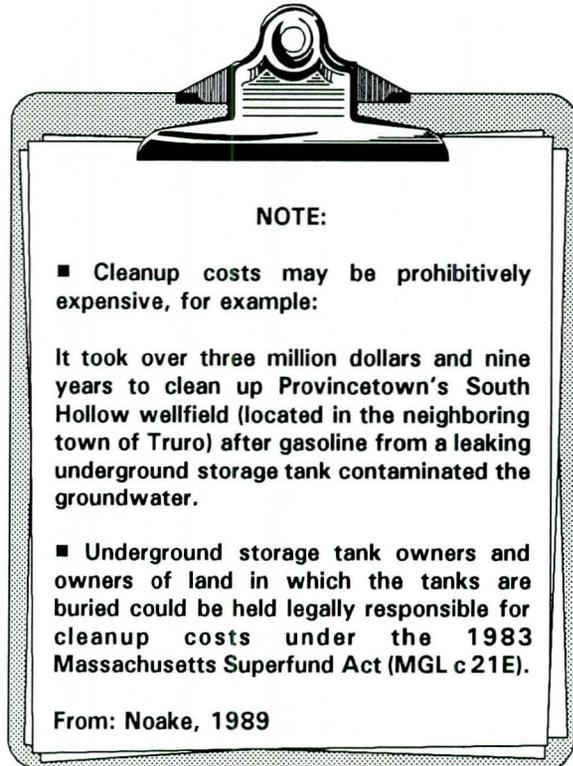
RES-STATE 45

Recent surveys of DEP files on confirmed hazardous waste disposal sites reveal that leaking underground storage tanks (LUSTs) are a major cause of soil and groundwater contamination in the Commonwealth. These surveys show that between 50 and 71 percent of all confirmed sites were caused by leaking underground storage tank systems. In addition, it is estimated that eight of every ten leaks from those USTs reached ground or surface water. Since 1960 when data collection started, releases of petroleum products from USTs and piping, or from spills and illegal disposals have contributed to the closure (temporary or permanent) of 15 public water supply wells and two public surface water supplies. These incidents account for 12% of all water supply contamination events during that time period.

RES-STATE 18

Tank systems nearest to wells and surface water supplies are a serious risk due to the short time of travel before contaminants reach the water supply. Many municipally owned USTs are at or near the wellhead, since water suppliers often use these USTs to store backup fuel for emergency generators. Several municipalities in Massachusetts have taken steps to remove these high risk tanks.

Fuel from a leaking underground storage tank can result in contaminated soil and groundwater that is especially difficult to clean up. Gasoline and fuel oil are not easily dissolved in water and are less dense than water so they float on the water table. However, several gasoline additives, such as benzene and toluene, are soluble and will



dissolve in the groundwater as the gasoline plume floats on the water table. When fuel from a leak or spill moves through the soil above the water table, the fuel coats the soil particles and leaves behind a residue of fuel trapped in the soil pores. As rain and melting snow percolate through the soil, the soluble components of the fuel will be flushed out. Once in solution, these highly mobile contaminants can move with the recharge water and enter the groundwater system.

UNDERGROUND STORAGE TANKS

Contamination Evidence:

- Petroleum odor in wells or basement
- Tank inventory losses
- Spills
- Detection of leaks

Causes:

- Corroded tanks
- Poor installation and/or maintenance
- No testing for tank leaks
- Poor inventory control
- No leak backup containment
- Deterioration of abandoned tanks

Prevention:

- Proper installation, maintenance, leak testing and inventory control
- Permit compliance
- Leak backup containment
- Removal of abandoned tanks or filling with inert material

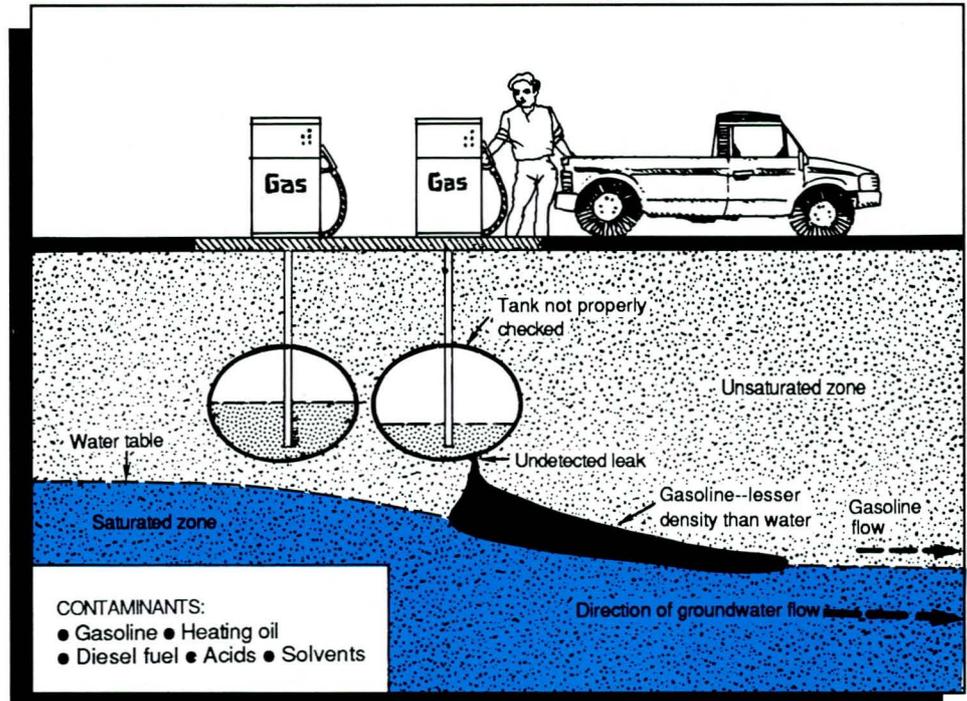


Figure 1.20 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

URBAN RUNOFF

Urban runoff accounts for approximately 50 percent of the nonpoint source pollution in Massachusetts. It is also a major cause of eutrophication and bacterial contamination to the waters of the Commonwealth. Urban runoff presents the greatest threat to both surface water and groundwater in Massachusetts (DWPC, 1989b).

Urban runoff is a by-product of development. Most all urban areas and roadways are constructed with drains to prevent flooding. Historically stormwater management simply meant flood control. Flood control measures, designed to move large quantities of water from an area, or control velocity, often do not protect water quality. These drains usually empty into the closest stream, brook, lake or other waterway. When it rains all of the accumulated pollutants get carried directly into the waterway. Urban runoff is not confined to cities and shopping malls. Even drainage from a small town with only one main street can have a significant impact on a local waterway.

The quality of the runoff water is reflective of the land use activities in the contributing watershed. All of the land uses described in this chapter may contribute to the quality of runoff measured at some point downstream from the activity. **Urban runoff is the most widely diverse and most influential of all the established EPA nonpoint source pollution categories.**

RES-STATE 46
RES-FED 2
RES-FED 8

BMP - See
Urban Runoff
BMPs



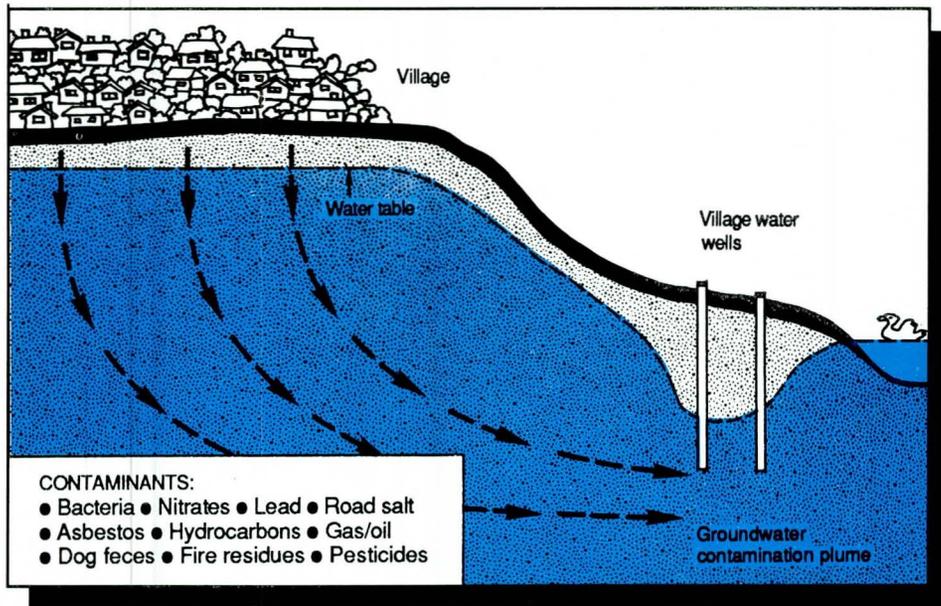


Figure 1.21 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

URBAN RUNOFF

Contamination Evidence:

- Detection of chemicals, metals, nitrate, petroleum, etc. in well water

Causes:

- Spills
- Random waste disposal
- Abandoned commercial/industrial sites
- Motor vehicle emissions
- Fires
- Pet Waste

Prevention:

- Provide public information/education
- Sweep streets
- Enforce anti-dumping codes
- Construct vegetated collection and infiltration basins for street runoff
- Clean up abandoned commercial/industrial sites

Urban runoff moves contaminants from a source area to a deposition area. Sources include roads, parking lots, turf areas, roofs, and storage and disposal facilities for industrial, commercial and domestic wastes. Deposition areas may be a long distance away from the source of the pollutant. Some of the contaminants associated with urban runoff are bacteria, nutrients, lead, road salt, asbestos, petroleum products, solvents, fire residues, pesticides, fertilizers, and many more depending upon the land use in the contributing watershed.

In rural or undeveloped areas, most of the precipitation infiltrates into the soil and supplies recharge water to the aquifer, thereby reducing the volume of runoff and rate of overland flow. In urban areas, however, two factors influence the volume and rate of flow of stormwater runoff:

- 1) The amount of impervious (paved or otherwise covered) surface area;
- 2) The stormwater control features.

An increase in impervious surface area reduces the amount of infiltrating water to the aquifer (recharge) and increases the volume of surface runoff.

RES-STATE 18
BMP-ISL

RES-STATE46
RES-FED 8

The EPA is now defining stormwater that is conveyed through any type of drainage system including pipes, ditches, trenches and swales as point sources of pollution. Certain industrial facilities, construction sites over 5 acres, and large municipalities (over 100,000) are now required to obtain a NPDES Permit (National Pollutant Discharge Elimination System) for their stormwater discharges. These permits require that each site has a Pollution Control Plan that contains appropriate BMPs to control stormwater

and protect receiving water quality. For more information about the Stormwater Permit Program contact the U.S. EPA, Region I or the Massachusetts DEP, Office of Watershed Management in North Grafton.

RES-FED 8
RES-STATE 46

TYPES OF STORMWATER CONTROLS AND POTENTIAL WATER QUALITY IMPACTS:

■ **Stormwater Sewers** - Street drains receive runoff from the land, building roofs, pavement, and through infiltration from groundwater. Street catch basins are often receptacles of accidental and illegal dumping of wastes, including waste oils. Storm drains are a potential conduit for nearly any type of natural or society-generated pollutant. Past practices of locating drain outlets at ponds, streams, wetlands, and estuaries have resulted in direct contamination and degradation of these water bodies (Morehouse, 1988).

BMP-RRSP
BMP-RSMP

■ **Catch Basins and Retention Ponds** - A **catch basin** is a settling chamber installed in a storm drain to retain heavy debris such as dirt, leaves and other refuse (called sump sediment). Catch basins may be connected to pipes that discharge the stormwater runoff to streams or other surface water bodies. In a **leaching catch basin** there is no outlet pipe and the water percolates through the sump sediments and drains from the catch basin by infiltrating the underlying soils.

BMP-IB

BMP-IT

Without routine maintenance, catch basins can increase the concentration of contaminants in stormwater. Sump sediment that is not removed on a regular basis is churned up and resuspended when stormwater enters the catch basin. Contaminants in the sediments are carried with the turbid stormwater as it flows through the outlet pipe and into a surface water system. Stormwater flowing into leaching catch basins that have not been properly maintained will percolate down through a thick layer of sump sediments. Contaminants in the sediments are leached out and carried with the water as it infiltrates the underlying soils.

BMP-SC

■ **Retention Basins** reduce the velocity of stormwater runoff by holding and releasing water at a controlled rate. When stormwater enters the retention basin, sediment settles to the bottom while oil and grease rise to the top. Retention basins gradually discharge accumulated water through the underlying soils. Some basins are equipped with overflow systems that discharge excess water to the surface water bodies. Like sump sediments in catch basins, settled sediments in retention ponds must be periodically removed; otherwise, incoming stormwater churns up the accumulated sediments and additional contaminants are released to the water that infiltrates the underlying soil.

BMP-RP

In heavily developed areas, leaching catch basins and retention basins do not effectively treat stormwater before discharging it to the soils. The soil has a limited capacity to attenuate heavy metals and filter bacteria and pathogens. Runoff that contains mobile contaminants such as sodium, chloride, nitrogen, solvents, and gasoline passes through leaching catch basins and retention basins relatively untreated. Although these stormwater collection systems were designed to provide recharge water to the groundwater system, leaching catch basins and retention basins generally do not provide adequate treatment of discharge water and can be a serious threat to groundwater quality.



VEHICULAR SERVICES

Automotive service stations, body shops, fuel stations, automotive dealerships, and rustproofing operations are included in this category.

RES-STATE 44
RES-STATE 18
RES-STATE 17
BMP-UIC
BMP-USTR
BMP-WSPZ
RES-STATE 45

The most common waste products generated by vehicular service operations are waste oil, fuel, antifreeze, solvents, used filters and batteries. Groundwater contamination results from the improper storage and disposal of products, careless/accidental spills, leaks and the release of wastes to floor drains. Vehicular service operations normally have underground storage tanks for fuel and oil. These tanks and their pipes are a threat to groundwater quality if they are leaking and a potential threat if they are old, rusty or improperly installed.

WELLS (MA Audubon, 1985)

RES-FED 6
RES-STATE 18

Contaminants can enter a well from the same land area (**natural recharge area**) that supplies the well with water. If contaminated groundwater enters the **area of influence**,

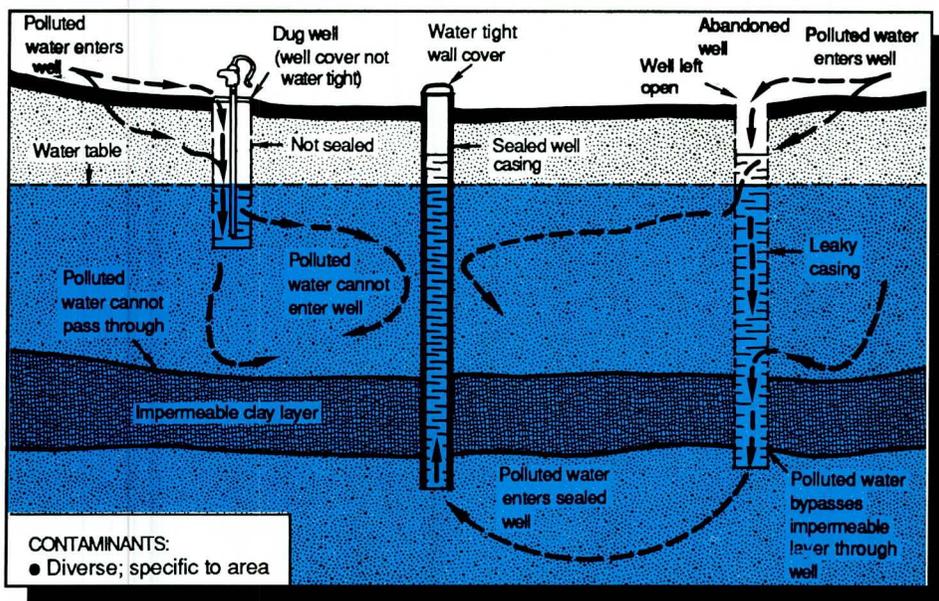


Figure 1.22 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

or its upland recharge areas, the contamination will eventually reach the pumping well. Likewise, if the area of influence expands due to overpumping or a reduction in precipitation, contaminated groundwater within the expanded area of influence will also be pulled toward the well. The contamination will reach the well if the pump continues to draw water from the expanded area of influence. Often, the area of influence contracts again, especially after heavy rains. If this occurs, the contaminated groundwater may never reach the well. Instead, the natural groundwater flow pattern will prevail once more and contaminants may flow toward the natural discharge area instead of toward the well. To

WELLS

Wells are potential pathways for contaminants to enter groundwater

Contamination Evidence:

- Detection of high bacteria levels in well water
- Well water turbidity
- Detection of other contaminants in well water

Causes:

- No well casing or leaky casing
- Well cover not watertight
- Open abandoned wells
- Groundwater movement from contaminated wells

Prevention:

- Watertight well cover
- Tight well casing
- Tight plumbing connections
- Identify and seal open abandoned wells

prevent contamination of the well, the area of influence and upland recharge areas should be identified and protected.

BMP-WLB
BMP-WSPZ

If surface water from ponds, lakes and rivers is being pulled into the well via **induced recharge**, a pollutant that enters the body of water upstream of the well is a potential source of contamination. Runoff from golf courses, parking lots, farms, wastewater discharge from industry, and leachate from septic systems are examples of potential pollution sources.

Contaminants can also enter a well by way of **stream infiltration**. Water from adjacent surface water sources can enter the well if pumping lowers the water table to an elevation lower than the adjacent surface water. Polluted surface water travels through the soil to the depression cone and directly into the well. The types of pollutants will vary according to the pollutants in the stream but will have a tendency to reflect highly soluble pollutants such as nitrate-nitrogen.

RES-STATE 37

STREAM INFILTRATION

Contamination Evidence:

- Odors in well water
- Other changes in well water quality
- Detection of excessive bacteria, chemicals in well water tests

Causes:

- Polluted stream or lake water enters well

Prevention:

- Locate well away from stream or lake
- Test well water regularly for potential contaminants
- Change to public water supply if feasible

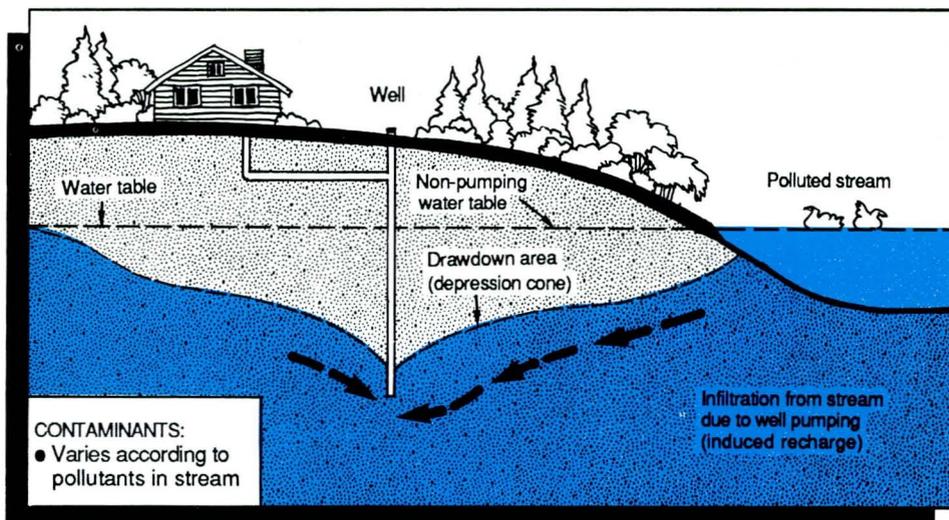
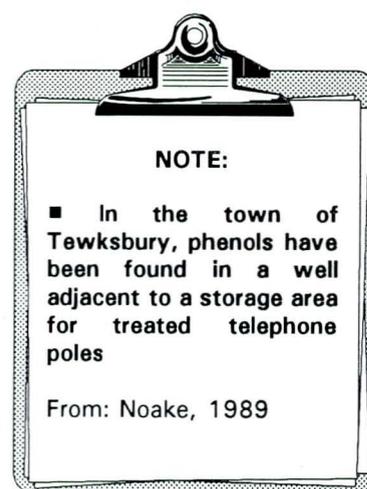


Figure 1.23 - Reprinted, in part, from "Groundwater Contamination", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

WOOD PRESERVING

Wood used in the construction of outdoor decks, fences, boats, pilings, docks and telephone poles is treated to make it water resistant and to protect it from the damaging effects of termites and other insects. A typical wood preserving operation uses any of the following processes to treat and condition raw wood and lumber: steaming, kiln, or air drying. The principal wood preserving agents used in these processes are phenols, such as creosote and pentachlorophenol (PCP), and two compounds that contain heavy metals: chromated copper arsenate (CCA) and ammoniacal copper arsenate (ACA). If areas where these activities take place are poorly sited and/or are exposed to direct precipitation or runoff, contamination of groundwater and surface



water is possible.

Figure 1.24 illustrates the magnitude of the impact from nonpoint source pollution from the major land use activities on Massachusetts rivers, lakes, and coastal areas, respectively (DWPC, 1989b). The greatest nonpoint source pollution threat to lakes is from urban runoff (45%) and land disposal; mostly septic system failures (40%). Nonpoint source pollution in rivers is predominately from urban runoff (49%). Salt water nonpoint source pollution problems originate mostly from urban runoff (48%) and marinas/boats (35%).

NONPOINT SOURCE POLLUTION PERCENT OF LAND USE IMPACT ON MASSACHUSETTS SURFACE WATERS

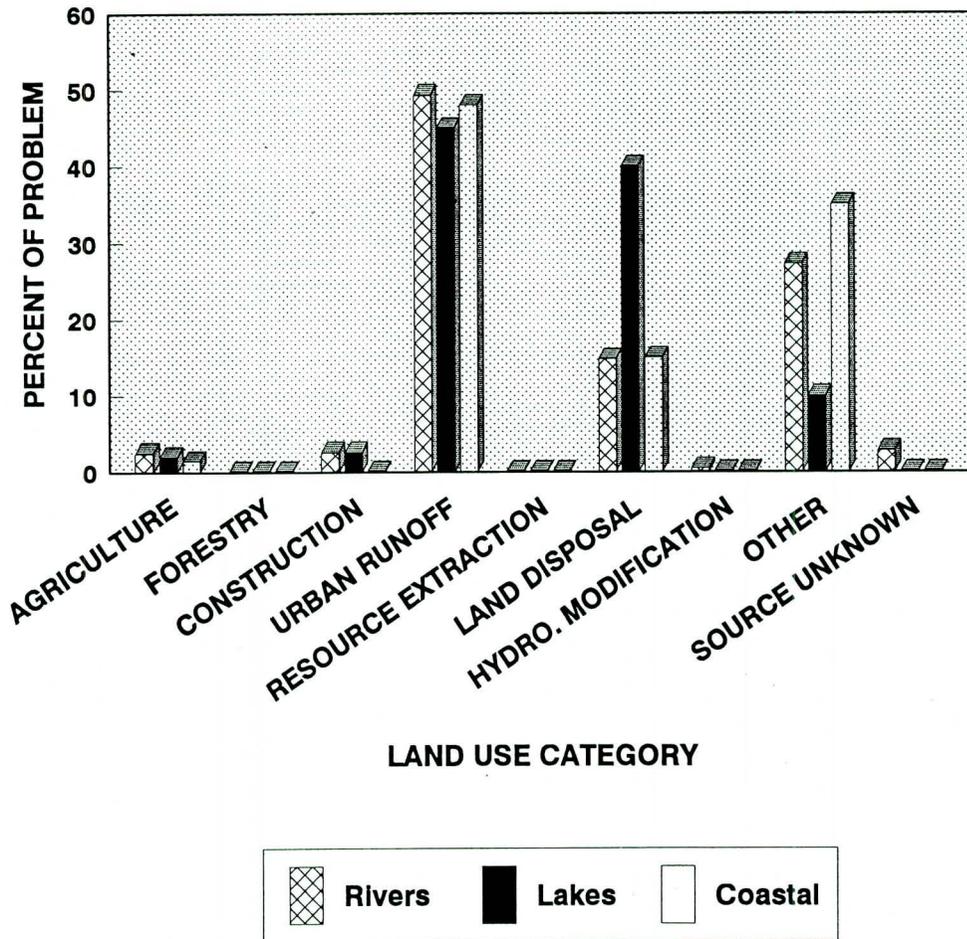
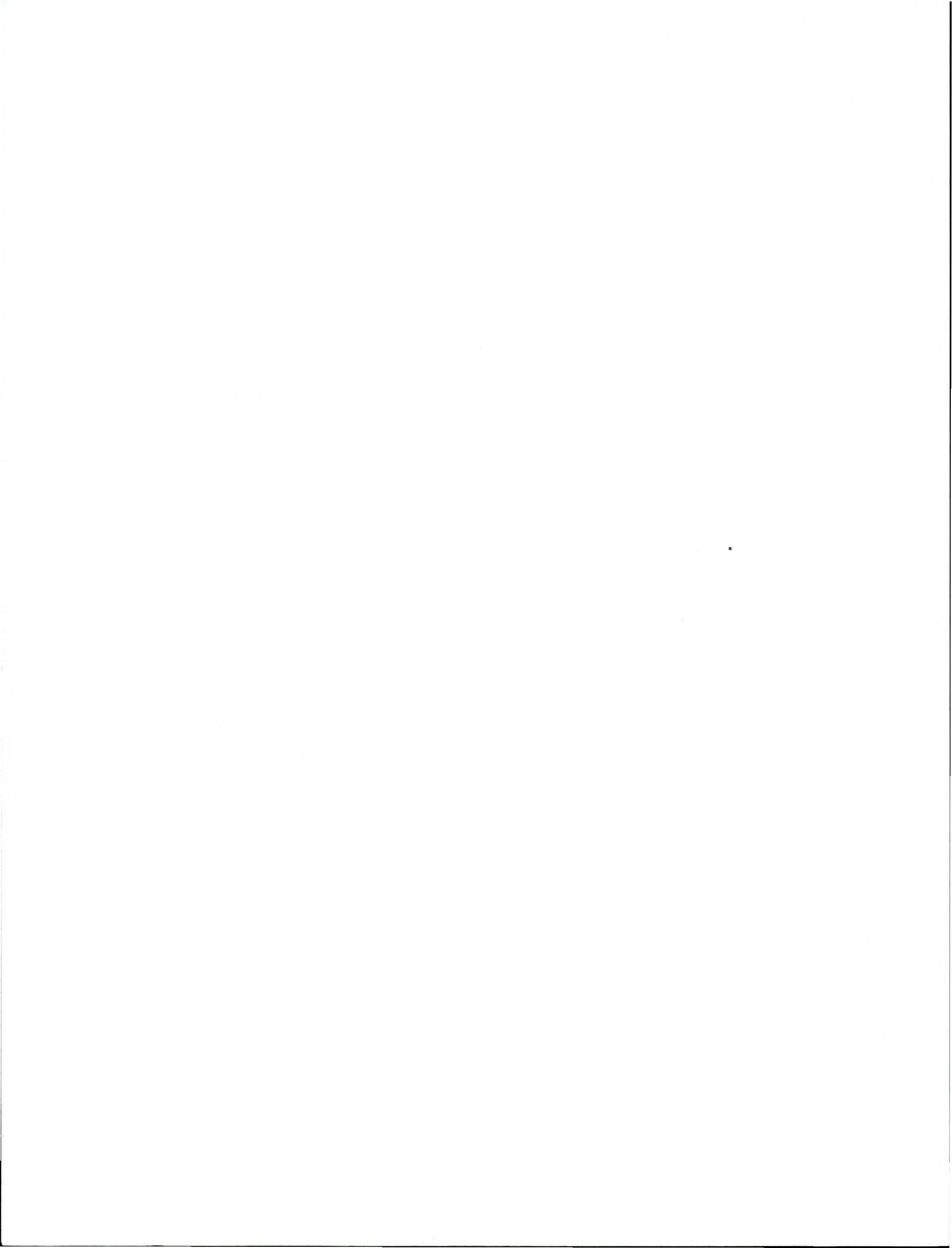
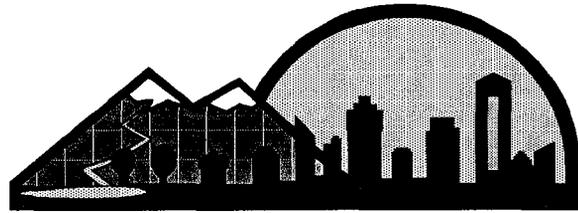


Figure 1.24 - Nonpoint Source Pollution Percent of Land Use Impact on Massachusetts Surface Waters





CHAPTER 2



A NONPOINT SOURCE MANAGEMENT PLAN FOR YOUR COMMUNITY

This chapter presents guidelines for designing and implementing a nonpoint source pollution management plan. The goal of a nonpoint source management plan is to: 1) establish a database for the community; 2) maintain existing water quality (surface water or groundwater); 3) improve impaired water quality; 4) provide a process for identifying appropriate and effective best management practices; 5) optimize chances of receiving federal and state funding to implement these goals.

A community's nonpoint source pollution control effort should be coordinated and directed to focus resources on clearly specified, realistic goals and objectives.

Focusing a community's resources, or "targeting", is recommended as a means of optimizing the visible water quality improvement, thereby generating public support and participation for water quality protection programs. Ideally, the community management plan should target priority areas in coordination with state goals (DWPC, 1989b).

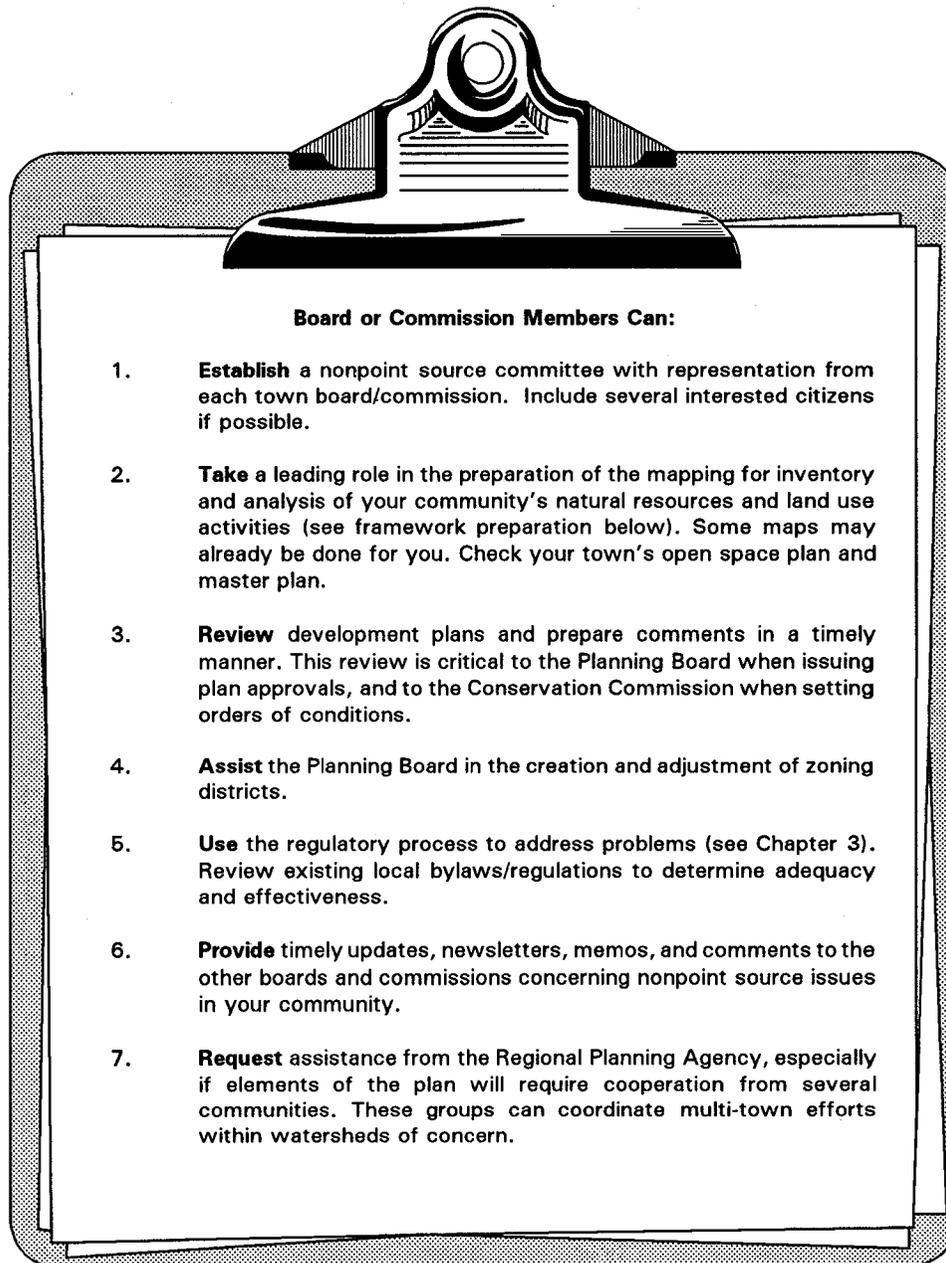
WHAT IS A COMMUNITY NONPOINT SOURCE MANAGEMENT PLAN? (Zoto, 1990)

A community **Nonpoint Source Management Plan** is a voluntary intramunicipal approach (involving Board of Selectmen/Mayor, Board of Health, Conservation Commission, Planning Board, Zoning Board of Appeals, etc.) to protect surface water and groundwater. It is designed to protect the natural resources of a community and is tailored to address the number and type of land uses that act as potential threats. Communities can use their nonpoint source management plan as a blueprint to initiate and direct actions that protect and manage water resources and related land uses. The plan can also be used to bring attention to the need for state financial, technical, or planning assistance. The ultimate goal is to prevent nonpoint source pollution from occurring. Without exception, pollution prevention and source reduction are more effective and less costly than remediating an existing problem.

The steps taken to implement a nonpoint source management plan will vary among communities, depending upon the resources to be protected. Strategies for protecting natural resources should be flexible to allow for modification and improvement to ensure that the most effective best management practices are employed. Upon request, the Nonpoint Source Section of the DEP will review your plan, noting areas of concern as well as directing communities toward informational sources and/or other resources.

WHAT ROLE CAN LOCAL BOARDS OR COMMISSIONS PLAY?

Strategies used by cities and towns for nonpoint source pollution protection will depend on financial resources, geology, and land use characteristics.



STEPS FOR PREPARING A NONPOINT SOURCE MANAGEMENT PLAN:

1. Construct a base map of your community to provide boundaries for your plan and to create a foundation layer for various overlay maps.
2. Be familiar with the existing natural resources within your community.
3. Be familiar with the land uses within your community.
4. Be familiar with various zoning districts and land use classification categories within your community.
5. Identify and prioritize your "critical natural resource areas".
6. Delineate the watershed boundaries for your prioritized list of critical areas on a separate set of overlays.
7. Show all land uses and likely sources of pollution that fall within the delineated watershed for the critical resource in question.
8. Develop a water quality sampling program.
9. Identify "Best Management Practices" for the existing and planned land use activities within the critical resource watershed.
10. Analyze your data and build your "Nonpoint Source Management Plan".

The following section explains steps 1 through 10 above. Refer to maps 1 through 12 at the end of this chapter for examples of the overlay maps. The steps taken to prepare a nonpoint source management plan will vary among communities, and will depend on the resources to be protected. A comprehensive framework is presented here, but not all of the steps or overlays may be necessary to complete for your community.

■ **STEP 1. Construct a base map of your community to provide boundaries for your plan and to create a foundation layer for various overlay maps.**

This step is simple, but important. This map should contain basic information that will appear on all the finished maps of a nonpoint source management plan, such as: boundaries that define the area, selected orientational features, and landmarks within the boundaries. It is recommended that you start with the USGS topographic map to prepare the community base map as these maps already illustrate roads, developed areas, rivers, lakes, streams, and large wetlands.

The map should be at a useful scale; too small a scale will cause the map to be cluttered and difficult to read; too large a scale will create a large, cumbersome map. One common practice is to use the same scale map as the USGS topographic sheets (1":25,000'). If the USGS sheet is chosen, then a plastic or mylar overlay sheet should be prepared from the topographic map that shows only the town boundaries and the road system. USGS quadrangles can be obtained from area bookstores or sporting goods stores, or by contacting the following addresses:



U.S. Geological Survey
Federal Center
Box 25286
Denver, Colorado 80225
(303) 236-7477

Cartographic Services
102D Hasbrouck Lab
Univ. of Massachusetts
Amherst, MA 01003
(413) 545-0359

■ **STEP 2. Be familiar with the existing natural resources within your community.**

This step requires the preparation of a series of up to seven mylar overlays (to go over the base map) that illustrate the soil and water resources in your community. Remember, it may not be necessary to prepare all of these maps, depending on the resources and goals of your community. Evaluate each of the overlay topics, and decide if it is appropriate to illustrate them.

The **first overlay** (Map 1) illustrates the areas in your community with **land slopes** in the following ranges:

- 0-8% - Flat to Moderate
- 8-15% - Moderate to Steep
- 15-25% - Steep
- >25% - Very Steep

Each range should be shaded with a different color so that areas of similar slope can be distinguished. The greater the slope the greater the potential for:

- erosion from construction
- failure of septic systems
- increased urban runoff

Slope data can be obtained through the U.S. Department of Agriculture, Soil Conservation Service Soil Survey. Most towns in Massachusetts have a completed soil survey which can be obtained at the local SCS office or Soil Conservation District Office servicing your county. Slopes can also be interpreted from the USGS topographic sheets.

The **second overlay** (Map 2) illustrates the **surface geology** of your community. This overlay should include:

- Sand and gravel deposits
- Swamp deposits
- Glacial till
- Bedrock

Each category should be shaded with a different color to distinguish between areas of dissimilar surface geology. Areas of sand and gravel deposits are superior for construction, provide a good base for driveways and parking lots, act as a filtration system for on-site septic systems, and are recharge areas for drinking water wells. Sources for this data include the local soil survey obtained through the Soil Conservation



Service, U. S. Geological Survey (USGS), and/or local Soil and Water Conservation Districts.

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The **third overlay** (Map 3) illustrates the **surface water bodies** within your community, including:

<u>Waterbody</u>	<u>Data Source</u>
• Ponds and Lakes	USGS
• Brooks, Streams, Rivers	USGS
• Reservoirs (Public Water Supply)	Division of Water Supply (DWS)
• Estuarine and Coastal areas	USGS, Coastal Zone Management (CZM)

This overlay should also include additional information about particular surface water bodies such as:

<u>Information</u>	<u>Data Source</u>
• Classification of the water body, including Anti-Degradation waters.	Division of Water Pollution Control (DWPC), Office of Watershed Management (OWM)
• Shellfishing waters-closed and open	Division of Marine Fisheries, local shellfish warden, CZM
• Stocked trout fishing rivers and streams	Division of Fisheries and Wildlife.
• Ponds/lakes with known water quality problems	DWPC, Congress of Lake and Pond Associations, Conservation Commission, Watershed Associations
• Areas of Critical Environmental Concern (ACEC)	DWPC, DEM, CZM, Conservation Commission, MA Audubon

The **fourth overlay** (Map 4) illustrates the **groundwater resources** within your community. Groundwater should be defined and illustrated on the map in terms of potential yield to wells in gallons per minute (GPM):

- high - > 250 GPM
- medium - 50-250 GPM
- low - 5-50 GPM
- very Low - < 5 GPM

Each yield category should be shaded with a different color to distinguish various groundwater yields within the community. MassGIS can provide maps of areas that yield at least 100,000 gallons/day (70 GPM). Sources of this information include the USGS Hydrologic Atlas', U.S. Geological Survey, DEP- Division of Water Supply, and your

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community water department. The following characteristics should also be noted on this overlay:

<u>Characteristic</u>	<u>Data Source</u>
• public supply wells	DWS
• private wells	Local Board of Health or water department
• known problem areas/impairments from nonpoint sources, such as: road salt, illegal dumping, septic systems, chemical contamination, etc.	DWS, Board of Health, DWPC, OWM

Mapping major sources of groundwater within a watershed is useful because groundwater frequently serves as a source of surface water flow. A map of these aquifer areas can also be used to inform local Boards of Health, Planning Boards, Board of Appeals, Conservation Commissions, and Selectmen of those locations within the community that are highly vulnerable to groundwater contamination. Issuing permits for new land use activities within these areas should be limited to those activities that have minimal impact on groundwater quality. Land use activity within these sensitive areas may be tied directly to a Board of Health regulation (**MGL c. 111, § 31**) that requires specific "best management practices" for eliminating potential contamination.

The **fifth overlay** (Map 5) should illustrate **soils with moderate to severe septic system limitations** in your community. These limitations are due to the following characteristics:

- High water table
- Slow percolation rate
- Shallow depth to bedrock
- Slope

Each area subject to potential subsurface disposal problems should be shaded with a different color to represent the appropriate characteristic. It is important to note that these limitations indicate "potential" only, and are not to take the place of a certified "deep hole observation" or "percolation" test as required by the State Environmental Code, **Title 5**. It is, however, very important when preparing a nonpoint source management plan, to be aware of areas in the community that have a high potential for surface water and groundwater contamination due to failure of on-site septic systems. Sources for this information include the SCS soil survey for your town or county.

The **sixth overlay** (Map 6) illustrates **soils with moderate to severe erosion potential** within your community. The erosion potential of soils is classified as follows:

- High potential
- Medium potential
- Low potential

Each category should be shaded with a different color to distinguish dissimilar areas of erosion potential. This information can be referenced when requiring sediment and

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erosion control features as part of the home owner's or developer's plan submittal. The data for this overlay can be obtained from the Soil Conservation Service soil survey for your community. Technical assistance for determining erosion potential can be obtained directly from the Soil Conservation District office nearest your community.

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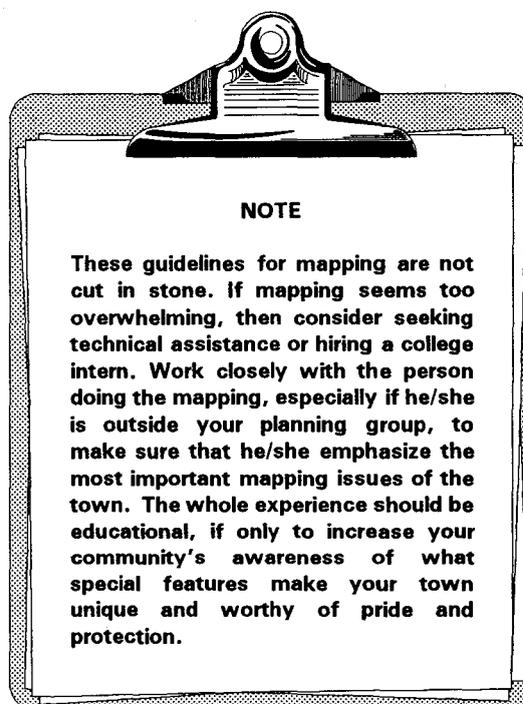
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The seventh overlay (Map 7) illustrates **wetland areas** within your community. This overlay should include:

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- Wetland areas that exist adjacent to ponds and lakes
- Wetland areas that exist adjacent to streams and rivers
- Coastal and estuarine wetlands
- Isolated wetlands
- Certified vernal pools
- Restricted wetlands
- ACECs

Interpretation of wetland areas often varies between communities. To avoid misunderstandings, communities should adopt a policy that clearly expresses the definition of wetlands and their extent. Sources to contact for this information include the Soil Conservation Service-soil survey, U.S. Fish and Wildlife Service-national wetlands inventory, DEP-Division of Wetlands and Waterways-Conservancy Program, and your local Conservation Commission.



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MassGIS maps are also available to assist in the delineation of wetland areas. These maps will, however, only provide approximate boundaries of wetland resource areas. The extent of the resource area under the jurisdiction of the Conservation Commission is frequently much larger than indicated by these maps. The exact boundaries of resource areas under the jurisdiction of the Wetlands Protection Act (**MGL c. 131, § 40**) can be determined using the definitions for each area provided in the Act's regulations (**310 CMR 10.00**).

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■ **STEP 3. Be Familiar With The Land Uses Within Your Community.**

Identify the various land uses within your community and list the potential nonpoint source pollution problems associated with each. As this information is compiled, note areas where urban runoff is likely. Urban runoff, the main nonpoint source of pollution in Massachusetts, is associated with all developed land uses, but it is most prevalent in more intensely developed areas such as transportation corridors, commercial, industrial, and dense residential areas. New construction activity, especially in areas with highly erodible soils, can also degrade the quality of runoff and pose a threat to water quality.

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The **eighth overlay** (Map 8) illustrates all existing and planned **land uses** within your community. Land-uses should be categorized and mapped as follows:

- Agricultural and Open Lands
- Forest Lands
- Sand and Gravel Operations
- Waste Disposal Areas
- Urban Land (residential, commercial industrial)
- Outdoor and Recreational Facilities

Agricultural land, forest, and sand and gravel operations should be shaded with different colors since they usually occupy large areas of land. Other land uses can also be shaded or coded using a map legend. Some of the resources for obtaining land use data include the MacConnell land use maps - compiled from aerial photographs (available from the University of Massachusetts), USGS topographic sheets, town assessors' maps, planning board maps, and regional planning agencies.

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The **ninth overlay** (Map 9) contains land use activities within the community that are considered major **potential sources of contamination**. For example, this overlay should include the following types of activities:

- Highway drainage discharges
- Salt storage sheds
- Underground storage tanks
- Landfills and dumps
- Hazardous waste generators (DEP registered)
- Hazardous waste sites (DEP registered)
- Marinas/Boat maintenance areas
- Groundwater and surface water discharges
- Gas stations
- Snow dumping areas
- Junkyards
- Sewer lines
- Utility easements

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Map the locations of activities using symbols that are keyed to a legend. Best management practices to address potential pollution problems associated with each activity may also be shown on this overlay using descriptive symbols.

Many of the activities listed above are subject to permitting/ licensing in Massachusetts. For help in identifying and locating these activities in your community ask the Massachusetts Office of Watershed Management (DEP) or the U.S. Environmental Protection Agency (EPA) for a list of permits and licenses that they have issued for your town/city. The DEP is also developing a facility master file that will contain all DEP permits for a given facility, both industrial and non-industrial. This resource is expected to be available in 2-3 years. Activities that are operating without required permits and/or licenses may also be discovered in this way.

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The following list presents some of the permits and licenses required in Massachusetts for activities posing a pollution risk. Contact the appropriate agency to obtain information about sites in your community.

- Surface water discharge permits
(DEP Regulation 314 CMR 3.00)
The discharge of process and waste water to the surface water system is controlled by the EPA in Massachusetts through the National Pollution Discharge Elimination System (NPDES). Information can be obtained by calling the Permits Processing Section at EPA Region I at (617) 565-3543.
- Groundwater Discharge Permits
(DEP Regulation: 314 CMR 5.00)
These DEP permits are for all industrial discharges to groundwater and for all large-scale wastewater discharges to groundwater that exceed 15,000 gallons/day. Information about discharges directly to groundwater can be obtained by calling DEP-Division of Water Pollution Control (617) 292-5663.
- Hazardous materials and waste facilities permits
(DEP Regulation: 310 CMR 30.00)
A request for information on large and small quantity generators should be made directly to EPA Region I, Freedom of Information Office (617) 565-3187.
- Chemical identity and quantity permits on wastes at RCRA facilities
(DEP Regulation 310 CMR 30.00)
Under the Resources Conservation and Recovery Act (RCRA), EPA issues permits for both large and small quantity generators. Communities can request a listing of the RCRA permits along with information on the chemicals and wastes used, stored, generated, treated, and disposed at these permitted locations. For information call the RCRA and Superfund Hotline at 1-800-424-9346.
- Local Board of Health and DEP-Division of Solid Waste Site Assignments/Permits
The location of information on existing solid-waste facilities within a community can be obtained directly from DEP's Division of Solid Waste. Solid waste facilities include refuse treatment & disposal locations, sludge disposal areas, vehicle junkyards, refuse incinerators, and bulky-waste dumps (tires, brush, stumps, demolition debris, and household white goods). Information on these locations can be obtained from the Division of Solid Waste, (617) 292-5960.

In addition to the resources listed above, sources of the information may include: town fire dept.- charged with approving installation of underground storage tanks; town/state DPW; town or regional sewer department; town assessors' maps; Massachusetts Division of Marine Fisheries; and Coastal Zone Management.

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■ **STEP 4. Be Familiar With Various Zoning Districts and Land Use Classification Categories Within Your Community.**

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The **tenth overlay** (Map 10) illustrates the current **zoning districts** within your community. Zoning determines the type and intensity of development which may occur now and in the future within defined districts. Zoning is a powerful tool that can be used to ensure the long-term protection of water resources. Once a management plan has been formulated, zoning can be used to define critical resource areas and restrict future land uses within them. Consult your local planning board or commission for zoning maps.

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The **eleventh overlay** (Map 11) shows existing special areas of **protected land** within your community. This overlay may include:

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- Conservation restricted land
- Municipally owned land (schools, town buildings, etc.)
- Town forest and parks
- Agricultural restricted lands
- State land
- Federal land

Sources for this material include the assessors' maps and your local Planning Board.

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The **twelfth overlay** (Map 12) depicts areas of **flood plain delineation and zoning** within your community. Typically, as the most desirable building locations in a community are used up, development spreads into the hills or begins to encroach into the floodplains. Frequency of flooding and precise flood elevations must be known for floodplains to ensure proper planning and growth management. It is also important to understand that as an area develops, the amount and rate of runoff increases, thereby increasing the flood elevation and extent of flooding. The elevations associated with the 100-year and 500-year storm events are the most common for delineating floodplains. One source of floodplain information is the Federal Emergency Management Agency Maps (FEMA) for 100- and 500-year flood plains. Most Conservation Commissions have these maps, or they can be obtained from FEMA directly or from the University of Massachusetts-Amherst, Cartographic Services.

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Geographic Information System (GIS):

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Computer produced maps, referred to as Geographic Information System (GIS) maps can be purchased by communities to assist in preparing the various overlays. These maps can be obtained from the Executive Office of Environmental Affairs (EOEA), Massachusetts Geographic Information System (MassGIS). MassGIS also provides quadrangle base maps for the entire state. MassGIS can also provide mylar overlay maps depicting many geologic, hydrologic and land-use features of the Commonwealth. MassGIS can create mylar overlays with the following information:

- Watershed boundaries
- Hydrologic features
- Surface water supplies and groundwater withdrawal locations
- Roads



- Highly erodible soils
- Political boundaries
- Open space areas
- MacConnell land-use information

Information generated in steps 1-4 above will serve as a data base for all your land use planning decisions. To optimize its usefulness:

- 1) **Keep the maps current.**
- 2) **Compare new/proposed development to all of the overlays. Determine whether this activity will/will not affect the area based on your data.**
- 3) **Adopt new bylaws/ordinances/regulations that are consistent with your data base and reflect the goals and objectives for the community.**

■ **STEP 5. Identify and Prioritize your "Critical Natural Resources Areas".**

Identify the natural resources that are important to your community. For example, aquifer recharge areas, such as wetlands, are critical if your drinking water supply is dependent upon groundwater. Ponds and lakes may be important to communities that value water based recreation, or if they are used for a surface drinking water supply. These decisions will be unique for each community and should be based on input from all of the municipal boards and commissions. These critical areas should be noted on the proper overlays.

Next, **prioritize** these critical areas and address high priority areas first. Your initial activities will determine public acceptance of the nonpoint source management plan and how it perceives nonpoint source pollution control in general. Choose a water quality improvement or protection goal that is going to produce the greatest amount of positive public reaction and support. Keep in mind that communities have limited funds, particularly when it comes to funding new, untested programs.

■ **STEP 6. Delineate the watershed boundaries for your prioritized list of critical areas on a separate set of overlays.**

Mapping watershed boundaries is most accurately accomplished using the USGS topographical maps. Briefly, this is accomplished by drawing a line between the ridge tops within the watershed resource area. It takes practice to delineate watershed boundary lines. Your community engineering department or your local Soil Conservation Service office can assist in this task. Many watershed boundaries have already been delineated, particularly for the major rivers and their tributaries (called river basins and sub-basins) and some lakes. For information about previously mapped watersheds contact the agencies listed in the adjacent margin.

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Delineate critical watersheds on one of the above overlays or on a separate set of overlays (one for each critical area). The watershed for your critical resource might extend into an adjacent community (or communities). It may require a cooperative inter-community effort to accomplish complete protection of a natural resource.

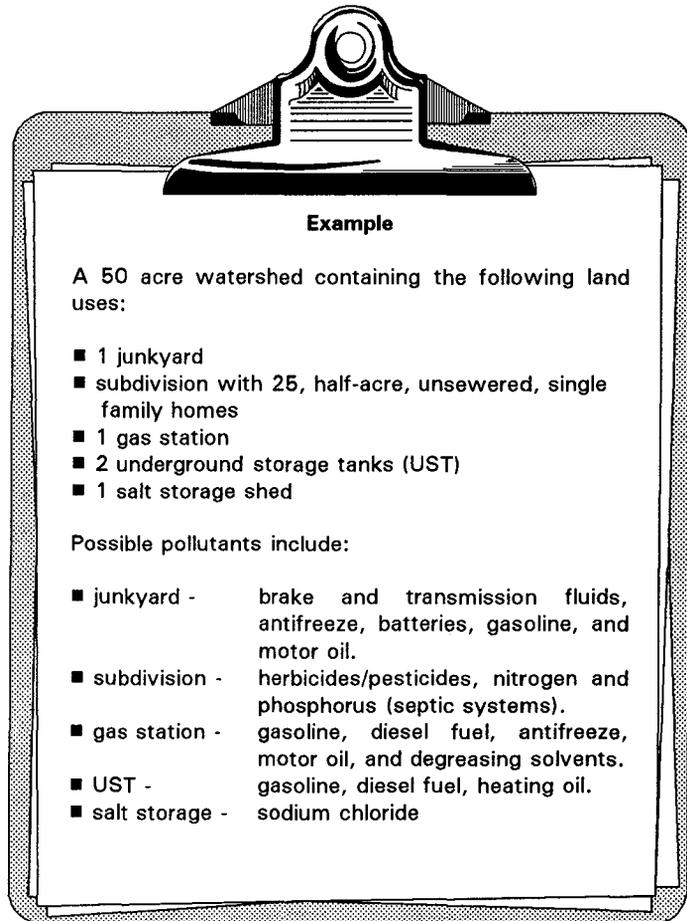
■ **STEP 7. Identify and map all land uses and potential sources of pollution that fall within the delineated watershed for the critical resource in question.**

Start by describing the watershed, referring to the overlays created in step 2. For example: " The watershed for this resource is comprised mainly of glacial till soils on moderately sloping land. The watershed can be characterized as having soils that do not erode easily but can be expected to have severe limitations for the installation of septic tank-leachfield systems."

Next, identify the various land uses that exist within the watershed of the critical resource by using the overlays from step 3. Use personal knowledge of the area as another source of information. Schedule a field trip to view the watershed and verify and/or update the land use map. Transfer this information onto the appropriate critical resource overlay map.

Show all potential sources of contamination on the overlay of the critical area. This information should also be field verified.

Describe the watershed in terms of the land uses occurring there and possible pollutants associated with them.



■ **STEP 8. Develop a Water Quality Sampling Program**

The best way to assess the impact of nonpoint source pollution on the water resources in your community is to implement a water quality sampling program. **It is strongly recommended that technical assistance be obtained before undertaking this step due to the high cost and the need to maximize benefits from the data obtained.**

Guidance on developing and implementing effective sampling plans is available from the Environmental Protection Agency (EPA), the Massachusetts DEP, Office of Watershed

Management and Division of Water Pollution Control, Massachusetts Division of Marine Fisheries, and the Massachusetts Division of Fisheries and Wildlife. There are also several citizen monitoring or "lay monitoring" programs in Massachusetts that can help groups organize a river or lake water quality monitoring effort, including the MDFWELE-Riverways Program and the Massachusetts Waterwatch Partnership.

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Use the prioritized critical resource list compiled in step 5 to begin developing your monitoring program. Focus monitoring resources on the top priority area(s) and design sampling programs for those rivers, streams, wetlands, lakes, etc. within the watershed boundaries of this area. Ultimately, the size and scope of the program will depend on economic resources and the number of committed participants.

Elements of a complete water quality sampling program include:

- 1) **Dry Weather Sampling** - Dry weather sampling programs establish baseline water quality conditions. In this way, continuous sources of pollutants can be isolated and their relative impacts determined.
- 2) **Wet Weather Sampling** - Wet weather sampling programs are conducted to examine the effect of storm water runoff. Sampling is usually conducted at the outlets of major storm drains, near drainage ditches, along areas of bank erosion, in sensitive receiving water areas such as shellfish beds, and in other areas where polluted runoff may occur. These programs, when done in conjunction with dry weather sampling, can document worse-case conditions and help in isolating sources of concentrated runoff from nonpoint sources such as storm drains and urban development.
- 3) **Best Management Practices (BMP) effectiveness** - To analyze the effectiveness of implemented BMP's, dry and wet weather samples are collected prior to and following BMP installation. By comparing the results of the pre and post implementation sampling, the actual pollutant removal effectiveness of the BMP can be determined.
- 4) **Long Term Water Quality Trends** - Sampling programs are conducted over extended periods of time to determine long-term pollution impacts.

Before sampling, a **water quality sampling plan** should be developed. Factors to consider when developing an effective water quality sampling plan include:

- establishing proper sampling locations;
- determining parameters of concern (i.e., flow, bacteria, nutrients, etc.);
- selecting the correct type of sampling program (dry weather, wet weather, BMP effectiveness, or long-term); and
- determining the number and frequency of samples to collect.



■ **STEP 9. Identify "Best Management Practices" for the existing and planned land use activities within the critical resource watershed.**

Best management practices should be selected to accomplish the water quality protection goals established in your management plan.

There are many agencies that can help you decide which best management practices to use for various land use activities. For instance, if you have farming activities within the boundaries of the critical area watershed, contact an agricultural agency, such as the Massachusetts Department of Food and Agriculture, Cooperative Extension, or the Soil Conservation Service. These types of agencies can provide you with the most updated information regarding practices that will best achieve your goals. Consult the DEP-Office of Watershed Management, Nonpoint Source Section for additional information about BMPs for all categories of nonpoint source pollution. The best management practice that is chosen should be described in narrative form for each area of need and should also be shown on the overlay map of "potential sources of contamination".

■ **STEP 10. Analyze Your Data and Develop a "Nonpoint Source Management Plan".**

Analyze the data you have collected and examine what actions you, as town/city officials, should undertake to reach your community objectives.

Utilizing the information you have gathered to formulate an action plan requires not only analysis but also judgement about priorities. One useful approach to analyzing data is to establish working committees made up of concerned citizens and key members of your local nonpoint source committee. If possible, involve the people that gathered the initial information. For a committee to take ownership of the project, it needs to be involved from the start. Request that each committee develop a recommended action plan for a specified nonpoint source pollution control goal. At the beginning, hold a joint meeting with all committees present so that everyone understands the overall nonpoint source management objectives and goals of the community. If there is general understanding initially, the individual committees will be more likely to come back with suggestions that the whole group of town/city officials will feel comfortable with.

EXAMPLE: Step 10 is demonstrated below using common nonpoint source problems found in many Massachusetts communities.

The overlay maps and data collected on a high priority resource area of your community show the following potential nonpoint source problems:

- In a pond designated as a primary recreation area for the town there is noticeable discoloration of the water and excessive weed growth. This body of water is also listed in the town master plan as a potential backup drinking water source. Several areas of sediment deposition in the upper reaches of the pond at the outlet to the pond's sole contributing tributary are also present.
- Upstream reaches of this tributary contain aquatic plant species indicative of high nutrient concentrations. There are no visible discharges, but there is a working farm nearby.

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- Within the watershed and adjacent to this tributary is a residential subdivision currently under construction.
- The DEP data obtained from the Division of Water Pollution Control note a history of complaints concerning the condition of the pond and indicate agricultural runoff into the main tributary may be impacting the pond.
- The land use map compiled by the nonpoint source management committee shows that there is also a town DPW garage/storage area and a golf course located within the watershed area of the pond.

The committee forms the following action plan:

1. **Verify** the identity of major pollution contributors (via DEP, field work, town or EPA records).
2. **Contact** the contributors to make them aware of the problem and request compliance. **Explain** what is expected for compliance. **Ask** for their voluntary cooperation and solicit their input for remedies to the problem. For example:
 - For a farm: Working with the farmer, contact one of the various farm assistance agencies. Most, if not all, farm operations have an agreement with at least one of these agencies: Soil Conservation Service, Agricultural Stabilization and Conservation Service, Cooperative Extension, Mass. Dept. of Food and Agriculture, or Conservation Districts. These agencies can assist the farmer in selecting and implementing the appropriate best management practices to mitigate agricultural runoff and address local concerns.
 - For DPW garage/road salt storage: Work with the Department of Public Works to reduce the amount of road salt used; change the sand/salt ratio; post the roads; consider a water resource buffer zone; cover exposed salt storage piles.
 - For a golf course: Request reductions in applications of fertilizer and pesticides as well as careful timing of applications that target pests and avoid high runoff events; suggest planting vegetative buffer strips near tributary drainage areas. Some of the same agencies that assist farmers, such as the Massachusetts Cooperative Extension (see above), could also provide BMP guidance to local officials and golf course operators.
 - For a construction site: Work with the developer to address problems of soil erosion and resulting sedimentation from the construction site. Review the Order of Conditions for the construction site and make provisions for enforcement. Modify the existing Order of Conditions, if necessary, to reflect the current environmental issue.
3. **Contact** all relevant public officials to alert them to the need for compliance (and lack thereof).
4. **Monitor** sources and regularly notify responsible parties of their compliance: "congratulations" for improvement or achieving compliance; expression of "regret

BMP-AMP
BMP-VTP
BMP-SP
RES-FED 2
RES-FED 1
RES-STATE 37
RES-STATE 19
RES-STATE 33

RES-STATE 41
RES-SPEC
PUR 21
BMP-RSSF
BMP-RRSP

BMP-AMP

RES-FED 2
RES-STATE 46
RES-STATE 17
BMP-E-SCS



and disappointment" for continuing non-compliance.

5. **Inform** the public of the lack of compliance, lack of enforcement, or progress being made using press coverage dramatizing water quality problems and public meetings.
6. **Explore** additional probable origins of nonpoint source pollution (DPW garage, golf course, farm activities).
7. **Request** assistance from appropriate agencies and organizations to address the current water quality problems in the pond. Work with the DEP-Division of Water Pollution Control, Watershed Associations, the Congress of Pond and Lake Associations, and/or "lay monitoring" groups to help formulate a pond restoration/preservation strategy.
8. **Develop** and launch a public information program designed to encourage homeowners and small business within the watershed (particularly those who live adjacent to the pond) to use the following best management practices:
 - reduce the use and disposal of hazardous household materials;
 - adopt a periodic clean-out/maintenance program for on-site septic systems near the pond (at least once per year);
 - apply lawn fertilizers/herbicides/pesticides sparingly, if at all (consult product label), get a soil analysis to determine needs, do not apply directly near pond (maintain buffer strips);
 - reduce activities that encourage shoreline erosion, such as: nearshore land clearing, powerful boat engines in sensitive areas, erodible shoreline pathways or boat accesses.
9. **Decide** if the town has the regulatory tools in place to enforce compliance if all else fails. If necessary, **adopt** regulatory approaches (bylaws, regulations, zoning) to prevent future nonpoint source pollution problems.

The following transparencies (maps 1 through 12) are examples of steps 1 through 4 above. They were prepared for the Massachusetts Water Resources Authority (MWRA) and Cambridge Water Board by the Metropolitan Area Planning Council (MAPC). The map overlays are part of a study entitled "Cambridge Reservoir Watershed Protection Plan" (MAPC, 1989).

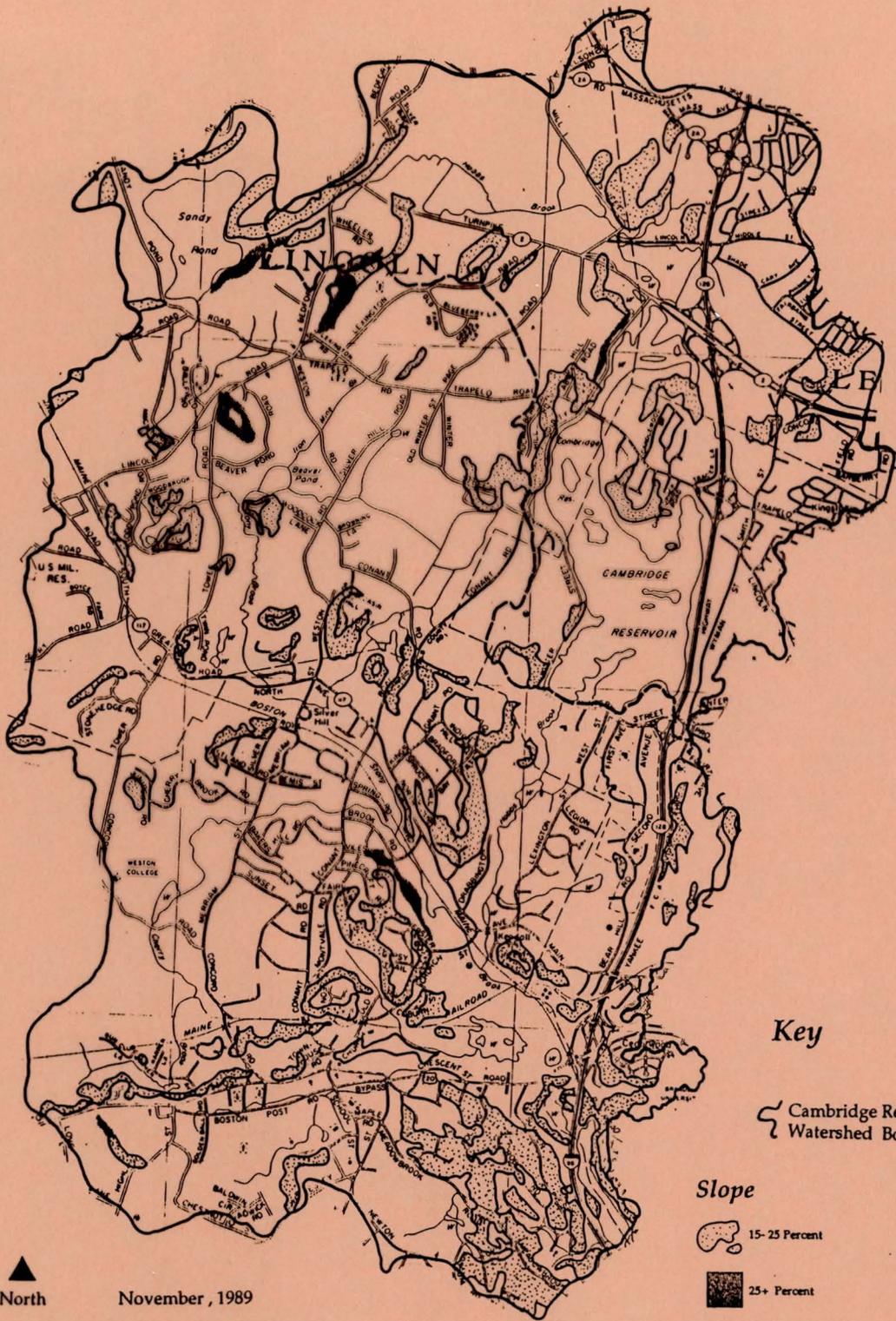
RES-STATE 17
RES-SPEC
PUR 16
RES-SPEC
PUR 30
RES-SPEC
PUR 9

BMP-PE

BMP-HMB

BMP-O-SDS
BMP-SSU

BMP-AMP



▲
North

November, 1989

Key
 Cambridge Reservoir Watershed Boundary

Slope
 15-25 Percent
 25+ Percent

Source: U. S. Department of Agriculture, Soil Conservation Service, Middlesex County Interim Soil Survey Report, July, 1966

Cambridge Reservoir Watershed Protection Plan

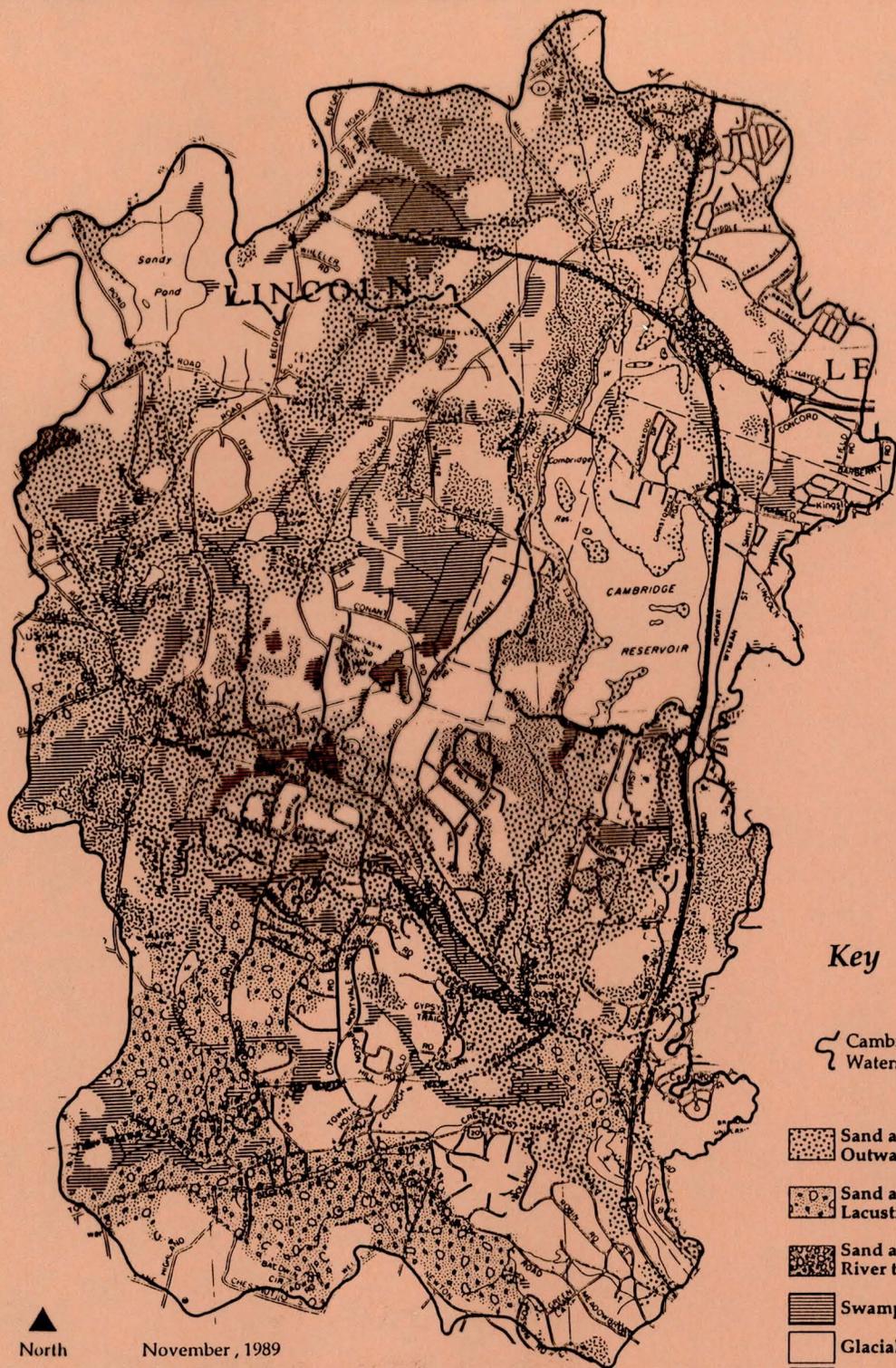
Map 1 : Slope



Prepared for:
 Massachusetts Water Resources Authority and Cambridge Water Board by:



Metropolitan Area Planning Council
 60 Temple Place
 Boston, MA 02111



Key

Cambridge Reservoir Watershed Boundary

Sand and Gravel Outwash Deposits

Sand and Gravel Lacustrine Deposits

Sand and Gravel River terrace Deposits

Swamp Deposits

Glacial Till

Bedrock Outcrops

▲ North
November, 1989

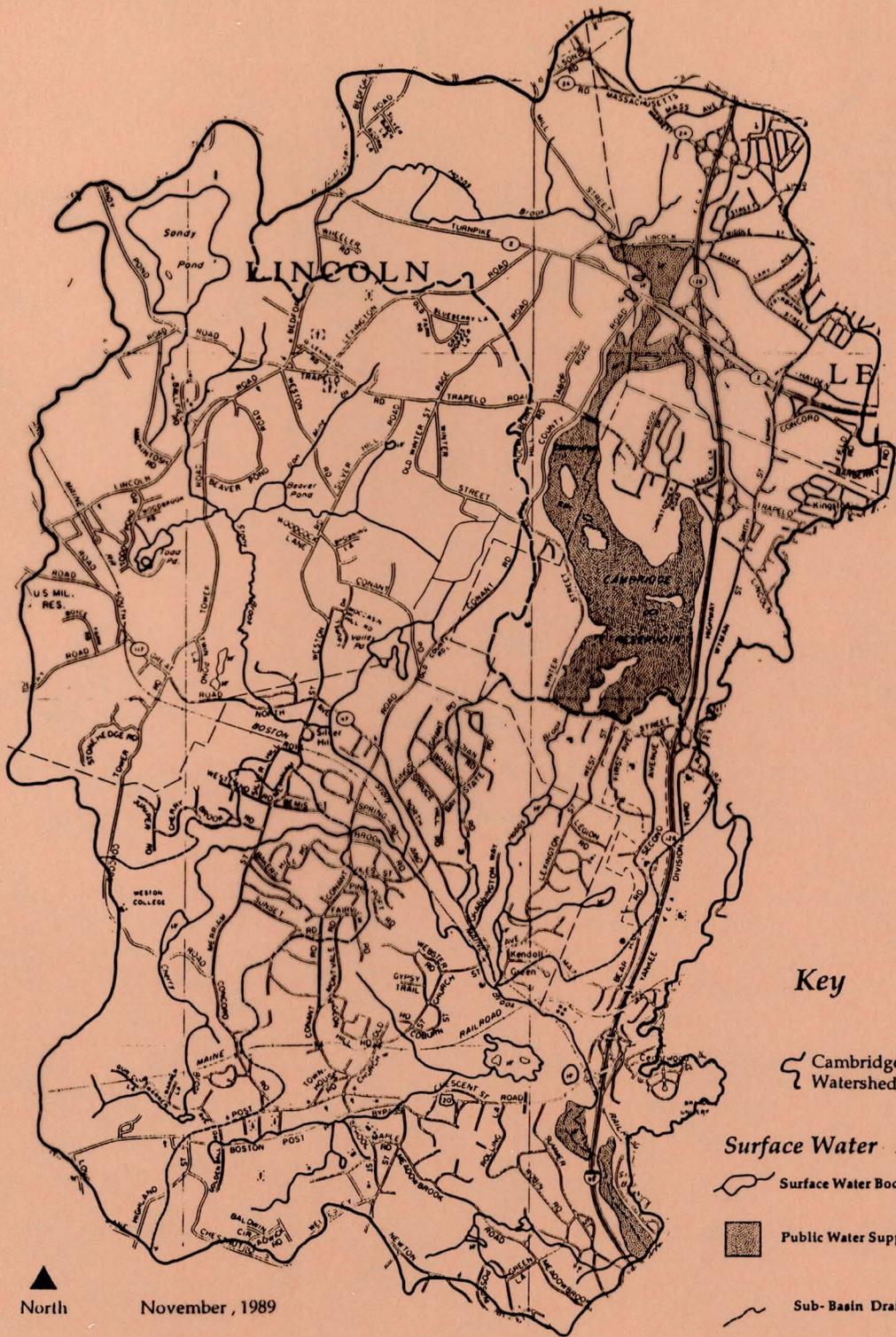
Cambridge Reservoir Watershed Protection Plan

Map 2: Surficial Geology



Prepared for:
Massachusetts Water Resources Authority and Cambridge Water Board by:





Key

- Cambridge Reservoir Watershed Boundary

Surface Water Resources

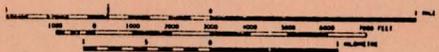
- Surface Water Bodies
- Public Water Supplies
- Sub-Basin Drainage

Source: USGS Topographic Quadrangles; Lexington, Concord, Natick

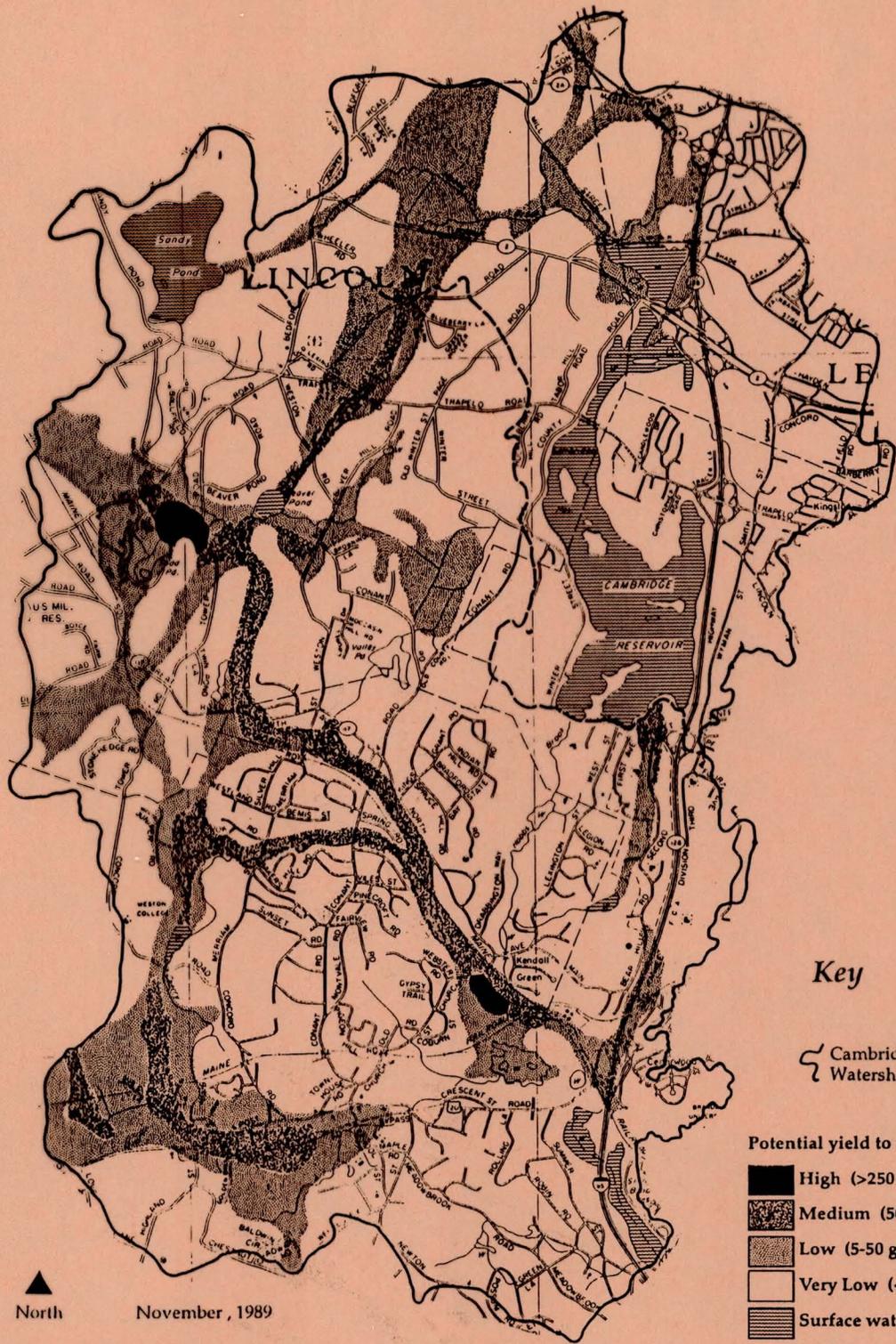
▲ North
November, 1989

Cambridge Reservoir Watershed Protection Plan

Map 3: Surface Water



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 Massachusetts Water Resources Authority and Cambridge Water Board by:
 Metropolitan Area Planning Council
 60 Temple Place
 MAPC Boston, MA 02111



Key

 Cambridge Reservoir Watershed Boundary

Potential yield to wells:

-  High (>250 gpm)
-  Medium (50-250 gpm)
-  Low (5-50 gpm)
-  Very Low (<5 gpm)
-  Surface water

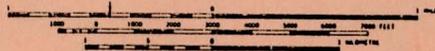
Source: USGS Hydrologic Atlas, HA-554



North November, 1989

Cambridge Reservoir Watershed Protection Plan

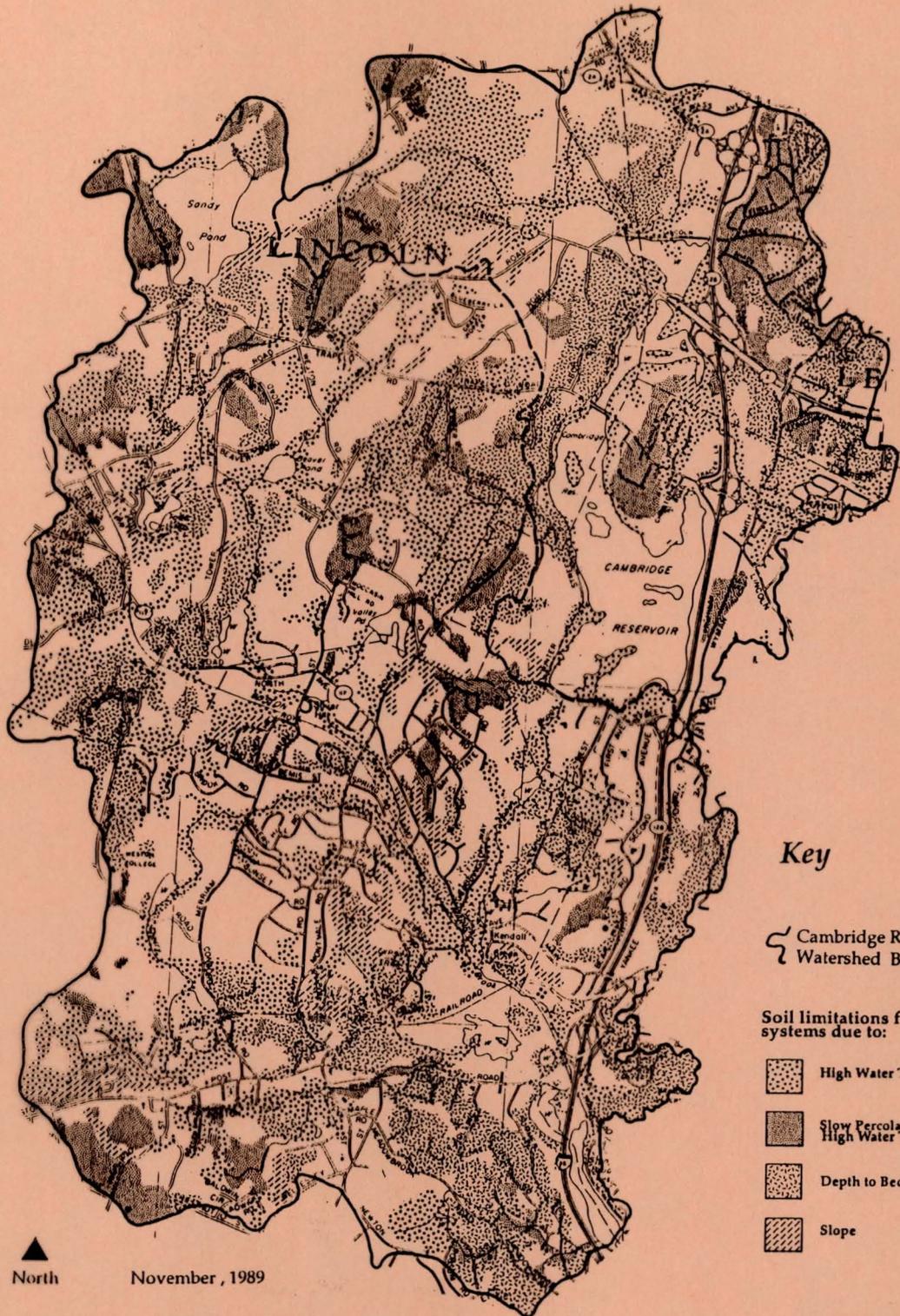
Map 4 : Groundwater Resources



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North November, 1989

Key

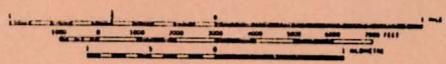
 Cambridge Reservoir Watershed Boundary

Soil limitations for septic systems due to:

-  High Water Table
-  Slow Percolation and High Water Table
-  Depth to Bedrock
-  Slope

Cambridge Reservoir Watershed Protection Plan

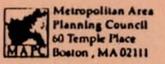
Source: U.S. Department of Agriculture, Soil Conservation Service, Middlesex County Interim Soil Survey Report, July, 1986



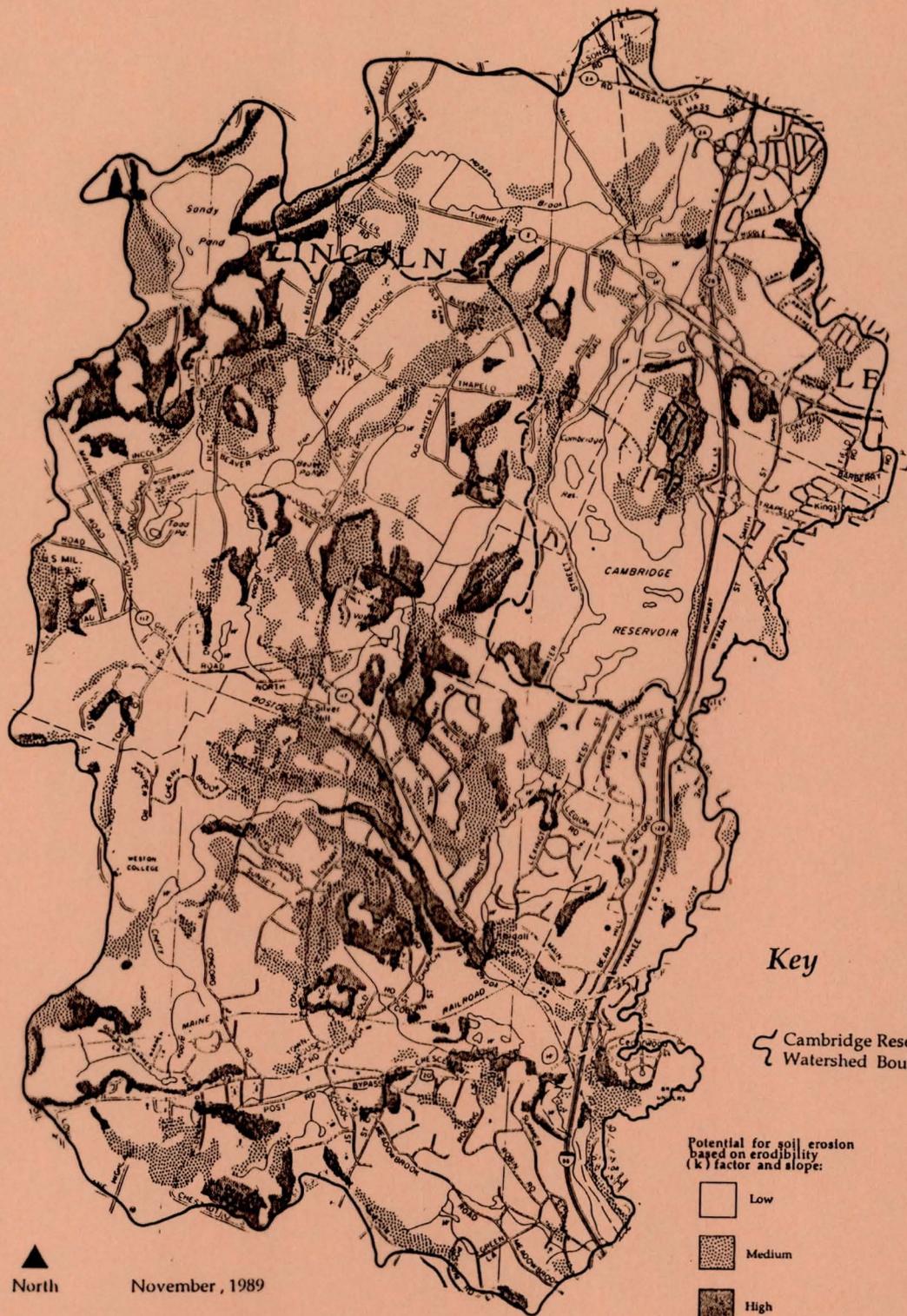
Map 5: Soils: Septic Limitations



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Key

Cambridge Reservoir Watershed Boundary

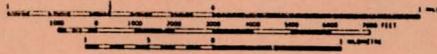
Potential for soil erosion based on erodibility (k) factor and slope:

- Low
- Medium
- High

Source: U.S. Department of Agriculture, Soil Conservation Service, Middlesex County Interim Soil Survey Report, July, 1986

▲ North
November, 1989

Cambridge Reservoir Watershed Protection Plan



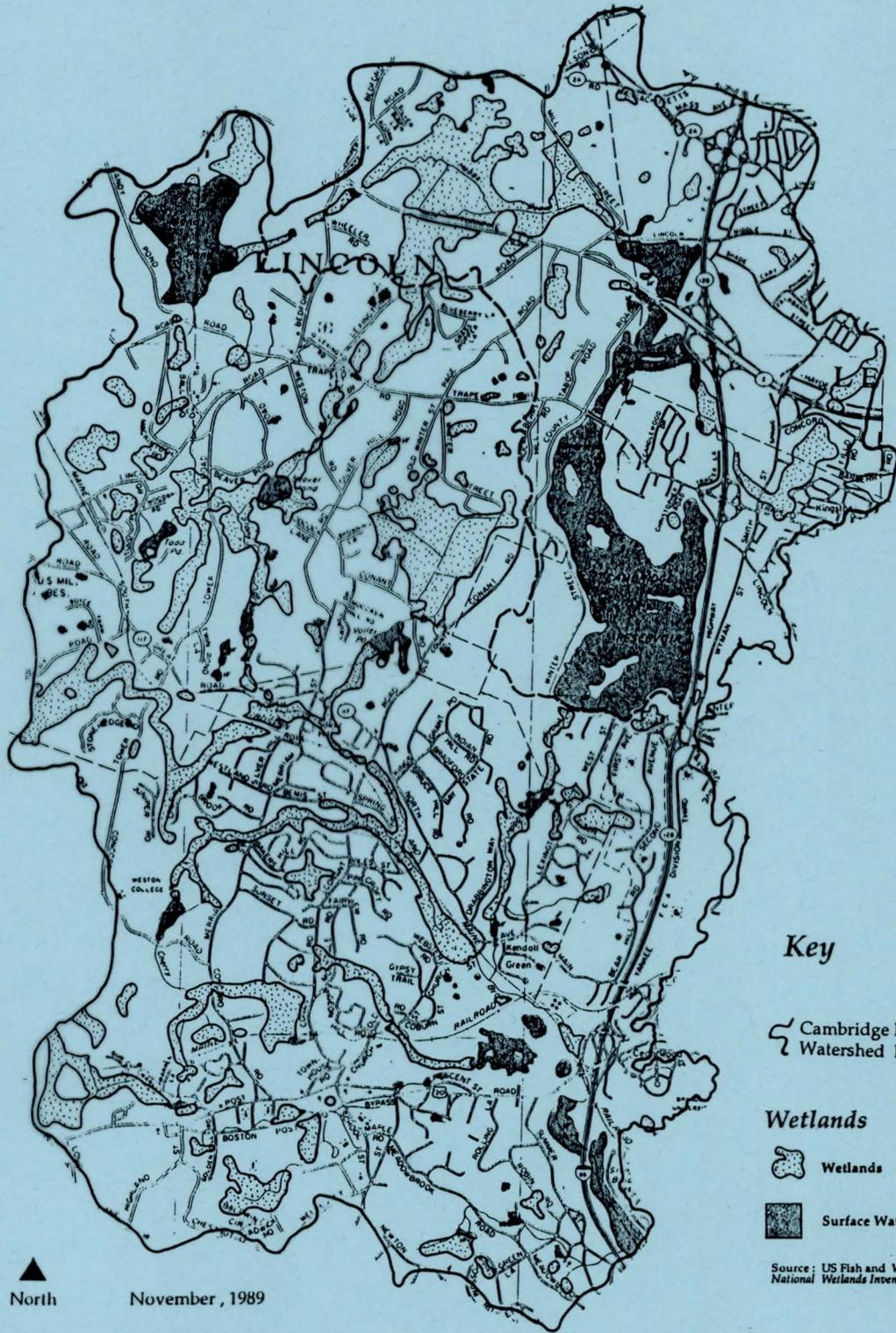
Map 6: Soils: Erosion Potential



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November, 1989

Key

☞ Cambridge Reservoir Watershed Boundary

Wetlands

☞ Wetlands

☞ Surface Water

Source: US Fish and Wildlife Service National Wetlands Inventory

Cambridge Reservoir Watershed Protection Plan

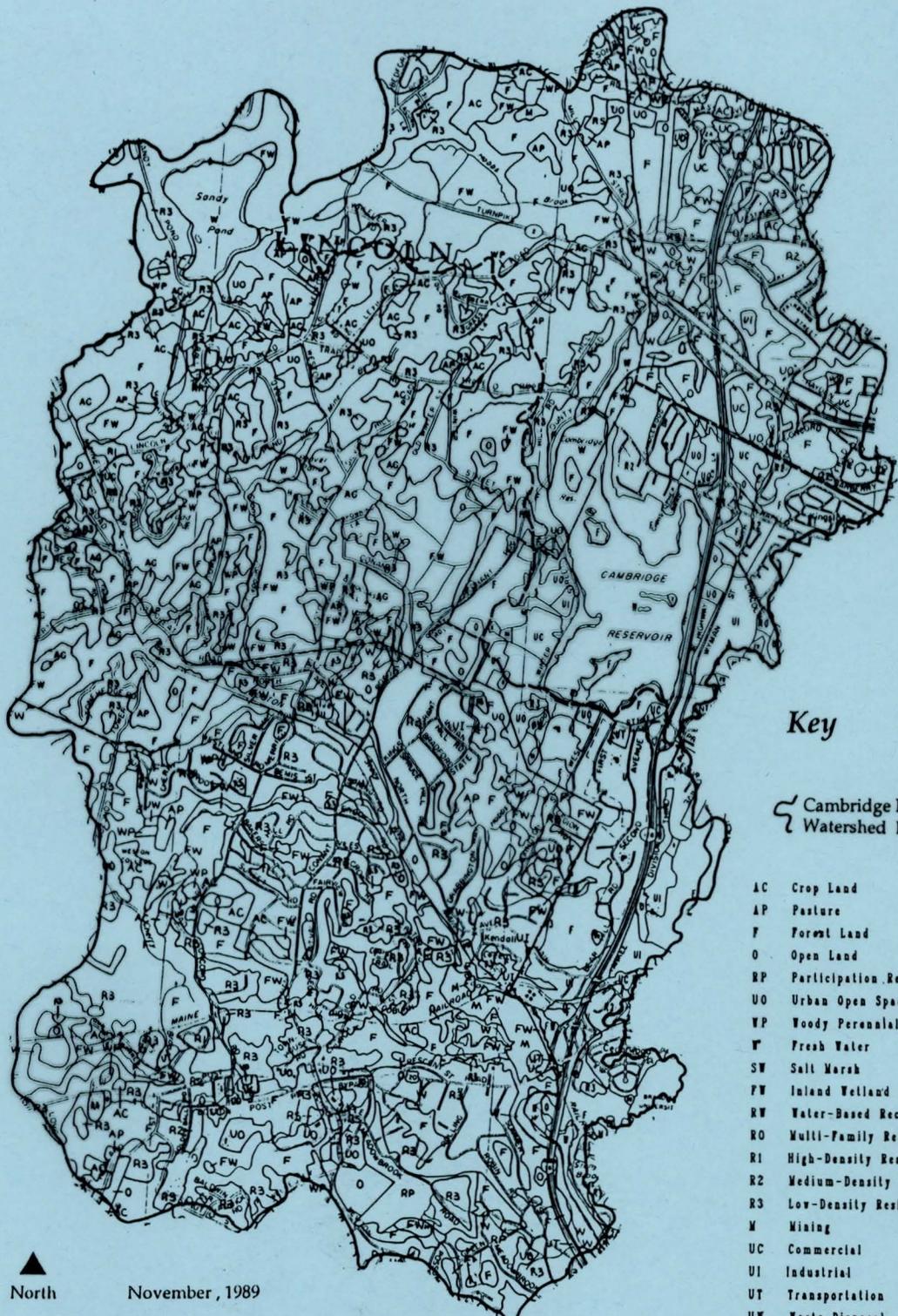
Map 7: Wetlands



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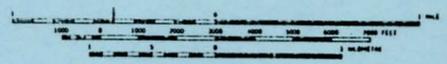
Key

Cambridge Reservoir Watershed Boundary

- AC Crop Land
- AP Pasture
- F Forest Land
- O Open Land
- RP Participation Recreation
- UO Urban Open Space
- VP Woody Perennial, Orchard
- W Fresh Water
- SW Salt Marsh
- FW Inland Wetland
- RW Water-Based Recreation
- RO Multi-Family Residential
- R1 High-Density Residential
- R2 Medium-Density Residential
- R3 Low-Density Residential
- M Mining
- UC Commercial
- UI Industrial
- UT Transportation
- UW Waste Disposal
- RS Recreation, Spectator

North
 November, 1989

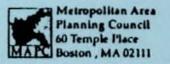
Cambridge Reservoir Watershed Protection Plan

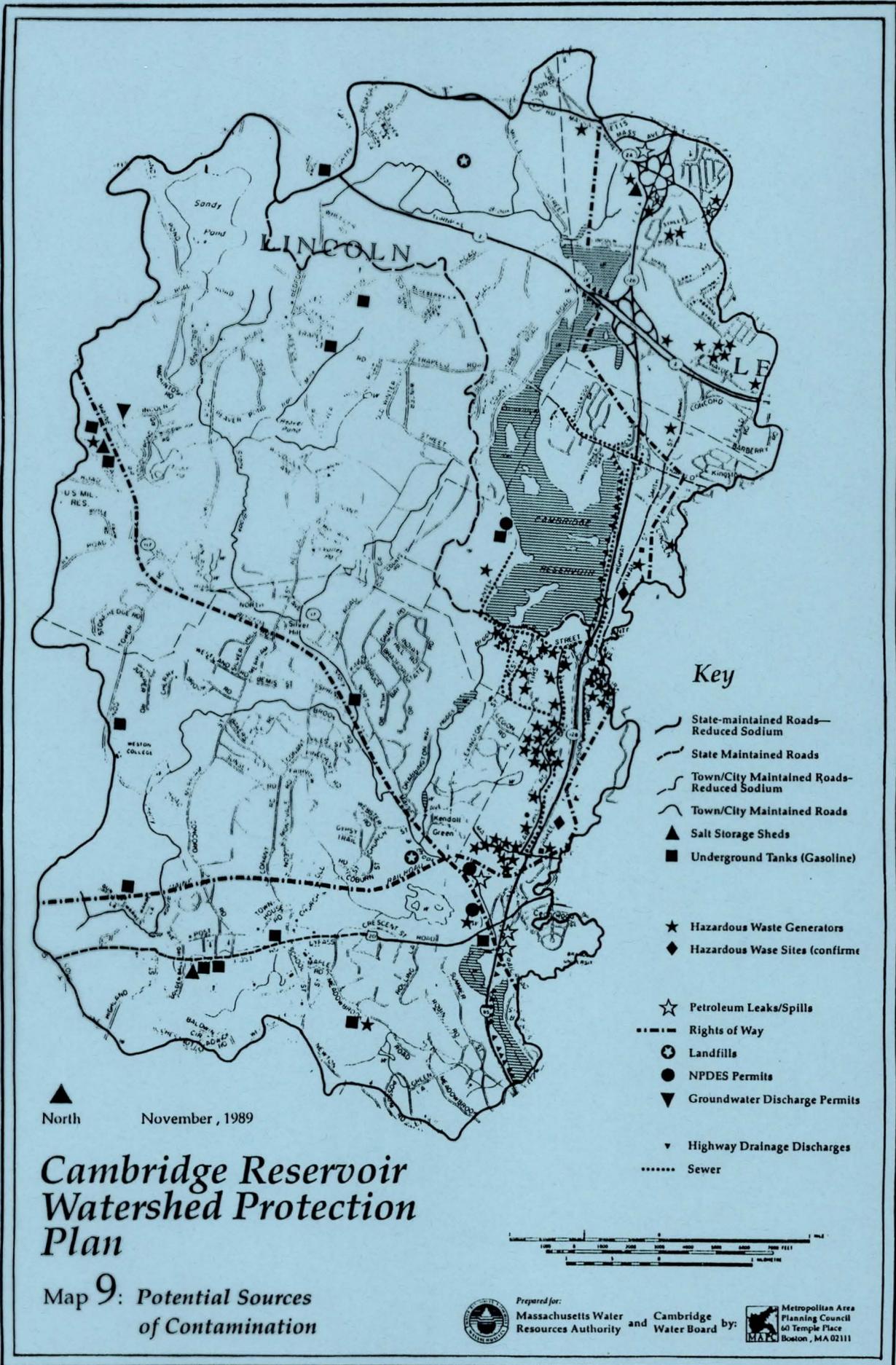


Map 8: Land Use



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 Massachusetts Water Resources Authority and Cambridge Water Board by:





Key

- State-maintained Roads— Reduced Sodium
- State Maintained Roads
- Town/City Maintained Roads— Reduced Sodium
- Town/City Maintained Roads
- ▲ Salt Storage Sheds
- Underground Tanks (Gasoline)
- ★ Hazardous Waste Generators
- ◆ Hazardous Waste Sites (confirm)
- ☆ Petroleum Leaks/Spills
- Rights of Way
- ⊕ Landfills
- NPDES Permits
- ▼ Groundwater Discharge Permits
- ▼ Highway Drainage Discharges
- Sewer

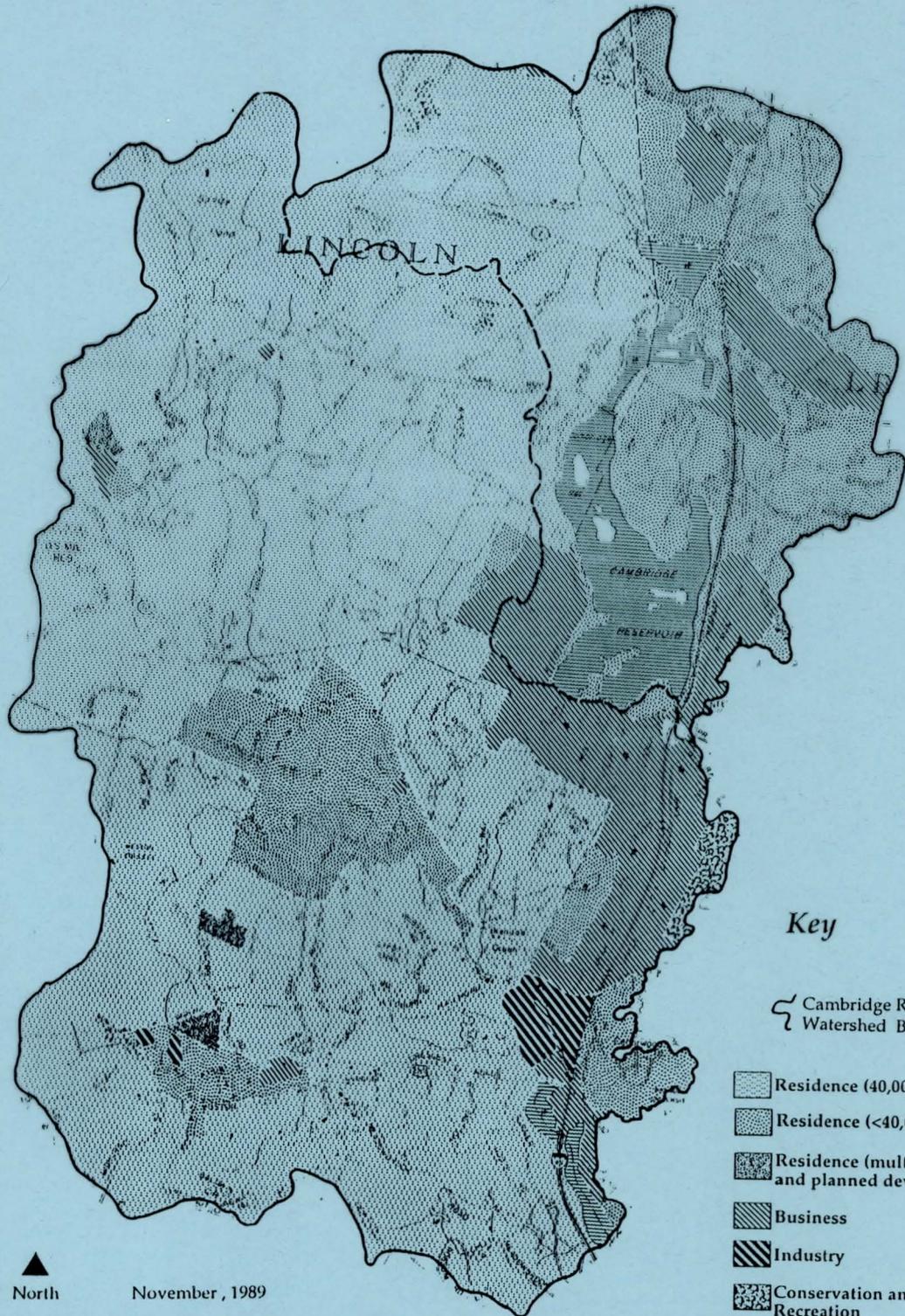
▲ North November, 1989

**Cambridge Reservoir
Watershed Protection
Plan**

Map 9: Potential Sources
of Contamination



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Cambridge Reservoir
Watershed Protection
Plan

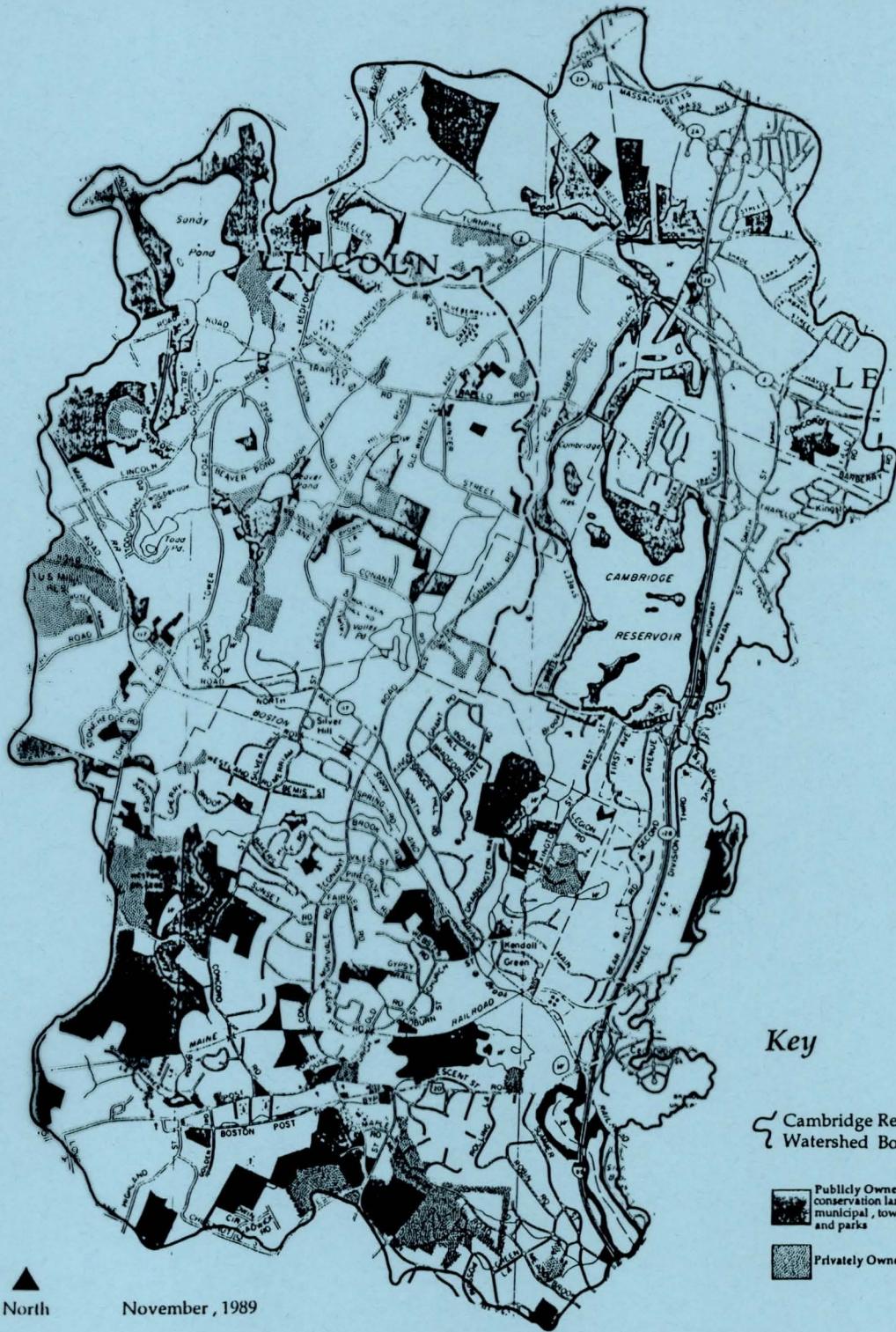
Map 10: Zoning



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Boston, MA 02111

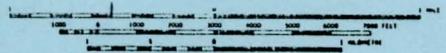


North November, 1989

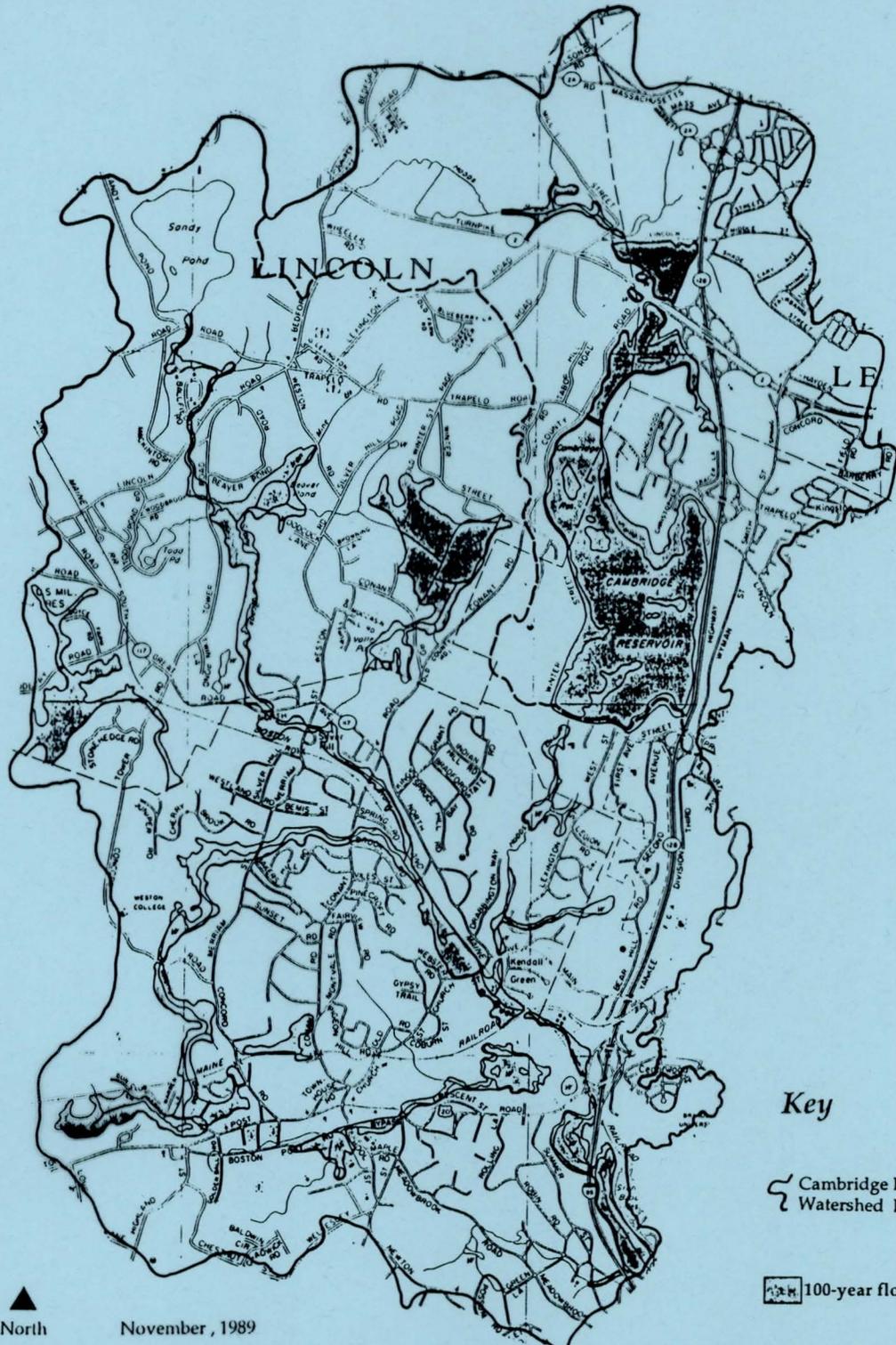
- Key**
-  Cambridge Reservoir Watershed Boundary
 -  Publicly Owned Lands
conservation lands, schools,
municipal, town forests
and parks
 -  Privately Owned Lands

Cambridge Reservoir Watershed Protection Plan

Map 11: Protected Lands



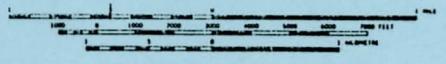
Prepared for:
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▲ North
November, 1989

Key
 Cambridge Reservoir Watershed Boundary
 100-year floodplain

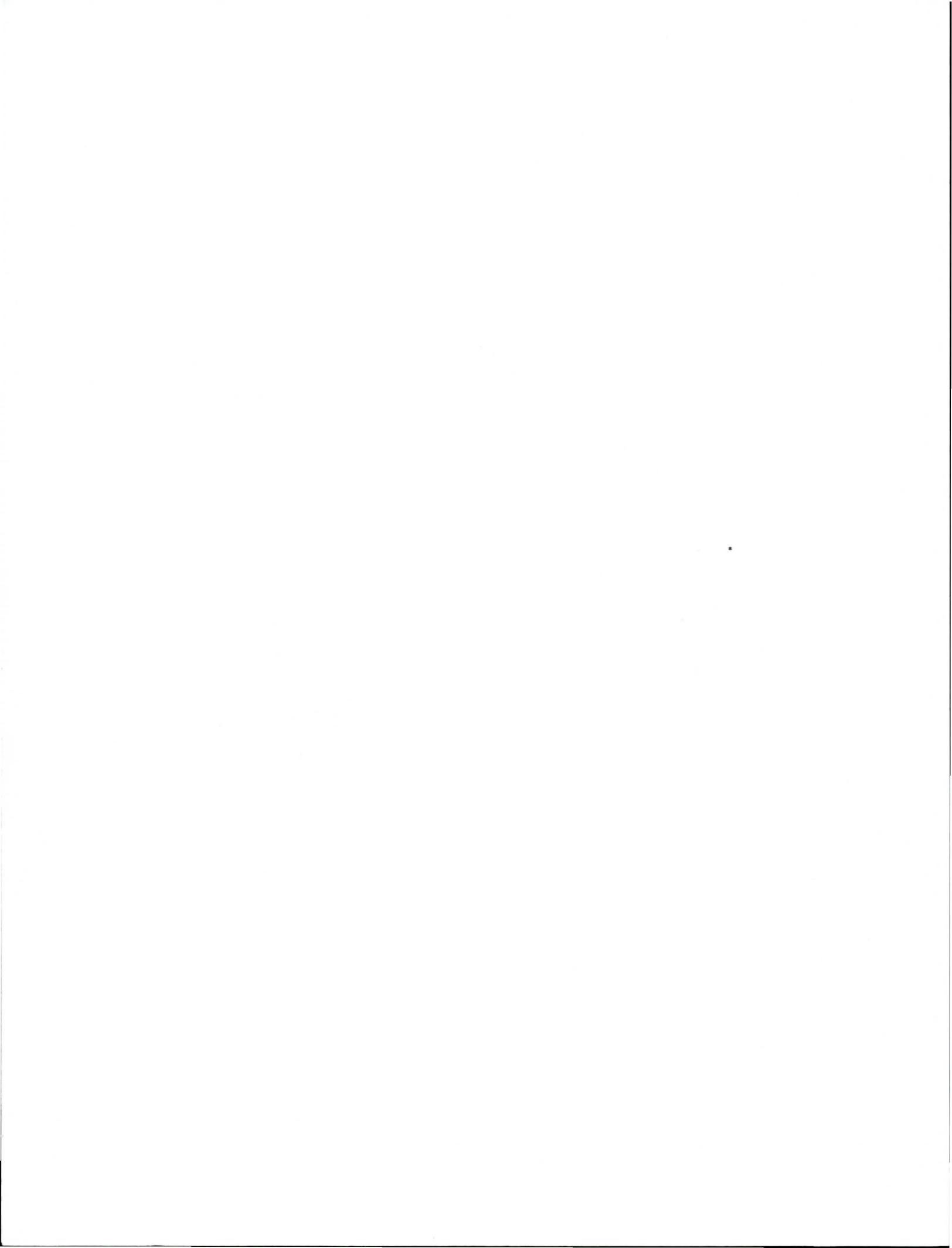
Source: Flood Insurance Rate Maps, (Lexington, Lincoln, Waltham) and Flood Boundary and Floodway Map (Weston), U.S. Dept. of Housing and Urban Development, Federal Insurance Administration, 1979, 1980.



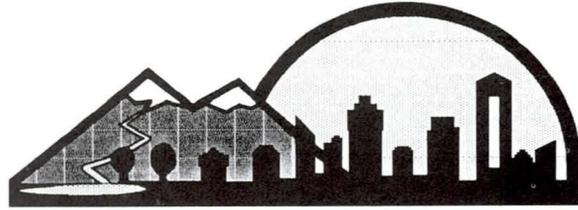
Cambridge Reservoir Watershed Protection Plan

Map 12: Floodplain

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 Boston, MA 02111



CHAPTER 3



REGULATING NONPOINT SOURCE POLLUTION

INTRODUCTION

To protect potential drinking water sources and to meet our national mandate of swimmable and fishable surface waters and no net loss of wetlands, it is often necessary to **regulate** land uses in watersheds of important groundwater and surface water systems.

There are several statewide programs that regulate land use to protect water quality in Massachusetts. In addition, in this state, cities and towns have the authority to pass laws on any subject not deliberately preempted by the state as long as the communities follow the rules for local governments as stipulated in state law. Most legal decisions that strike down local controls occur because of procedural and technical issues rather than because of the purpose of the bylaw (MA Audubon, 1984).

Ultimately, the prime responsibility for protection of local water resources from nonpoint source pollution rests with municipal boards and commissions.

Municipal boards and commissions have the authority to enact city or town land use controls to protect local water resources through either: zoning bylaws (**MGL c. 40A**), local bylaws and ordinances (**MGL c. 40**), or Board of Health regulations (**MGL c. 111**).

To enact local nonpoint source pollution controls that are effective and support the goals of the entire community, municipal boards and commissions must work together. Also, it is very important that the public be informed and involved from the very beginning of any nonpoint source pollution control effort. Public support is essential to the success of any new bylaw/regulation. In addition, to make the most efficient use of town/city resources, municipal officials should be familiar with pre-existing controls and strive to enforce them before passing new ones.

For any action, be it zoning, bylaw, ordinance, or regulation, municipal officials should always consult the town counsel/city solicitor for input and advice early in the process. The expertise of these individuals should be sought as necessary to ensure that the goals of local boards can be effectively implemented. While arrangements between boards and their legal advisors vary, generally the drafting of regulations is a collaborative effort.



Studying model bylaws and ordinances provides an excellent introduction to approaches taken by other communities. When local officials have identified their needs and priorities, town counsel or city solicitor can recommend the most effective implementation of existing authority, use of a model tailored to the local situation, or the development of new provisions.

Your counsel will also be aware of the results of any recent cases where municipal efforts have been challenged and can advise on how to avoid pitfalls. State statutes and regulations also change over time so it is important to ensure that municipal efforts, both existing and proposed, are consistent with the current legal framework. Although assistance is available in many forms and from many sources, including organizations and state agencies, cities and towns should rely on their own counsel for legal advice.

The chapter begins with a description of relevant state programs. Sections that describe the authority and responsibility of each board and commission relative to local nonpoint source control options follows. A step-by-step guide on how to write a regulation is provided as well as several model bylaws/ordinances and regulations demonstrating examples of current (as of 1991) local controls.

A NOTE ON MASSACHUSETTS LAWS AND REGULATIONS

MGL = Massachusetts General Laws

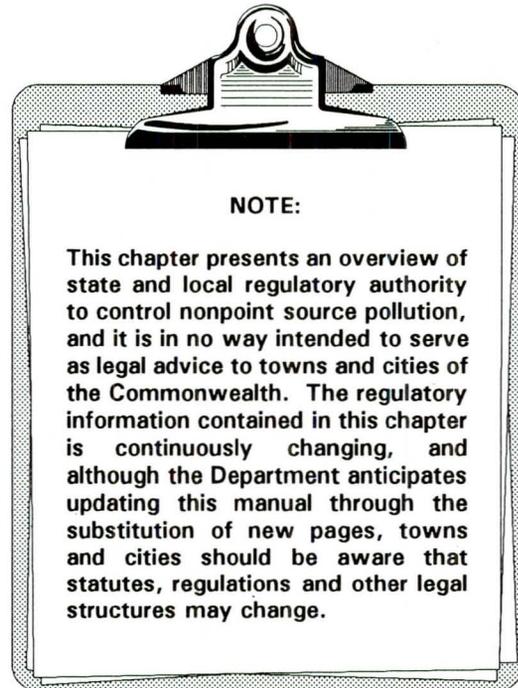
c. = A chapter of the MGL

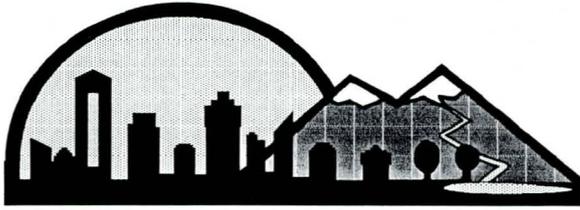
§ = A section of a chapter

The Massachusetts General Laws are organized into chapters, and each chapter is divided into sections. Your town hall (Selectmen's Office or Police Station) usually has a full set of the state laws. You can also obtain them at your local county courthouse and some public libraries.

CMR = Code of Massachusetts Regulations

Massachusetts numbers the regulations according to state department and subject. State regulations can be found at the State House Library or purchased at the State House Bookstore. You can also obtain copies of these regulations at your local county courthouse and some public libraries.





STATE REGULATORY PROGRAMS AND RESPONSIBILITY

The statewide regulatory programs that help protect water resources from nonpoint source pollution in Massachusetts include the following:

■ The **Massachusetts Wetlands Protection Act** is considered by some to be one of the strongest wetland laws in the nation. By regulating land use in and near wetlands, this program protects valuable wetland functions as well as wetland habitat. The Wetlands Protection Program is administered at the local level by the municipal Conservation Commission and at the state level by the Division of Wetlands and Waterways (DWW) in DEP. A more complete description of this program can be found in the Conservation Commission section of this chapter.

RES-STATE 15

■ The **Wetlands Conservancy Program**, also administered by DWW, employs a proactive approach to protecting wetlands. The program photographs and maps the state's wetland resources using color infrared aerial photography, orthophoto base maps, photo-interpretation, field verification, and Mass GIS. From 1966 to 1987 this program also placed permanent restriction orders on wetlands in over 50 coastal and inland communities in eastern Massachusetts. Although the placement of new restriction orders has been suspended pending reevaluation of this wetlands protection tool, all existing orders remain in full effect. Questions about the application of these orders, which are recorded and indexed with the appropriate Registry of Deeds, should be addressed to the Division of Wetlands and Waterways (DEP).

RES-STATE 15

RES-STATE 42

■ Massachusetts has established minimum standards and regulations for the design, construction, and location of septic systems through **Title 5** of the State Environmental Code (discussed further in Board of Health section of this chapter), landfills, and public water supply wells. The state, with participation from local health officials, regulates the siting of **hazardous waste facilities** and the **transportation of hazardous waste**.

RES-STATE 17

RES-STATE 16

RES-STATE 18

RES-STATE 12

■ The state also has enacted the **Water Management Act** which places an upper limit on the total amount of water that may be withdrawn from a watershed. Other state programs require the licensing of all well drillers and commercial pesticide applicators.

RES-STATE 46

RES-STATE 18

RES-STATE 22

■ The **Massachusetts Wellhead Protection Program**, administered by the Division of Water Supply in DEP (DWS), protects groundwater recharge areas that supply public water systems. These recharge areas, referred to as the zones of contribution, or **wellhead protection areas**, are defined in Massachusetts as Zones I, II, and III (DEP, DWS, 1990 and 310 CMR 22.02).

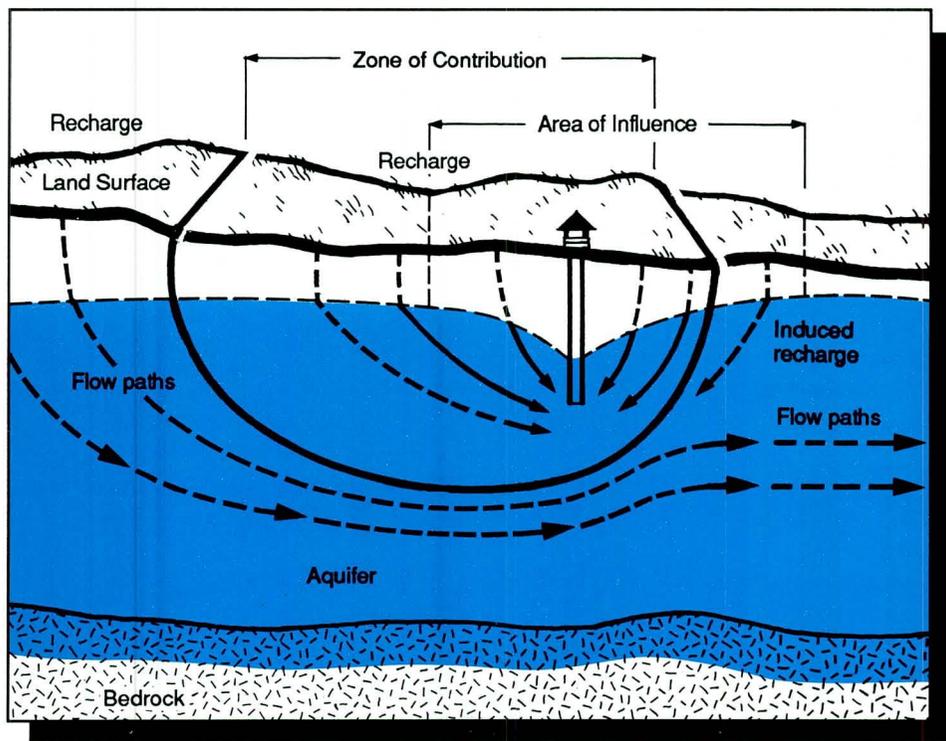
RES-STATE 18



- **Zone I** is the protective 400 feet radius around a public well or wellfield that a water supplier must own or control if pumping 100,000 gallons per day or greater as required by DEP Drinking Water Regulations (**310 CMR 22.00**) to protect groundwater from microbiological or other contamination. If pumping less than 100,000 gallons per day then the radius of protection can be less than 400 feet.

- **Zone II** is the primary recharge area to a well. It is the area that recharges a well under the most severe recharge and pumping conditions that can be realistically anticipated. It is bounded by the groundwater divides which result from pumping the well and by the contact of the edge of the aquifer with less permeable materials such as glacial till and bedrock.

- **Zone III** is that land area beyond the area of Zone II from which surface water and groundwater drain into Zone II.



WELL CONTRIBUTION ZONE

A groundwater recharge area that is the source of water for a well is known as the contribution zone or catchment area. This may include only a portion of a larger aquifer recharge area. The area of influence due to well pumping, that overlies the cone of depression, may extend beyond the contribution zone. Induced recharge from well pumping causes groundwater to flow towards the well that would not normally contribute water to the well.

Figure 3.1 - Reprinted, in part, from "What is Groundwater", Lyle S. Raymond, Jr. 1988, New York State Water Resources Institute, Center for the Environment at Cornell University.

RES-STATE 18

Contaminated municipal water supplies are usually a result of inappropriate land uses, either legal or illegal, located in the primary recharge areas (Zone II) of the wells. It is a state requirement that any proposed new well that will pump at least 100,000 gallons a day have a Zone II delineation completed and approved by DEP prior to the well coming on line. (See Source Approval Regulations, **310 CMR 22.21**.)

In November, 1992, revisions to the DEP's Wellhead Protection "Source Approval" regulations (**310 CMR 22.21**) went into effect. This regulation requires that towns putting new wells on-line that pump over 100,000 gallons-per-day implement controls prohibiting any floor drain which discharges to the ground when the drain is located in an area where pollutants may enter the drain. This requirement is consistent with the



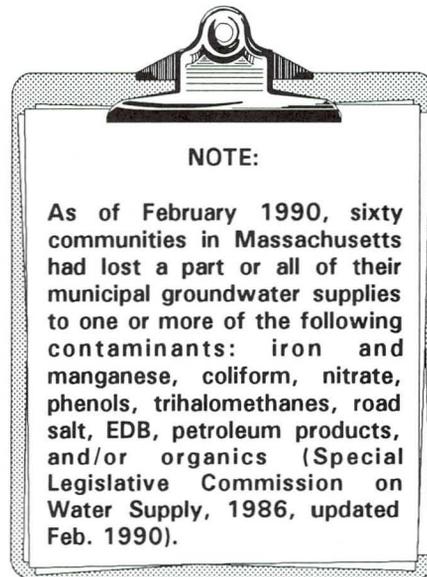
DEP Underground Injection Control (UIC) regulations (**310 CMR 27.00**) (see below).

The Division of Water Supply's UIC and Wellhead Protection Programs have also prepared a guide document to assist municipalities in implementing a local hazardous materials management program. This document outlines in detail, the process of drafting and implementing a hazardous materials bylaw or regulation. For copies of this guide, contact the DWS.

In August 1987 DEP adopted a policy creating an area of special protection around public water supply wells: the "Interim Wellhead Protection Area". This area, also known as the "Interim Zone II", is a one half mile (2,640 feet) radius around the well. In the absence of a DEP approved Zone II based on a hydrogeologic study, the Interim Zone II of one half mile is used as the primary recharge area on which protection efforts should be focused.

The Wellhead Protection Program uses the following steps to prevent contaminants from entering recharge areas to public water supply wells:

- identifying the location and boundaries of the primary recharge areas (Zone I and Zone II);
- identifying any potential sources of contamination in the recharge area;
- controlling those potential sources to prevent the release of contaminants; and
- controlling future land use in the recharge area to prevent activities which are known to threaten groundwater quality.



■ The **Underground Injection Control Program (UIC)** within DEP, Division of Water Supply (DWS), regulates subsurface discharges of industrial and commercial wastes and wastewaters (**310 CMR 27.00**).

RES-STATE 18

These regulations prohibit the discharge of pollutants to the ground. Floor drains in facilities that use, store, or maintain hazardous materials such as vehicle service stations, must either be sealed (with approval of the local plumbing inspector), be connected to a holding tank, or connected to a municipal sewer line leading to a waste water treatment plant (WWTP). The regulations also require that hazardous waste streams be kept separate from one another and that the facility implement a waste minimization plan.

The DEP has drafted a Model Floor Drain Regulation to aid towns in complying with the Wellhead Protection Program's new Source Approval regulations (**CMR 310 22.21**). Refer to Appendix D for a copy of this model floor drain regulation.

■ Discharges to the ground are also regulated by DEP, DWPC (**310 CMR 15, 314 CMR 5.00 and 6.00**) and the Division of Hazardous Waste (DHW).

■ **Underground storage tanks (USTs)** are regulated by the State Department of Public Safety (DPS), through the Board of Fire Prevention (**527 CMR 9.00 - Tanks and Containers**). Enforcement of these regulations is conducted on a local level by the fire department. The State regulations require that existing USTs (with some exceptions) be

RES-STATE44



RES-STATE 45

upgraded prior to 1998 or be removed. Because of the vulnerability of water supplies, DEP recommends that all substandard tanks in Zones I and II of public water supply wells and within one half mile of reservoirs be removed sooner than is required under the current DPS regulation.

■ Another state-administered regulatory program, **401 Certification**, is directed at projects which discharge to water bodies. Under Section 401 of the Federal Clean Water Act, DEP is required to certify that activities for which federal permits are needed, including the filling of wetlands under Section 404 of the federal statute, will not violate Massachusetts Surface Water Standards.

A 401 Water Quality Certification, issued by DEP, is a statement to the Army Corps of Engineers (COE) that there is "reasonable assurance" that the proposed activity will not violate Massachusetts Surface Water Quality Standards (**314 CMR 4.00**). DEP may attach conditions to any project's Certification that will ensure that water quality is protected, environmental damage is minimized, and all other applicable state requirements are satisfied. Activities that may require a 401 Certification and that could generate nonpoint source pollution include dredging, filling, and placing or constructing structures in wetlands and waterbodies.

RES-STATE 15

The DEP recently revised its 401 Program to improve coordination with the Wetlands Protection Act. As of October 1, 1992, applications for both programs are reviewed by wetlands staff in DEP regional offices. Previously 401 certifications were issued by water pollution control staff in Boston. Standards for review have been clarified so that only projects with potentially high impacts will receive a 401 review under the federal statute by DEP. Other projects may proceed with a valid order of conditions under the state Wetlands Protection Act by local conservation commissioners.

Jurisdiction of 401 is determined by federal law which does not recognize a buffer zone; therefore, 401 review is triggered only by work in wetlands or a point source discharge to a water body. However, once jurisdiction is established, the review can incorporate all impacts of the project. Information from conservation commissions and others submitted during the public comment period will assist DEP in its review.

RES-FED 8
RES-STATE 46

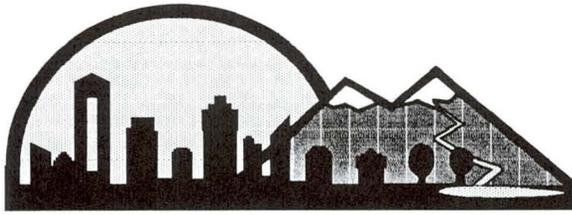
■ The U.S. EPA is now defining stormwater runoff that is conveyed through any type of drainage system (including pipes, ditches, trenches, and swales) as a **point source of pollution**. Stormwater discharges from certain industrial facilities, large municipalities (over 100,000) and construction sites over 5 acres are now required to have an **NPDES Permit** (National Pollutant Discharge Elimination System). These permits require that each site has a Pollution Control Plan that contains appropriate Best Management Practices (BMPs) to control stormwater and protect receiving water quality.

RES-STATE 46
RES-STATE 2
RES-STATE 4
RES-STATE 17
RES-STATE 8
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■ Other state regulations and/or programs related, either directly or indirectly, to nonpoint source pollution control include: Massachusetts Nonpoint Source Program, Massachusetts Coastal Zone Management's Nonpoint Source Program, Massachusetts Environmental Policy Act, Massachusetts Clean Water Act, Chapter 91, Massachusetts Water Quality Standards, and the Forest Cutting Practices Act (**MGL c. 132**).

■ In general, and in addition to the regulatory programs, many state environmental and planning agencies can also provide technical assistance in the form of maps, guidance, and in some cases, funding for water quality protection. The funding programs depend on appropriations from the federal government or the state legislature, and thus priorities and amounts vary from year to year.





LOCAL BYLAWS/ORDINANCES AND REGULATIONS

Local bylaws/ordinances and regulations can play an important part in the implementation of a community's nonpoint source management plan. Although local bylaws/ordinances and regulations must be designed as specified by the Massachusetts General Laws (MGL), each can reflect a significant amount of local preference and decision making.

Given the extraordinary range of powers that may be exercised by local elected and appointed officials, local controls have the potential to provide very effective protection against nonpoint source pollution. However, many of the 351 cities and towns in the Commonwealth have yet to implement or effectively exercise their powers. In addition, this approach may lead to fragmentary, and even conflicting, actions by towns (on situations such as river pollution) which clearly affect more than one town or originate in more than one jurisdiction, and can only be resolved by cooperative action. Cooperation among citizens and town officials, as well as between towns, is crucial to eliminating nonpoint source pollution.

The types of controls that can be enacted at the local level to protect water resources fall into three categories: 1) **Zoning (MGL c. 40A)**; 2) **Local Bylaws and Ordinances (MGL c. 40, §21)**; and **Board of Health Regulations (MGL c. 111)** (See Table 3.1). Examples of some controls are: water supply protection districts, floodplain districts, inland wetlands districts, toxic and hazardous material controls, wetlands protection bylaws, septic system management requirements, herbicide, pesticide, and underground fuel storage controls.

■ **ZONING** establishes the land-use activities that are permitted in each section of town, as well as the allowable density of development. Zoning can be used as a means for communities to manage growth and conserve natural resources. It also outlines the procedures that must be followed in order to receive special permits for the uses that might be allowed, but which need careful evaluation before approval. A local zoning bylaw can list the information that an applicant must provide to reviewing officials. The most common natural resource protection type of zoning prevents contaminants from getting into water supplies by regulating activities and land-uses that introduce contaminants in an area that recharges the groundwater.

■ **LOCAL BYLAWS OR ORDINANCES** may be enacted by municipalities for the benefit of the community's welfare, for example, to control hazardous or toxic material. Rather than regulating land-use, these types of bylaws focus on other concerns such as safeguards for handling and storing materials. With general bylaws, pre-existing uses can be reasonably regulated and there are no limitations on who may be designated to

enforce or issue permits.

■ **BOARD OF HEALTH REGULATIONS** are enacted by the local Board of Health to protect public health, and as such, can relate closely to environmental protection. For example, Boards of Health can regulate the storage and handling of fuel and hazardous materials and the siting of landfills. The local Board of Health plays a crucial role in enforcement of percolation testing for septic systems and determining which alternative technologies may be allowed for on-site septic disposal.

Table 3.1 compares the procedural requirements of these three categories:

TABLE 3.1 - TYPES OF LOCAL REGULATORY CONTROLS**

Statutory Authority	Who Adopts	Required Vote	Other
Zoning - MGL c. 40A	City/Town Council, Town Meeting	2/3 vote of all members of city council/Board of Selectmen and 2/3 vote of town meeting	Required public hearing, allows "grandfathered activities".
Local Bylaw - MGL c. 40, §21	City/Town Council, Town Meeting	Majority vote of all members city/town council and majority vote of town meeting unless otherwise provided by law, ordinance, or chapter	No public hearing required, no grandfather clause. Approval by Attorney General (c. 40 §32), must be published in a local newspaper.
Board of Health - MGL c. 111, §31; MGL c. 40, §21	Board of Health	For c. 111, a majority vote of the Board of Health. For MGL c. 40, see above	No public hearing required, but regulation must be published in a local newspaper.

** Check statutes for specifics; in some cases other statutes may also apply. Consult town counsel/city solicitor.

EXAMPLE: HOW TO WRITE A REGULATION

When preparing a regulation or bylaw/ordinance there are several important steps to consider. These steps are outlined below using the process of writing a Board of Health regulation as an example. Many of these steps also apply to zoning and other bylaws or ordinances enacted by bodies other than the Board of Health.

Before attempting to draft a bylaw/ordinance or regulation, check to see if there is already a model form of it in existence. It is much easier to modify the wording to suit the specific local goals than to start from scratch. (See the section on model bylaws and regulations in this chapter and Appendix D for examples of some of the more common local controls.) Consult agencies such as the DEP, DFWELE, Soil Conservation Service, and planning agencies for other examples.

Both substantive purpose and procedural requirements should be considered when choosing any type of control best to achieve your goal. Throughout this process, the town counsel or city solicitor should be consulted. Much time and effort can be wasted if the regulation is later overturned by a court because it was not properly drafted and adopted.

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Steps 1-8 were taken from an article by Barbara J. Saint Andre, Esq., published in the Massachusetts Association of Health Boards Quarterly (Saint Andre, 1991).

1. Identify Legal Authority: Make sure that the Board of Health has the legal authority to enact regulations in the particular area that is under consideration. Often, there will be a specific statute authorizing the Board to enact regulations on particular matters. Most of these statutes for the Board of Health are found in **MGL c. 111**. If there is a particular statute, be sure to check it to see if there are any limitations on the Board's authority or particular requirements that have to be met. For example, Title 5 of the Sanitary Code provides that a Board may adopt regulations to supplement the Code, if there are "specific, identifiable local conditions" which require more stringent regulation. Therefore, if the Board is adopting regulations under Title 5, it should be sure to include a finding as to the specific local conditions which make the regulation necessary.

The source of authority should be cited in the regulation in either a preamble or the regulation itself. Even if you cite the wrong statute, the regulation will be upheld if in fact the Board was authorized to adopt it. If you cannot find a statute that specifically grants authority for the regulation you are considering, **MGL c. 111, §31** allows a Board to adopt "reasonable" health regulations.

2. Comply with Any Procedural Requirement: It is disappointing to have an otherwise perfectly valid regulation thrown out on a "technicality". Be sure that the regulations are adopted in compliance with any procedural requirements in the enabling statute. One of the most important is found in **MGL c. 111, §31**, which requires that regulations adopted under any provision of **c. 111**, not just **§31**, be published in a local newspaper before they are effective. So if the regulation is adopted pursuant to another section of **c. 111**, which includes Title 5 regulations, it must be published in accordance with **c. 111, §31**. This section also requires the Board to file a copy of the sanitary codes, rules, regulations, and standards adopted (including amendments) with DEP. Finally, be sure to comply with local charter or bylaw provisions that apply to the adoption of local regulations.

3. Determine the Problem to be Addressed: One of the most important aspects of a regulation is to determine, **and state in the regulation**, the problem that the regulation is designed to address. Many Boards may have in mind the purpose of the regulation, but do not set it forth in the regulation. If challenged, a well-written statement of the purpose for which the regulation was adopted, including the perceived problem or need, will increase the likelihood the regulation will be upheld.

4. Address Only the Problem Identified: One of the most common challenges to local regulations is that they are overly broad; i.e., they go far beyond what is necessary to solve the problem they were enacted to address; therefore, the substance of the regulations should be drawn up so that they specifically address the problem. For example, restrictions on on-site septic systems may be needed only for that section of town that serves as a recharge area to the public water supply well.

5. Rely on Technical Data if Available: In drawing up a regulation to address a particular problem, it is desirable to rely upon and refer to any reliable technical data which support the regulation, rather than imposing arbitrary rules. When setting limitations, be as specific as possible based upon the best technical information available. Include definitions of technical terms.

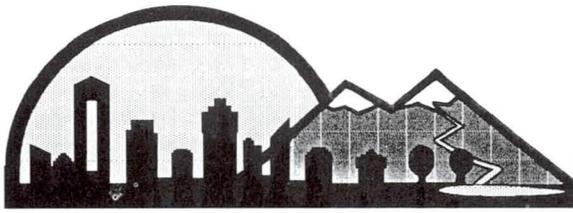


6. Severability: A severability clause should be inserted to the effect that if any portion, sentence, or clause is held invalid, the remainder of the regulation shall remain in full force and effect. This may prevent an entire regulation from being thrown out based upon a flaw in one section.

7. Enforcement: Provide a penalty that is consistent with the maximum fine allowed by the enabling statute. If your community has a provision for non-criminal disposition, and you want the regulation to be enforceable through that means, be sure that your local bylaw or ordinance provides for non-criminal enforcement of health regulations.

8. Be Reasonable: The basic test for a regulation is that it be rationally related to the concerns of the Board (or commission) and that it be reasonable. If a regulation is well-written and reasonable, it is less likely to be challenged.

9. Attorney General Approval: Although Attorney General approval is not required for Board of Health regulations, ordinances and bylaws passed by municipalities must be reviewed and approved by the state Attorney General's office before they are enacted as law. Without this approval the ordinance/bylaw is not valid.



MODEL BYLAWS/ORDINANCES AND REGULATIONS

Model bylaws/ordinances and regulations can be adapted and used by community officials to address various nonpoint source pollution problems. To help determine which models are appropriate and useful to your community, consider the following:

1. The decision to adopt a bylaw/ordinance should be based upon a well conceived planning process, including:
 - consultation with town counsel;
 - review of existing bylaws/ordinances and regulations in the town;
 - determination of community goals;
 - defining community needs/problems;
 - mapping resources, environmental constraints, and other land characteristics;
 - technical information/data;
 - properly timed public participation and public education.
2. The bylaw/ordinance should be consistent with the goals of your community's nonpoint source management plan.
3. Tailor the selected model bylaw to meet your community's needs, and to ensure compatibility with other components of the community's zoning bylaw or related regulations. Do not adopt the language of any model bylaw word for word. Careful attention must be given to bylaw details and how the proposed bylaw fits into the structure of your community's existing set of bylaws /ordinances. For example, if you are considering adopting the model scenic upland zoning bylaw, which makes reference to a site plan approval process, it is important to ensure that your existing zoning bylaw contains a site plan approval process which can be linked to the upland bylaw.
4. Provide for the legal review of the proposed bylaw by town counsel before proceeding with public hearings and adoption.

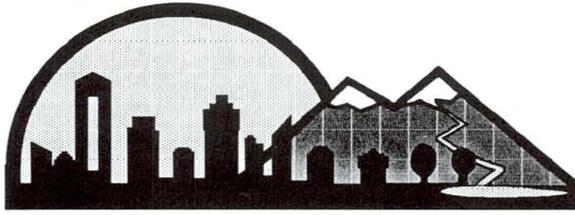
Consult Appendix D, table D.1 for a list of Massachusetts communities that have enacted bylaws/ordinances and regulations that help prevent or reduce nonpoint source pollution (DWS, 1991). For information about specific bylaws, contact the community(ies) that already have one in place.

Appendix D also contains the following model bylaws/ordinances and regulations that

can be used for review, comparison, and assistance in formulation of ones for your own community. These models were collected from "The Growth Management Workbook" (MA EOCD and PVPC, 1988), and from the files of the DEP-Office of Watershed Management, DEP-Division of Water Supply, and the USDA-Soil Conservation Service.

- Model Open Space Community Zoning Bylaw
- Model Agricultural Preservation Zoning Bylaw
- Model Site Plan Approval Bylaw
- Model Water Supply Protection Zoning Bylaw
- Model Bylaw/Ordinance Groundwater Protection District
- Model Floodplain Management Zoning Bylaw
- Model River Protection Zoning Bylaw
- Model Scenic Upland Zoning Bylaw
- Model Wetlands Protection Bylaw
- Model Hazardous Material and Underground Storage Tank Bylaw
- Model Underground Storage Tank Ordinance
- Model Septic System Inspection Bylaw
- Model Soil Erosion and Sediment Control Bylaw
- Model Floor Drain Regulation





BOARD OF HEALTH

(CLF, 1982 and MA Audubon, 1984)

Boards of Health are responsible for ensuring that the health and safety of the community are protected. Every town must elect a three person Health Board unless the town selectmen serve in this capacity. Very few towns in the Commonwealth do not have a separate Board of Health. In cities, Health Boards are appointed by the mayor. In many communities the chief environmental duties of the Board of Health involve the regulation of landfills, approval of subdivision plans for adequate drainage, and approval of septic system installations. Recently, Health Boards have taken on some authority over hazardous materials and waste disposal. Boards of Health also inspect and approve the installation of private wells.

RES-SPEC
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The following section details some of the mandated Board of Health responsibilities that relate to protecting waters from nonpoint source pollution. The areas that were chosen for discussion represent the primary areas of a Board's concern and should not be considered a comprehensive listing of its responsibilities.

■ Housing and Dwellings / Subdivision Plans

(O'Donnell, 1982 and MA Audubon, 1984)

The Board of Health must review and approve or disapprove plans for the subdivision of land (**MGL c. 41, §81 S - 81 V**). The Board of Health has special authority over drainage and waste disposal in proposed subdivisions. Subdivision plans must be submitted to the Board of Health for its recommendations to the planning board. If the Board of Health rejects a plan within the forty-five day review period, giving specific reasons for denial, the planning board cannot override that decision. Inadequate drainage, which could result in flooding or pollution of ground or surface waters is a legitimate reason for disapproval. The proposed development area should be compared, or overlaid with a map that identifies the natural resources that need protection in the town. Using this method, potential problems are easier to visualize and explain to town residents. **Most successful Board of Health decisions have broad citizen support.**

BMP-SPR

■ Hazardous Wastes

(**MGL c. 111, §150 B, MGL c. 21C**, O'Donnell, 1982 and MA Audubon, 1984)

Boards of Health are responsible under **MGL c. 111, §150 B** for assigning sites for hazardous waste treatment, storage and disposal facilities licensed under **MGL c. 21C**; however, no regulations have been promulgated. Because of the ambiguities in this

RES-STATE12

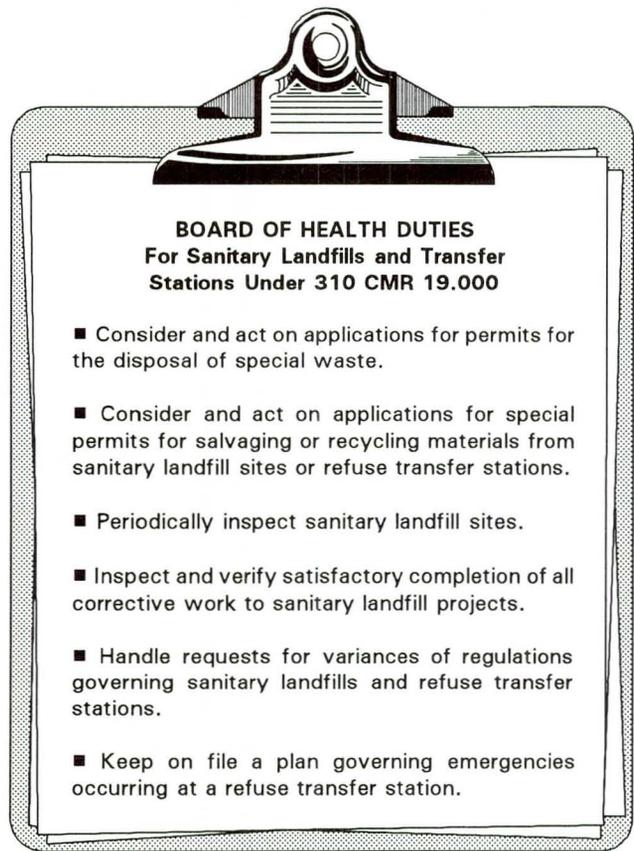


statute there has been an effort to revise the Hazardous Waste Siting Law (**MGL c. 21D**), and incorporate **§150 B** and the licensing provisions of **MGL c. 21C** in a more coordinated procedure. At present there are twenty-one such facilities in the Commonwealth, and most of these have gone through a form of site assignment. In **MGL c. 23** of the Acts of 1992 the Legislature "grandfathered" all existing treatment, storage and disposal facilities by amending **§5 of MGL c. 21C**. This amendment stated that "Boards of Health may enforce **§§31, 31C, 122, 123, and 125 of MGL c. 111**, and such other provisions of law as may apply, with respect to hazardous waste treatment, storage or disposal facilities." The siting of any new facility proposing to locate in the Commonwealth would require that the Board of Health serve as a liaison between the community and the developer in the siting process. This provides a method for the city or town to communicate local priorities during the negotiations. A local nonpoint source management plan can be a valuable guide when identifying and striving to protect priority resources during this process.



The Board of Health also acts as liaison between the DEP and the mayor, city council, or board of selectmen for the transfer of hazardous waste information (**MGL c. 21 C, §4**). The DEP notifies the Board of Health of pending applications for licenses for collection, storage, treatment, or disposal of hazardous wastes. **MGL c. 21C, §4** also provides that the DEP shall furnish information on the types and quantities of hazardous waste generated, stored, treated, or disposed of within the city or town.

BMP-HMB



RES-STATE 16

Many communities are now adopting regulations/bylaws that require registration systems for all activities that involve hazardous materials as well as requiring the generators and users to inform the Board of Health how they use, store, and dispose of listed chemicals.

■ **Solid Waste Disposal**

Disposal of solid waste, including sludge (but not sewage), must be at a sanitary landfill, or a refuse incinerator. No disposal facility may be established without a site assignment issued by the local Board of Health after a site suitability report has been issued by the DEP (**MGL c. 111, §150 A**,

§150½ and 310 CMR 16.00). The Board of Health must make sure that a facility will not present a threat to the public health, safety, and the environment.

State landfill regulations (**310 CMR 19.000**) are designed to keep landfills out of wetlands and floodplains. Leachate from landfills may be a major source of groundwater contamination. New landfills are required to be lined, monitored, and the leachate collected. Soon after a landfill reaches capacity it must be capped with two feet of an impervious material, such as clay. Proper enforcement of this regulation will help limit the leaching of materials from old landfills located over groundwater areas. The Board of Health may also monitor the operations of a landfill to make sure that forbidden materials, such as hazardous chemicals from businesses and industries, are not deposited there.

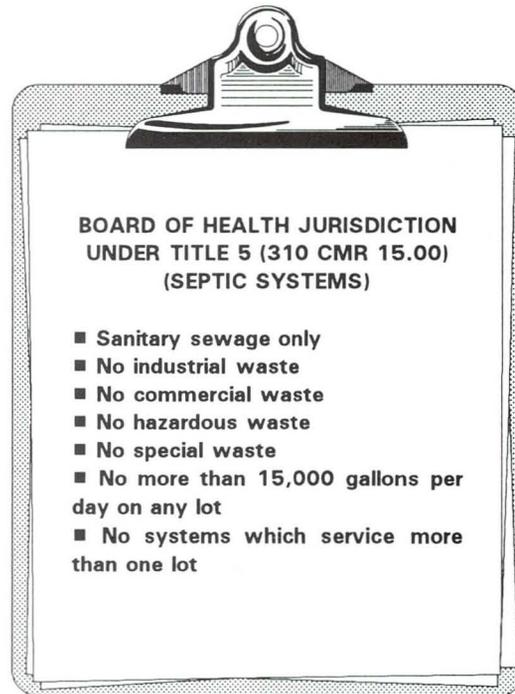
BMP-WSPZ

■ **Septic Systems and Septage**
(**310 CMR 15.00** and MA Audubon, 1984)

Research has shown that underground disposal of human, household, and commercial wastes can pose a threat to groundwater quality. Failed underground systems located around the shorelines of ponds, lakes, and wetlands can adversely affect the quality of surface water and groundwater. Massachusetts General Laws, Chapter 21 A, Section 13 (**MGL c. 21 A, §13**), and **Title 5** of the State Environmental Code (found in **310 CMR 15.00**) provide minimum standards for the location, construction, and operation of septic tanks and leaching fields for subsurface disposal of wastes in unsewered areas.

The following statutes allow the Board of Health to promulgate stricter requirements for the protection of public health:

- **MGL c. 111, §31** permits The Board of Health to make reasonable health regulations;
- **310 CMR 11.02** (Title 1 of the State Environmental Code) allows stricter local health regulations as necessary to promote and protect the health and well being of the community;
- **310 CMR 15.00** (preamble- Title 5 of the State Environmental Code) relative to minimum requirements for subsurface disposal of sanitary sewage, stricter requirements may be applied when local conditions warrant stricter regulations to protect the interests of public health and the environment.



Since one of the most important areas of concern for a Board of Health member is the understanding and enforcement of subsurface disposal of wastes, the following discussion will review some of the specifics of **Title 5** with respect to nonpoint source pollution.

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BMP-O-SDS

The local Board of Health may issue a permit for any septic system handling up to 15,000 gallons per day (e.g., a small apartment house); large industrial septic systems must be approved by the DEP. **Potential groundwater contamination from these systems is an important consideration.** In granting or denying a permit, boards usually rely on results of two tests performed on the property:

1. A "**percolation test**" to see if the soil will allow liquid to pass through at a reasonable rate, and
2. A "**deep observation hole test**" to determine the level of the groundwater at the wettest time of the year.

BMP-SDPR

RES-FED 2

Title 5 states that the bottom of the leaching field must be at least four feet above the water table at the time of maximum groundwater elevation. This standard protects the groundwater since the contaminants from leaching systems that are located at or below the water table will enter groundwater directly without the benefit of filtering through the soil. Sometimes, even if the four foot standard is carefully enforced, groundwater may become polluted from septic systems. The density (number/area) of septic systems and the permeability of the soil are also factors that influence the likelihood of groundwater contamination. **Title 5 bans systems in soils which "perc" too slowly. Local health boards may also wish to set a maximum percolation rate since effluent that filters through the soil very quickly is more likely to carry contaminants into the groundwater.** The establishment of a maximum percolation rate should not be done arbitrarily. To ensure adequate treatment, systems in rapidly draining soils may be required to have a reduced loading rate and/or more depth to groundwater. Consultation with soil scientists may be necessary to make informed decisions in some cases.

Title 5 recommends that the "deep observation hole test" be done when the groundwater is at its maximum elevation, described generally as during the months of December through April. Some Boards of Health have adopted local regulations limiting tests to the two-to-three month period when the water table is at its maximum elevation (generally March and April). This helps prevent malfunctioning systems during periods of high groundwater. USGS water table data, adjustment formula and predictive tools are also accepted methods for determining the maximum groundwater elevation. The "wettest" time of the year may well be in October and not the typical month of April.

Title 5 also establishes minimum distances between all septic system components and various water sources. The minimum distance from a well or other drinking water source to a leach field is 100 feet, and to a septic tank, 50 feet. Boards of Health may increase these distances if local conditions warrant such action. For example, in an area where continuous pumping of a well may draw groundwater from a long distance, the 100 foot lateral dimension may be increased significantly to compensate for the threat of contamination.

BMP-SSU

Health boards may also adopt regulations pertaining to the removal, transportation, and disposal of septage from septic systems. Boards of Health are required to identify and have an approved septage hauling facility. Septic tank additives are not allowed under Title 5 and are banned by the local Boards of Health, although these bans are difficult to enforce. There is strong evidence that the bacteria which is necessary for biological breakdown of the wastes can be adversely affected by these cleaners. Boards of Health may, by regulation, require periodic inspection and pumping of every system in the community. Health boards may also require any landowner abutting a public sewer to connect into it (**MGL c. 83, §3**) if that landowner presently has a septic system that poses a threat to the quality of a surface or groundwater resource.



KEY PROBLEMS ASSOCIATED WITH SEPTIC SYSTEMS

Location of Septic Systems:

A. New Systems:

- Siting new systems in highly permeable soils that have a limited fine component (silt and clay) will provide less treatment to the effluent than soils that contain silt and clay particles.
- Sorption and ion exchange attenuation processes that immobilize heavy metals and phosphates occur on the silt and clay particles.
- In addition, silt and clay particles filter the pathogens (bacteria/viruses).

B. Old/Existing Systems:

- Presence of impermeable soils may result in mounding of the effluent or flooding of the system.
- If the leaching system is too close to the seasonal high water table, the system may flood or fail, resulting in a discharge of effluent to the groundwater.
- Stormwater flooding of systems may be due to siting in depressions or swales.

C. Other:

- Wetlands are lost if these areas are filled to achieve setback distances.

Maintenance of Septic Systems:

A. Pumping:

- Failure to pump septic systems every 2-3 years may cause the sludge and scum layers to overflow into the leaching system resulting in system failure.

B. Septic Tank Cleaners:

- **Never** use septic tank and cesspool cleaners to avoid pumping of the tank. Septic tank and cesspool cleaners are not a substitute for routine pumping of the septage.
- Some of these cleaners actually kill the necessary bacteria and upset the biodegradation process.
- These cleaners do not eliminate scum and sludge buildup.
- Septic tank cleaners have been linked to groundwater contamination by the organic solvents trichloroethylene and trichloroethane (EPA 1985).

Use of Septic Systems:

- Improper disposal of household hazardous waste into the septic system (i.e., pesticides, petroleum products, and solvents) may upset the system's biodegradation process. These products contain benzene, toluene, 1,1,1-trichloroethane and 1,1,2-trichloroethane. **The septic system cannot treat this waste!**
- If the current waste load exceeds the design capacity of the system (i.e., summer cottages with cesspools or septic systems now used year round), the system may fail.

RES-STATE 17

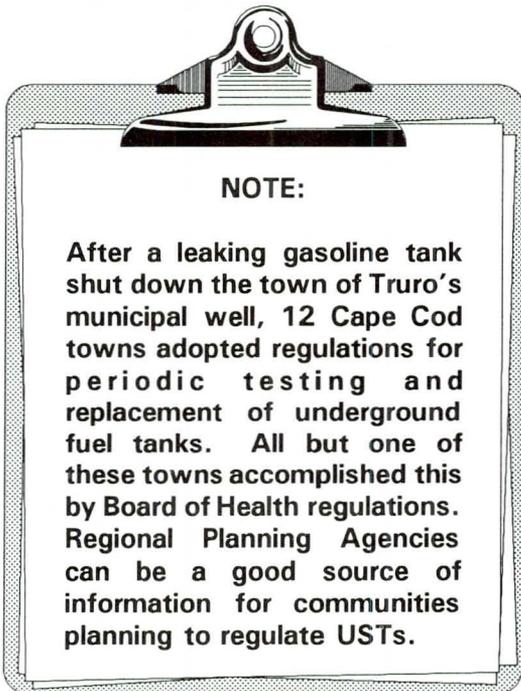
The Board of Health should review the community's existing regulations on sewage disposal and decide if tougher ones are needed. Adopting stronger Title 5 regulations by the Board of Health does not require a vote by town meeting or the city council; however, a public hearing with published advanced notice and filing with DEP are required (Dawson, 1992 and **MGL c. 111, §31**). It is also advisable to consult town counsel when questions arise during the process.

■ **Emergency Powers**

The **State Environmental Code, Title 1, (310 CMR 11.00)**, and the **State Sanitary Code, Chapter 1, (105 CMR 400.20)**, empower the Board of Health to respond to an emergency. In the language of the Sanitary Code, "Whenever an emergency exists in which the interest of protecting the public health requires that ordinary procedures be dispensed with, the Board of Health or its authorized agent, acting in accordance with the provisions of **MGL c. 111, §30**, may, without notice or hearing, issue an order reciting the existence of the emergency and requiring that such action be taken as the Board of Health deems necessary to meet the emergency..."

■ **Other**

The Board of Health also has authority in the following areas relative to the protection of surface and groundwaters:



RES-STATE 13

- Boards of Health can adopt regulations to control air pollution (**MGL c. 111, §31 C**);

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- groundwater monitoring (**MGL c. 41, §69 B**);

RES-STATE 45

- underground storage tank regulations (**MGL c. 111, §31 C**);

RES-STATE 18

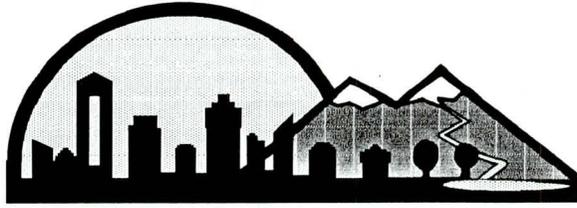
- prohibiting the use of floor drains unless connected to a holding tank or approved to discharge to a sanitary sewer system (**MGL c. 111, §31 & 122**);

RES-STATE 22

- pesticide regulations (**333 CMR 2.00**);
- nonpoint sources of pollution that create health hazards in areas not specifically designated as Board of Health concerns can be legally addressed by the Board of Health under **MGL c. 111, §122** (nuisances). Board of Health authority can extend to activities which it decides constitute a public nuisance even if these activities have existed for years;
- any other reasonable regulations to protect water supplies from contamination (**MGL c. 111, §31**).

**Table 3.2 - Land-use Categories of Concern to Boards of Health
Relative to Controlling Nonpoint Source Pollution**

Land-Use Category	Area of Responsibility or Concern
Agriculture	<ul style="list-style-type: none"> ■ Herbicides and pesticides ■ Nuisances (Nonpoint sources of pollution that create health hazards) ■ Other reasonable regulations to protect public health and safety
Construction and Urban Runoff	<ul style="list-style-type: none"> ■ Subdivisions ■ Air Pollution ■ Nuisances (Nonpoint sources of pollution that create health hazards) ■ Other reasonable regulations to protect public health and safety
Resource Extraction	<ul style="list-style-type: none"> ■ Air Pollution ■ Nuisances (Nonpoint sources of pollution that create health hazards) ■ Other reasonable regulations to protect public health and safety
Land Disposal	<ul style="list-style-type: none"> ■ Septic Systems ■ Landfills (Solid Waste) ■ Hazardous Waste ■ Nuisances ■ Other reasonable regulations to protect public health and safety
Other	<ul style="list-style-type: none"> ■ Underground Storage Tanks ■ Other reasonable regulations to protect public health and safety



CONSERVATION COMMISSION

RES-SPEC
PUR 12

Almost every city and town in Massachusetts has a conservation commission, appointed by the selectmen or the mayor under **MGL c. 40, §8 C**. The Conservation Commission has the responsibility to protect natural resources. Usually members are involved in determining the location of wetlands and whether proposed developments adhere to regulations that protect wetlands. Your town's development review process should incorporate the Commission's information and scheduling requirements. Ideally, Conservation Commissioners should be closely involved in the writing of zoning regulations that pertain to environmentally sensitive areas, (i.e., a wetlands protection overlay).

The Conservation Commission's authority to protect surface water, groundwater, and other water related resources comes directly from several Acts:

1. The Conservation Commission Act (**MGL c. 40, §8 C**);
2. The Wetlands Protection Act (**MGL c. 131, §40**);
3. The Forest Cutting Practices Act (**MGL c. 132, §40-46**).

RES-STATE 15

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Cities and towns may delegate other appropriate duties to their conservation commissions. Consult town counsel and your town's existing regulatory structure. The following examples are presented to illustrate the range of conservation commission responsibilities.

■ Conservation Land

Many communities have protected sensitive water resources by acquiring critical land and water areas and putting them under the jurisdiction of the conservation commission. Commissions may receive gifts of land (and money) with the approval of the selectmen/city council (no town meeting vote required), and they may purchase land or interests in land (easements or conservation restrictions) by direct appropriation by town meeting or through a conservation fund that the community may vote to establish under **MGL c. 40, §5(51)**. Commissions may also acquire land by eminent domain - but this requires the vote of town meeting/city council (MA Audubon, 1984).

Municipalities with conservation commissions are eligible to obtain up to 90 percent reimbursement of the cost of acquiring conservation land through the Division of Conservation Services (DCS) of the Executive Office of Environmental Affairs (EOEA). The money comes from the **State Self Help Act (MGL c. 132A)** and the **Urban Self Help Act** added by **chapter 933 of the Acts of 1977**. The community must file an open space plan with EOEA and meet certain requirements. Federal reimbursement of up to 50

RES-STATE 3



percent is sometimes available under the Land and Water Conservation Fund also administered by DCS. Land otherwise acquired by the municipality, such as land acquired when taxes are not paid, may also be turned over to the conservation commission by vote of the town meeting or city council. Town counsel should check the deed and transaction of the property.

Conservation land should be formally dedicated to conservation use by a properly authorized vote of the city council or town meeting. Once established, the land is under the protection of both the Conservation Commission Act and Article 97 of the amendments to the Massachusetts Constitution, and a two thirds vote of the state legislature is required before it can be diverted to a different use. The land is controlled by the conservation commission, which may establish regulations for its use. In aquifer or recharge areas these regulations could include such things as herbicide or pesticide restrictions, or limits on the use of salt on parking lots.

■ Conservation Restrictions (CRs)

Conservation commissions have the authority to acquire permanent or temporary conservation restrictions (**MGL c. 184, §31-33**). Differing from conservation land, these restrictions do not transfer land to the commission but, instead, restrict present and subsequent landowners from using their land in a way that damages natural resources. In its simplest form, a Conservation Restriction (CR) is an agreement in writing between the landowner and the commission (or a nonprofit group) wherein the owner agrees to keep the land predominantly in a natural, open, or scenic condition, or in farming or forestry. A Conservation Restriction can provide more permanence than zoning, as well as more detailed control. For example, farming could continue over an aquifer, but without the use of dangerous chemicals. Most CRs are gifts for which the owner receives a possible income tax deduction together with some reduction in real estate taxes if the land was otherwise likely to be used for more valuable types of development. Conservation Restrictions established for public benefit are perpetual and cannot be released except under the procedures described in **MGL c. 184, §32**. As with any gift, approval of the city council or selectmen is required under the Conservation Commission Act. Approval by the Secretary of the Executive Office of Environmental Affairs is also required to make the CR enforceable.

Since farmers cannot usually afford to donate interests in land, the legislature has provided funds to compensate farmers who agree not to develop prime farmland into more lucrative uses. Agriculture Preservation Restrictions (APR) were created by a 1977 amendment to the CR law to provide a means by which a farmer may nominate prime farmland for the sale of development rights. The owner is paid to give up the right to use the land for purposes other than farming. Projects for the purchase of Agricultural Preservation Restrictions are submitted to a committee within the state Department of Food and Agriculture after review by the local conservation commission. The purpose of agricultural restrictions is to protect prime farmland. However, the agricultural restriction may also help to protect important surface water and groundwater supplies (MA Audubon, 1984).

Conservation restrictions under **MGL c.184, §31-33** should not be confused with wetlands restrictions under the Wetlands Conservancy Program, administered by the Division of Wetlands and Waterways (DEP).

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RES-STATE 15

■ **Wetlands Conservancy Program**

Conservation commissions are responsible for enforcing the permanent restriction orders issued by the Division of Wetlands and Waterways under the Wetlands Conservancy Program. Wetlands restrictions, in force in some communities in eastern Massachusetts, apply only to mapped wetlands, not to developable uplands. These restriction orders state the allowed and prohibited uses of wetlands, which generally parallel the Wetlands Protection Act. Violations of restriction orders constitute violations of Orders of Conditions under the Wetlands Protection Act. Additionally, conservation commissions cannot issue Orders of Conditions that permit violations of the restriction orders.

The Wetland Conservancy Program is in the process of mapping the wetlands in all of the cities and towns in Massachusetts. Some communities have already been mapped. Conservation commissioners (as well as other municipal officials) are encouraged to use these maps in planning and permitting activities. Check with the Division of Wetlands and Waterways, Wetlands Conservancy Program to see if wetland maps are available for your community.

■ **Wetlands Protection Program**

RES-STATE 15

This program requires landowners to obtain permits for conducting certain land-use activities within or near a wetland area. Under the Wetlands Protection Act and Wetlands Regulations (**MGL c.c131, §40, and 310 CMR 10.00**), the conservation commission is responsible for determining if the project requires a wetlands permit, and for denying or issuing the permit. Since 1972, conservation commissions have had primary jurisdiction over activities within 100 feet of inland wetlands, coastal wetlands, and areas within the 100-year floodplain. In the absence of a commission, the selectmen or mayor exercise this authority. The purpose of the program and types of wetlands resources it strives to protect are summarized below:

THE WETLANDS PROTECTION ACT
MGL c 131, §40

Under the regulations, **310 CMR 10.00**, its **purpose** is:

- Protection of public and private water supply
- Protection of groundwater supply
- Flood control
- Storm damage prevention
- Prevention of pollution
- Protection of land containing shellfish
- Protection of fisheries
- Protection of wildlife habitat

Under the regulations, **310 CMR 10.00**, **protected inland resource areas** are:

- Land under water bodies and waterways
- Banks of water bodies and waterways
- Vegetated wetlands that border water bodies and waterways
- Bordering and isolated land subject to flooding

Under the regulations, **310 CMR 10.00**, **protected coastal resource areas** are:

- Salt marshes	- Land under salt ponds
- Land under ocean	- Rocky intertidal shore
- Land containing shellfish	- Coastal banks
- Coastal beaches	- Coastal dunes
- Barrier beaches	- Designated port areas

The Wetlands Protection Act has jurisdiction over proposed work in a wetland or floodplain that will "remove, fill, dredge, or alter". As a rule, strict performance standards apply, except in three instances:

1. **statutory exemptions** for certain activities specifically stated in **MGL c. 131, § 40** (e.g., for agricultural land--DEP has drafted regulations that more specifically define agricultural exemptions. Regulations may be promulgated as early as 1993.);
2. **variances** from the Commissioner of DEP to further an overriding public interest or to avoid a taking of the land; and
3. **limited projects** specifically listed and defined in **310 CMR 10.53** (e.g., roadways and utility lines; in which case special conditions may be applied, depending on the category of the project).

If work is proposed in the **buffer zone** (outside, but within one hundred (100) feet of the wetland resource area), then the applicant must demonstrate whether or not that work in fact will "remove, fill, dredge, or alter" the wetland. If it will, appropriate permit conditions for protecting the wetland are issued on a case-by-case basis.

If work is proposed outside the wetland and the buffer zone, then there is no jurisdiction unless an after-the-fact determination is made that the work actually "removed, filled, dredged or altered" the wetland.

Typically, the landowner subject to Wetlands Protection Act jurisdiction prepares a plan which describes the details of the proposed work and the measures to be taken to protect wetland resources. Any landowner who is uncertain whether the work falls under the jurisdiction of the Wetlands Protection Act may submit a **Request for Determination of Applicability** to the conservation commission. If the Commission finds jurisdiction, or if the landowner wishes to skip that intermediate step, then a **Notice of Intent** is filed. The Commission holds a public hearing on the Notice of Intent and issues an **Order of Conditions**. The Order of Conditions states that the work can proceed subject to the conditions contained in the Order which are designated to protect the wetland, or it can deny approval of the project.

The Order of Conditions is recorded at the Registry of Deeds and becomes part of the title to the landowner's real estate. A **Certificate of Compliance** must be obtained and recorded when the work is completed. If the applicant or an interested party (as defined in the statute) or the Department (through its Regional office) is dissatisfied with the conservation commission's order, then an appeal may be filed with the Regional office. Regional offices may issue their own **Superseding Order of Conditions (SOC)** which overrules the conservation commission. Appeals of SOC's may be taken, in turn, to DEP's Boston office; this appeal results in an adjudicatory hearing before a hearing officer. Appeals beyond this go to Superior Court.

Although conservation commissions can exercise authority over work in wetland resource areas, they do not have jurisdiction over activities that may impact ground and surface water if these activities take place in upland areas. In the areas not covered by the Wetlands Protection Act, other regulatory measures such as Board of Health regulations, local aquifer or watershed protection zoning, or a nonzoning bylaw or ordinance can be used.



■ Municipal Wetlands Protection Bylaws and Ordinances

Many Massachusetts towns and cities have adopted local, more restrictive versions of the Wetlands Protection Act (**MGL c. 131, §40**). As with the state law, these local wetlands bylaws are administered by conservation commissions. The advantages of local wetlands protection include the right to add values not covered in the state law. Decisions under a local bylaw or ordinance can only be appealed to the courts. Advantages of a nonzoning wetlands bylaw over a zoning ordinance or bylaw include: no need for a two thirds Town Meeting or City Council vote (only a majority vote is required for nonzoning bylaws); no need for a map, required for all zoning districts; and the fact that permit authority may be given to the conservation commission (not possible under zoning laws) (MA Audubon, 1984).

■ Other

Conservation commissions may be designated as the agency that has permit power under various bylaws or ordinances as long as they are not adopted under the Zoning Act (**MGL c. 40A**). For example, they may review applications for sand and gravel excavation or earth removal. (Many communities have some sort of earth removal regulation.) A modern earth removal bylaw may contain provisions restricting earth removal in sensitive areas, requiring buffers around surface waters, and limiting the depth of excavations to no more than four feet from the water table to avoid exposing the groundwater to contamination and evaporation. Restoration of the site is also important. Approximately 90 percent of our best groundwater supplies in Massachusetts are found under sand and gravel deposits. Conservation commissions are the likely local authority to administer such nonzoning bylaws or ordinances. Under **MGL C.40A**, known as the **Zoning Act**, a city or town may actually prohibit all earth removal except that which is incidental to other allowed uses such as construction of buildings or wells (MA Audubon, 1984).

Under **MGL c. 40, §15 C** conservation commissions may also nominate roads for consideration as scenic roads.

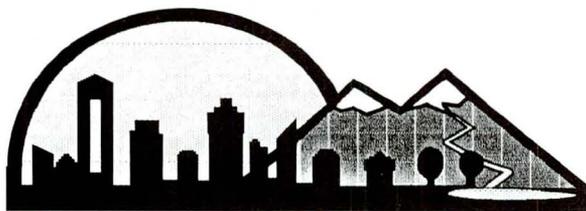
SUMMARY OF CONSERVATION COMMISSION AUTHORITY

(MA Audubon, 1984)

- Can acquire conservation lands (with the approval of selectmen/mayor) including aquifers and recharge areas; can apply for state and federal funding for land acquisition.
- Can purchase or acquire by gift, conservation restrictions on land important for ground and surface water protection; can also hold agricultural preservation restrictions.
- May receive gifts of land and money.
- May establish requirements for use of land under its control; can include measures to protect ground and surface water.
- Can develop local bylaws to provide additional protection to wetlands; bylaws must be passed by town meeting or city council.
- May serve as the permit agency for earth removal applications.
- Can provide environmental education activities to the public.
- Additional functions and powers specified in **MGL c. 40, §8 C and MGL c. 131, §40** (Wetlands Protection Act).

Table 3.3 - Land-use Categories of Concern to Conservation Commissions Relative to Controlling Nonpoint Source Pollution

Land-use Category	Area of Responsibility or Concern
Forestry	<ul style="list-style-type: none"> ■ Without approved Forest Cutting Plan or agricultural exemption, activity may fall under Wetlands Protection Act.
Construction	<ul style="list-style-type: none"> ■ Wetlands Protection
Resource Extraction	<ul style="list-style-type: none"> ■ Wetlands Protection ■ Earth Removal
Agriculture	<ul style="list-style-type: none"> ■ Without approved Conservation District/Soil Conservation Service plan, activity may fall under Wetlands Protection Act. Exempted activities include normal maintenance and normal improvements.
Hydrologic Modification	<ul style="list-style-type: none"> ■ Wetlands Protection
Other	<ul style="list-style-type: none"> ■ Conservation Restrictions ■ Conservation Land ■ Specific Nonzoning Bylaws and Ordinances



PLANNING BOARD

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Historically, Planning Boards were required to make careful studies of the resources, possibilities, and needs of the municipality, and make plans for its development. In 1936, the legislature improved local planning by authorizing municipalities to establish five to nine member Planning Boards under the provisions of section **MGL c. 41, §81 A**. These boards were responsible for all planning functions within the municipality (EOCD, 1989b).

Today, the responsibilities and powers of Planning Boards include the following:

PLANNING BOARD RESPONSIBILITIES AND POWERS

As specified in MGL c. 41, §81 B:

- Plan for the "resources, possibilities, and needs" of the community, including groundwater and surface water protection; develop master plans and conduct other planning studies, including water supply plans.
- Serve as the special permit granting authority within zoning districts.
- Develop and propose an official map governing the layout of roads and parks. (Protection of groundwater and surface water can be considered as the map is developed.)

As specified in MGL c. 41, §81 Q:

- Adopt regulations for reviewing subdivision plans which may include groundwater and surface water protection measures regulated to drainage, public ways, and public safety; may require extensive information about a proposed subdivision, including information about groundwater and surface water; may require construction bonds to ensure that drainage work is done properly.

As specified in MGL c. 40A, §5:

- Review all proposed zoning bylaws and amendments; may develop and recommend zoning and non-zoning provisions including site plan review bylaws, and environmental performance standards to control design of projects not covered by subdivision controls.

As specified in MGL c. 82:

- Submit recommendations via town meeting or city council regarding any proposed road (in addition to their regulation of roads within subdivisions under MGL c. 41, §81 B).



■ **Planning Board Subdivision Control Powers**
(MGL c. 41, §81 K-81 GG and MA Audubon, 1984)

Under the Subdivision Control Act (MGL c.41, § 81 K-81 GG), anyone planning to subdivide land into new lots that do not have adequate frontage must submit plans to the Planning Board and also to the Board of Health. The purpose of the Act is to provide for public safety, adequate ways, water, sewage, drainage, and other services (MGL c. 41, §81 M). Protection of surface water and groundwater may be considered part of the law's purpose and may result from provision for adequate drainage and well-designed ways, or from the power to enforce sanitary conditions. Boards of Health have primacy over the latter interest, however, if the Board of Health does not act, the Planning Board may modify or disapprove a plan for health reasons, including surface water and groundwater pollution.

When considering drainage, the Planning Board is limited to drainage within and coming into the subdivision. It can not consider drainage which goes out of the subdivision because it is limited by the definition in MGL c. 41, §81 L as "control of surface water within the tract of land to be divided". In this matter, the Board of Health's powers are broader.

All of the powers of review exercised by a Planning Board under the Subdivision Control Act depend upon, and are limited by, state law and the regulations adopted by that board. Thus, if a Planning Board wishes to protect surface water and groundwater in subdivisions, it must adopt detailed regulations that specify this. For examples the Board should consult model subdivision regulations. Model regulations include provisions for maximizing surface water and groundwater quality through the use of swales or other alternative drainage designs, limiting pavement over aquifer recharge areas, and preventing pollution from runoff.

Because of its overall planning function, a Planning Board may require extensive information about a proposed subdivision even if this information is not directly relevant to ways or utilities. The power to deny a proposed subdivision plan, or to regulate its impact on the rest of the community is, however, strictly limited by the Subdivision Control Act. In particular, the Board must be able to point to a particular regulation with which the proposed subdivision plan does not comply. These regulations must contain explicit standards so that the developer will know what is expected. A provision that runoff from the subdivision should not exceed that of pre-existing conditions would be adequately clear; a requirement to preserve surface water and groundwater quality might be too vague.

■ **Planning Board Powers Under the Zoning Act**
(MGL c. 40A, §§1-17 and MA Audubon, 1984)

Almost all Massachusetts cities and towns have zoning ordinances and bylaws governing the type and density of development permitted in various zoning districts delineated on a zoning map. The function of the Planning Board in adopting zoning ordinances or bylaws is advisory. The Planning Board must review all proposals for zoning amendments and may present recommendations to the city council or town meeting. They may reject the recommendations, but the Planning Board's report, developed after a public hearing, is generally influential.

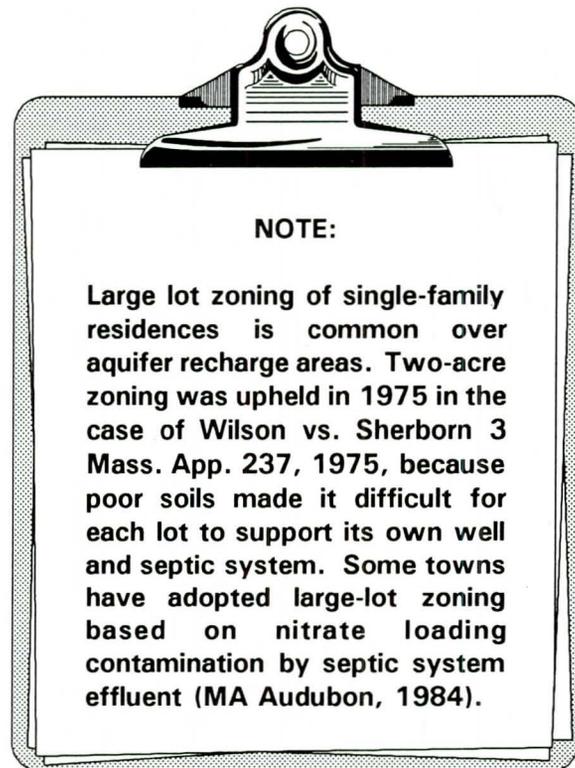
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• Zoning Districts

It is common for communities to adopt zoning districts for protection of sensitive areas such as wetlands and floodplains. Zoning districts that protect aquifers, recharge areas, and areas of influence are also becoming more common. The DEP-Division of Water Supply has regulations that require land use protection in wellhead areas (**310 CMR 22.21**). Models for such districts have been developed by regional planning agencies, such as the Cape Cod Commission, the Metropolitan Area Planning Council in Boston, and the Pioneer Valley Planning Commission. The strictest models allow practically no development in sensitive areas.



When dealing with a large amount of land (such as an aquifer recharge area), however, it is not always necessary to forbid all development. Instead, some uses may be banned outright and others made subject to special permit review.

• Special Permits

In the case of the **Special Permit** the zoning ordinance or bylaw may neither allow nor disallow a particular use. Instead, the bylaw/ordinance may provide that the use of land or density of development requires case-by-case review by a special permit granting authority (SPGA), before a permit may be granted, to see what should be allowed, denied, or allowed with conditions and modifications (**MGL c. 40A, §9**). This flexible power works particularly well when protecting natural resource areas, including those related to surface water and groundwater. Results obviously depend upon how the SPGA decides. Therefore, the attitude of this body toward resource protection is important. The municipality may designate in its zoning ordinance or bylaw whether the SPGA shall be the Planning Board, the Selectmen/City Council, or the Zoning Board of Appeals (**MGL c. 40A, §9**).

An example of the use of the special permit is in cluster zoning and planned unit developments. Local zoning codes may permit residential and nonresidential uses to be clustered on lots smaller than would ordinarily be allowed, with the rest of the land permanently devoted to open space. Clustering may be a way to protect the quality and quantity of surface water and groundwater by moving development away from sensitive areas without requiring the community to buy them.

While the special permit approach is valuable in protecting resources, it can be

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exercised only in careful compliance with legal ground rules. Specificity is important. The **Special Permit Granting Authority cannot deny a permit on grounds of danger to surface water or groundwater if this natural resource is not mentioned in the zoning ordinance or bylaw or in the SPGA's rules.**

- **Site Plan Review**

A subspecies of the special permit process is **site plan review**, a procedure that allows the SPGA to review projects, typically large commercial or industrial proposals, that are not subdivisions. Site plan review provisions found in zoning codes do not usually allow the special permit granting authority to veto a project outright. However, the proposal must meet the standards of the SPGA for such design features as access, parking, and layout.

For example, activities that might be banned in an aquifer-zoning district include salt storage, storage or use of hazardous materials, landfills, service stations, junkyards, underground fuel tanks, large parking lots, large septic systems, some industries, and the use of road salt and certain chemicals. Under a special permit provision, some or all of these land uses might be allowed but only after special permit review, with restrictions. For example, a SPGA might wish to require oil traps in parking lots or even in permeable parking lot pavement.

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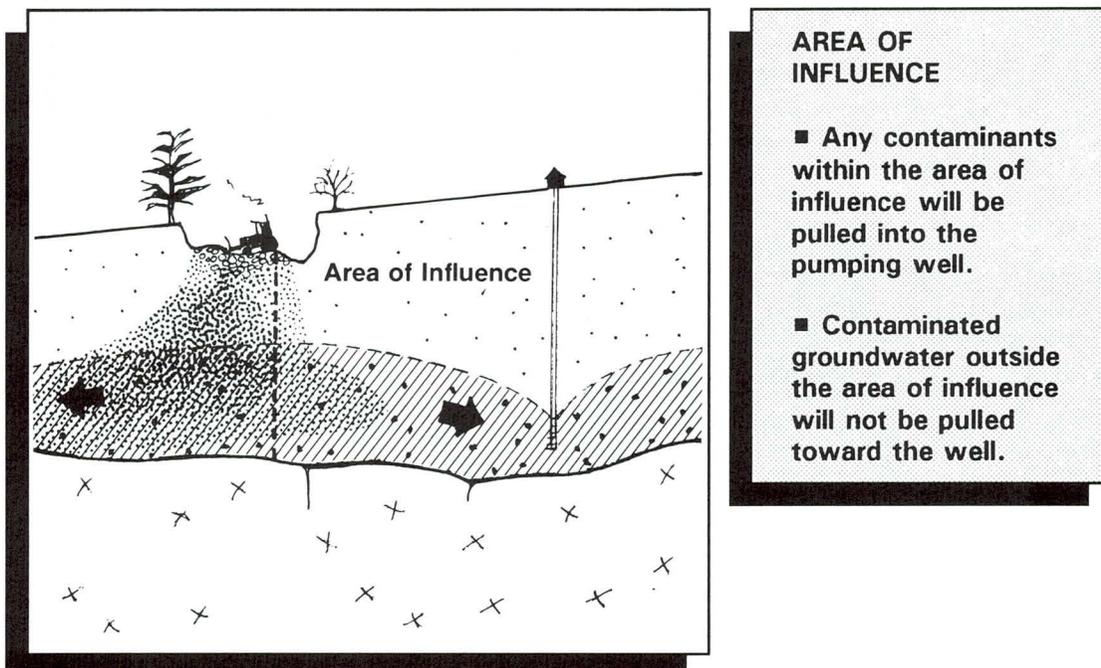


Figure 3.2 - Protecting The Area of Influence of Drinking Water Wells (MA Audubon, 1985)

- **Planning Board Powers Relative to Roads (MGL c. 82, c. 40, §15, c. 41, §81 E, and MA Audubon, 1984)**

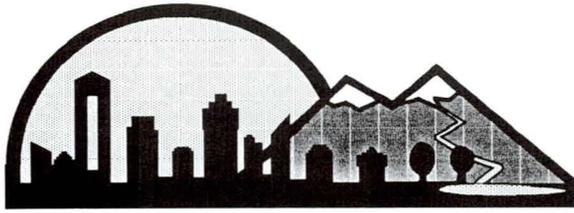
Road construction, road salting, road paving, and development resulting from creation of roads all have an impact on surface water and groundwater, yet none are controlled through traditional zoning. Under **MGL c. 82**, the Planning Board submits recommendations to the town meeting or city council regarding any proposed new road.

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(This is in addition to their regulation of roads within subdivisions under Subdivision Control Act.) Under **MGL c. 40, §15** Planning Boards also may nominate roads in their community to be considered "scenic roads" as well as have direct control over work done on such designated scenic roads. Planning Boards should also consider recommending that the community adopt an official road map under **MGL c. 41, §81 E**. If the community adopts such a map, no new public way that does not appear on the map may be laid out without amending the map.

Table 3.4 - Land-use Categories of Concern to Planning Boards Relative to Controlling Nonpoint Source Pollution

Land-use Category	Area of Responsibility or Concern
Agriculture	<ul style="list-style-type: none"> ■ Zoning Bylaws and Ordinances
Land Disposal	<ul style="list-style-type: none"> ■ Zoning Bylaws and Ordinances
Resource Extraction	<ul style="list-style-type: none"> ■ Zoning Bylaws and Ordinances
Hydrologic Habitat Modification	<ul style="list-style-type: none"> ■ Zoning Bylaws and Ordinances
Construction and Urban Runoff	<ul style="list-style-type: none"> ■ Subdivisions ■ Roads ■ Site Plan Review ■ Special Permits ■ Zoning Bylaws and Ordinances



ZONING BOARD OF APPEALS

The Zoning Board of Appeals (ZBA) usually consists of three or five members who are appointed by the mayor, subject to confirmation of the city council, or board of selectmen. The city council or board of selectmen act as the Zoning Board of Appeals if one does not presently exist in a community.

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A Zoning Board of Appeals has the following functions:

Functions of the Zoning Board of Appeals (MGL c.40A, §14)

- To hear and decide appeals from decisions of the building inspector or zoning administrator
- To issue hardship variances
- To grant special permits

The ZBA most often must decide whether the zoning has created a financial hardship or practical difficulty for a property owner wishing to build a structure. In some towns where the zoning is stricter and where there are economic problems, this board could be very busy. In other towns where the zoning is up to date and reflective of local needs, there may be little call for its services.

It is important that all town/city Boards or Commissions understand the Appeals process and operation of their Zoning Board of Appeals (**MGL c. 40A, §15 - Appellate Procedure**). Many land use decisions that involve critical environmental resources can be made by using the appeals process. **It is important that environmental concerns continue to be stressed throughout the appeals process.** Failure of a developer to adequately address environmental concerns can be a reason for denial of a variance or for upholding a building inspector's or zoning administrator's decision to deny (MA Audubon, 1977).

■ APPEALING BUILDING INSPECTOR OR ZONING BOARD DECISIONS

To illustrate a typical appeals process, the following example is presented from the "Town of Grafton, Massachusetts; Manual for Developers" (Lowitt and the Town of Grafton, 1989). It is important to note that appeals may also be filed by someone



aggrieved by the granting of a variance. The process described here may vary slightly from town to town. Consult your town counsel or city solicitor for specifics relative to your community.

Appealing a Decision

A. Development option: You are a builder who believes that a decision of the building inspector is unfair. You must appeal to the Zoning Board of Appeals (ZBA) to reverse the decision.

B. What must you do?: You fill out a notice of appeal with the Town Clerk, who will send copies to the necessary people. If you are appealing a decision of the building inspector, he/she will respond within 30 days, or it will be considered denied, and then the appeal will be brought to the ZBA.

C. What is the purpose of the Appeals Process?: The appeals process is part of the necessary "checks and balances" in the Zoning Bylaw. It ensures that you have a convenient, locally available way to question a decision that seems unfair to you.

D. How long does the Appeals process take?: You have 30 days from the date of the Inspector of Building's decision to file an appeal with the Town Clerk, who then sends copies of the appeal to the necessary boards. The ZBA then calls a hearing within 65 days from transmittal of the appeal by the Town Clerk. The ZBA will be responsible for any necessary notifications, and the meeting will be open to the public. The decision will be made within 100 days after the date of the filing of the appeal. If the Board doesn't act within that time, the application will be automatically approved. Within 14 days of the decision, copies of the decision will be filed with the Town Clerk, and notice will be sent to you.

E. What's next?: If you receive an unfavorable decision, you can re-petition the appeal within two years if all the following criteria are met:

- Four of the five members of the ZBA consent to hear it again;
- Four of the five members of the Planning Board consent to hear it again (**MGL c. 40A, §16**);
- Four of the five members of the ZBA find specific and substantial changes have occurred in the conditions upon which the previous decision was based and describe these changes; and
- Notice is given to interested parties concerning the time and place of the proceedings at which it will be discussed.

Alternatively, you can appeal to the Superior Court by taking an action to the Town Clerk within 20 days after the decision was filed with the Town Clerk.

■ ISSUING HARDSHIP VARIANCES

Application for a Variance

A. What is a variance, and what is its purpose?: A variance makes an exception to the law due to conditions of hardship. Variances exist to provide necessary flexibility in the law. It is important that provisions are made for situations that can't meet exact requirements of the law, but will not harm anyone if relief from the strict letter of the law is offered to them through the process.

B. Development option: You may have certain circumstances that make it impossible for you to build according to the regulations in the Zoning Bylaw. A variance may be granted when all of the following conditions are met:

- Because of conditions that affect your parcel(s) or building(s) but do not generally affect the zoning district in which your property is located, a literal enforcement of the law would cause you substantial hardship, financial or otherwise.
- Your proposed action will not substantially harm the public good.
- The variance that you request is in keeping with the intent or purpose of the Zoning Bylaw.
- The Special Conditions affecting the land which make it impossible for you to strictly follow the letter of the law are related to soil conditions, shape, or topography of the land or structures.
- The variance does not authorize any use or activity which is not otherwise permitted in the district in which your land or structure is located.

C. What must you do?: If you are petitioning for a variance, you must fill out a written application form which you can get from the Town Clerk. You then submit it to the Town Clerk who will send copies of the application to any relevant boards or departments for their review and report.

D. How long will it take?: Within 65 days after the application is filed, the ZBA will hold a public hearing. A decision will be made no later than 100 days after the application for the variance has been filed with the ZBA.

E. What's next?: If the variance is granted, you have one year from the date of grant to use it, after which it will lapse. It can be renewed with a new public hearing. Note that the variance is effective only after it has been registered by you at the Registry of Deeds. You will need to file a copy of the decision certified by the Town Clerk that 20 days have elapsed since the decision was filed with the Town Clerk and no notice of legal appeal has been filed. This allows time for an appeal to be made.

If you are not granted the variance, you have the right to appeal the decision to the Superior Court. To do this, you must take an action to the Town Clerk's office within 20 days from the date of decision.



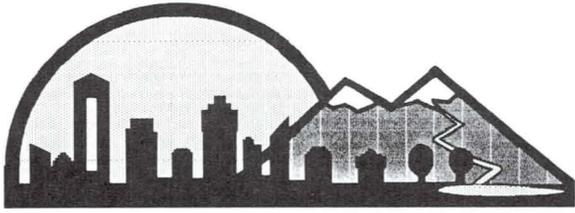
■ **SPECIAL PERMITS**

Under a zoning ordinance or bylaw with a special permit provision, a particular land use may neither be allowed or disallowed until a case-by-case review by a special permit granting authority (SPGA) occurs. The SPGA must decide what should be allowed, denied, or allowed with conditions or modifications. Depending on the particular city or town, the SPGA may be designated to either the Planning Board, the Selectmen/City Council or the ZBA (**MGL c. 40A §9**). This power is valuable in protecting natural resources, however the SPGA cannot deny a permit on grounds of danger to water resources if the water resource is not mentioned in the zoning ordinance or bylaw or in the SPGA's rules (see also Planning Board section of this chapter).

It is advisable for the Zoning Board of Appeals to keep in touch with the Conservation Commission by encouraging their attendance at ZBA meetings and by sending advance copies of all applications, including appeals, variances and special permits. For example, the Zoning Board of Appeals needs to make the Conservation Commission aware of all applications to the Board for special permits to build in a Flood Plain or Wetlands Protection District.

Table 3.5 - Land-use Categories of Concern to Zoning Boards of Appeal Relative to Controlling Nonpoint Source Pollution

Land-use Category	Area of Responsibility or Concern
Construction and Urban Runoff	<ul style="list-style-type: none"> ■ Appeals ■ Variances ■ Special Permits
General Land-use Activities	<ul style="list-style-type: none"> ■ As it relates to Planning Board Activities: Appeals, Variances, Special Permits



SELECTMEN AND MAYOR/CITY COUNCIL/CITY MANAGER

(MA Audubon, 1984)

Boards of Selectmen administer general town business and set town-wide policies for growth and development. They direct the operations of some town boards and appoint members of others, such as Conservation Commissions. Sometimes they will also serve as the special permit granting authority for specific types of development, or they may serve as the Zoning Board of Appeals. As town government has grown more complex, many of the regulatory (permit) programs formerly administered by the Selectmen have been transferred to other bodies such as the Board of Health or Conservation Commission.

The authority of City Councils, Mayors, and City Managers varies greatly, in accordance with each city's charter and ordinances. In general, their authority is even greater than that of Boards of Selectmen. Check your city or town charter for specifics relative to your municipality.

■ General Powers

Although the powers of these officials differ from city to city, the powers and duties of Boards of Selectmen are set out in **MGL c. 41**. These three to five member Boards are elected and, if town meeting so votes, the Boards may act as assessors, water commissioners, sewer commissioners, Boards of Public Works, and/or Boards of Health. Under the Wetlands Protection Act (**MGL c. 131, §40**), the Selectmen act as the Conservation Commission until a commission is established by town vote pursuant to **MGL c. 40, §8 C**. Thus, especially in small towns, the Board of Selectmen may actually carry out the functions of most of the other agencies discussed in this manual except for the Planning Board. (For the equivalent duties of city officials, see **MGL c. 39, §1**, and **MGL c. 41, §3**, which states that city officials fulfilling state functions generally have the same powers as town officials.)

These elected officials can provide leadership by making the protection of surface water and groundwater a publicly stated municipal objective. They can also establish standards and practices for the Boards under their jurisdiction and require those bodies to report regularly on activities that affect surface water and groundwater quality. For example, they can exert pressure on the Public Works Board to limit the use of road salt; they can pressure the Board of Health to keep a tight rein on the number and location of failed or failing septic systems; they can introduce and support protective bylaws and ordinances; and they can seek grants from the state to improve water supplies, to build sheds to store road salt, and to acquire land to protect water supplies. They can also appoint members interested in surface water and groundwater protection to the Boards and Commissions under their jurisdiction. These officials can also play an important role in



implementing surface water and groundwater protection plans in their community.

All municipal lands that have not been voted by town meeting or city council into the "care and custody" of some particular Board are generally administered by chief elected officials. **MGL c. 40** gives the Board of Selectmen the right to lease, but not sell, such lands. These officials should determine which municipal lands should be administered to protect surface water and groundwater and then limit the construction of roads and buildings and the use of chemicals. The most sensitive land areas should probably be voted into the care and custody of the Conservation Commission.

Even when there is a separate Board of Health, **MGL c. 139** gives these officials concurrent power to abate any "nuisance" that may be injurious to public health. If the Board of Health fails to act, the chief elected officials may do so. Other health laws allow the Mayor or Selectmen to petition DEP to remove the cause of pollution of a surface drinking water supply (**MGL c. 111, §162**) and to seek a court injunction against pollution (**MGL c. 111, §§167-169**).

These officials can work to establish a recycling commission to recycle paper, glass, and metal wastes, thus cutting back on dump and landfill contamination and expansion. They may also appoint a hazardous waste coordinator in each community to work with DEP for the control of hazardous waste. They may consider nominating sensitive areas as areas of critical environmental concern (ACEC) under the Massachusetts Environmental Policy Act (MEPA). MEPA regulations (**310 CMR 10.17**) insures that almost any project proposed within an area of critical environmental concern will require a full environmental impact report.

■ Permit Powers

Selectmen and City Councils often sit as special permit boards under the Zoning Act (**MGL c. 40A**). They may also act as permit-granting authorities for activities, such as those governing the removal of sand and gravel, that require a permit under local bylaws and city ordinances. Many of these local bylaws and ordinances were passed many years ago and should be reviewed to ensure they contain adequate provisions for surface water and groundwater protection.

■ Licensing Powers

Chief elected officials have a variety of licensing duties under state law not directly related to surface water and groundwater protection, but sometimes useful in that context. For example, every food serving establishment must obtain a license before doing business in a city or town. The only standards given by **MGL c. 140, §2**, to Selectmen or other city licensing boards for granting or denying such a license is that they must determine whether it will be in the "public good" to grant it. This broad standard would allow these officials to consider whether an onsite septic system for such an establishment might be a source of pollution to underlying groundwater.

These elected officials must also license automobile junkyards under **MGL c. 140, §59**. The original intent of this law was probably aesthetic; to control unsightly outdoor storage of auto parts, however, the associated pollutants of junkyards such as grease and oil, battery acid, trace metals, and asbestos, can contribute significantly to contamination of surface water and groundwater. **MGL c. 148, §13** requires a license from the "local licensing authority" (Selectmen or special board, City Council, or licensing board), as well as the Fire Department, for use of buildings, including garages, where

flammable materials will be kept. This is in addition to the regulation of underground gas tanks discussed in the section on the powers of Health Boards.

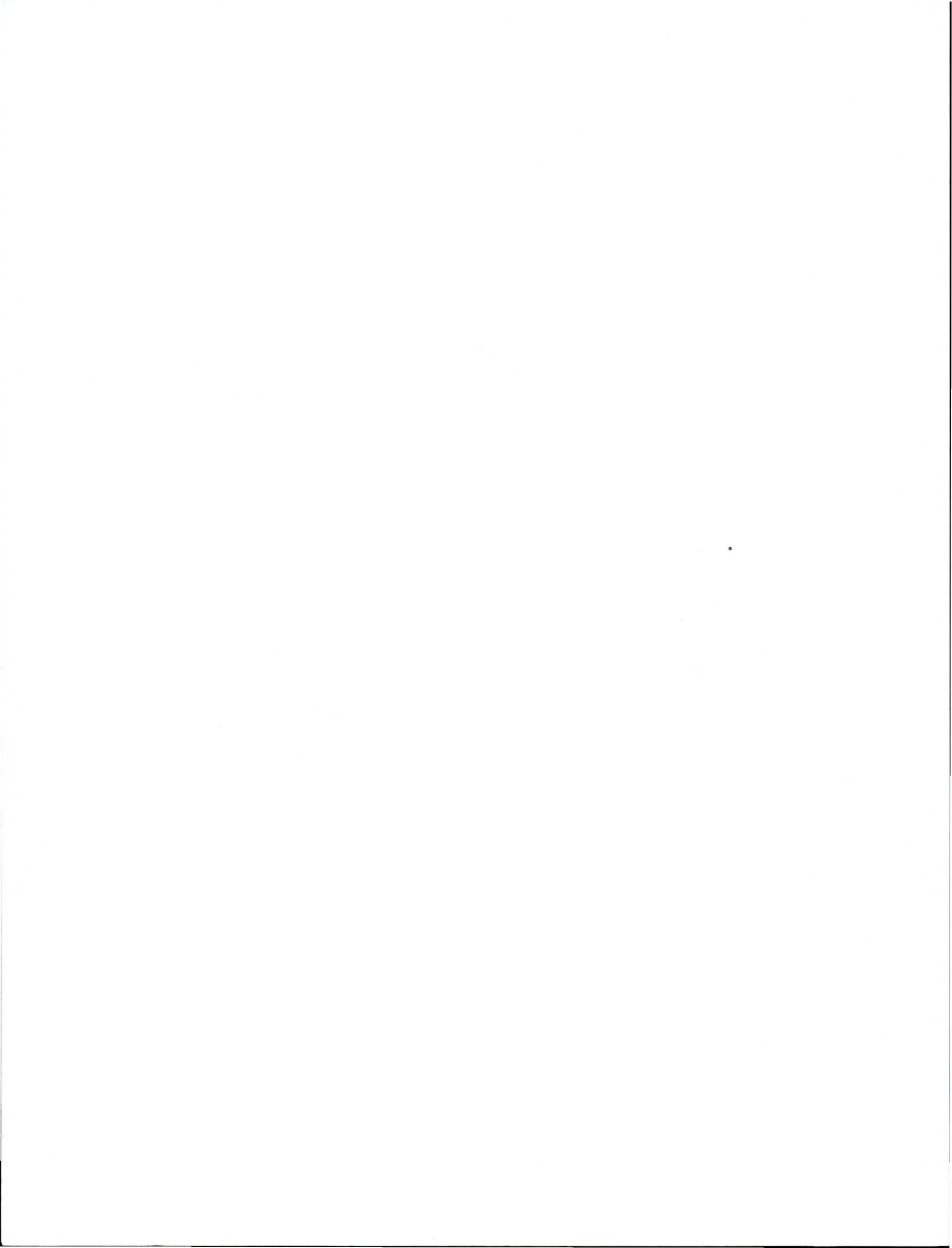
In summary, chief elected officials operate as the administrators and leaders of their communities. The impact of their leadership in the protection of the surface waters and groundwaters of Massachusetts can be substantial.

**SUMMARY OF THE AUTHORITY OF SELECTMEN AND MAYOR/
CITY COUNCIL/ALDERMEN/CITY MANAGER
Under MGL c. 41 (MA Audubon, 1984)**

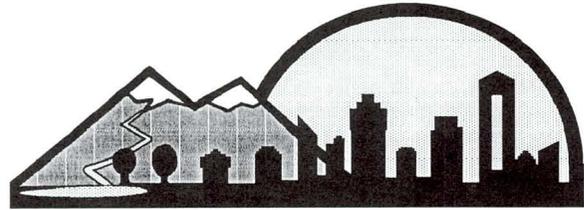
- Can establish groundwater and surface water protection standards and practices for departments and boards under their jurisdiction and can require regular reports.
- Can appoint citizens concerned about groundwater and surface water protection to town boards and committees.
- Can place and support articles in the town meeting warrant to establish town bylaws for hazardous materials control, wetlands protection, earth removal, and the creation of a recycling commission.
- Can seek grants for aquifer acquisition, salt storage sheds, and other appropriate programs, when funds are available.
- Can administer town lands under their jurisdiction to protect ground and surface water.
- Can accept conservation restrictions for the community.
- May appoint a hazardous waste coordinator and provide official support for a hazardous waste management program.
- Can act to abate a nuisance that may be injurious to public health if the Board of Health fails to act.
- May serve as the special permit granting authority.
- Can serve, in towns, as Health Boards, Conservation Commissions, and Water and Sewer Commissions if separate boards have not been established by a vote of town meeting.

**Table 3.6 - Land-use Categories of Concern to Chief Elected
Officials Relative to Controlling Nonpoint Source Pollution**

Land-use Category	Area of Responsibility or Concern
Construction and Urban Runoff	<ul style="list-style-type: none"> ■ General ■ Special Permit Board ■ Nuisances (if Board of Health does not act)
Resource Extraction	<ul style="list-style-type: none"> ■ Earth/Gravel Removal
Land Disposal	<ul style="list-style-type: none"> ■ Junkyards ■ Landfills
General Land-use Activities	<ul style="list-style-type: none"> ■ Nuisances (if Board of Health does not act) ■ Provide leadership by making the protection of surface and groundwater a publically stated objective



CHAPTER 4



BEST MANAGEMENT PRACTICES (BMPs)

Best management practices are structural, non-structural and managerial techniques that are recognized to be the most effective and practical means to prevent and/or reduce nonpoint source pollution. Best management practices are to be compatible with the productive use of the resource to which they are applied and are to be cost effective.

SELECTING BMPs TO CORRECT AND PREVENT WATER QUALITY PROBLEMS

When water quality has been degraded or the potential for degradation exists, a systematic approach to BMP selection should be followed. Efforts to solve a water quality problem without properly evaluating the cause can result in failure and the waste of already limited funding. The following questions should be answered as part of the evaluation process:

1. What is the water quality problem or potential?
2. What pollutants are contributing to the problem?
3. How are the pollutants delivered to the water resource?
4. What is a reasonable goal for water quality?
5. What Best Management Practices can be used to achieve the water quality goal?

1. What is the water quality problem or potential problem?

A water quality problem may manifest itself in many ways. For example: a citizen may complain of algae blooms on a lake, a Board of Health Agent may note high nitrate levels in domestic wells, a fish kill may occur in a stream, or a large number of septic tank leachfield problems may be occurring in certain areas of the community. In some instances, water quality standards set for a lake or stream may have been exceeded. In any case, a water quality problem exists when a designated use of a water resource either has been impaired or has the potential to become impaired. Some examples of designated uses for water resources include drinking, irrigation, recreation, and fish and wildlife uses.

2. What pollutants are contributing to the problem?

Once the water quality problem has been identified, the pollutants and their sources should be identified. If the water quality problem is localized, the type of pollutant involved and its source may be easy to determine. With larger water quality problems, a detailed study may be needed to properly identify pollutants and sources.

Monitoring is the best way to determine which pollutants are affecting a water resource. Monitoring can be relatively simple for a small lake or stream, or relatively complex for larger watersheds and groundwater. A monitoring plan should be developed by a trained individual who can select proper sites and procedures for sampling and analysis. (See Chapter 2, Step #8). Contact the DEP-Division of Water Pollution Control, the Riverways Program of the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement, or other groups listed in Appendix A for more information concerning water quality monitoring and the steps needed to establish a program for your community.

3. How are pollutants delivered to the water resource?

It is important to know how a pollutant is delivered to a lake, stream, or aquifer before it can be controlled. For example, a soluble pollutant is controlled differently than one that is bound to soil particles. There are three stages to the pollutant delivery process, these are:

a) Availability

a) Availability is a measure of the amount of a substance in the environment that can become a pollutant. It can be controlled simply by doing things such as; reducing fertilizer and pesticide application to lawns and golf courses, pumping out septic tanks on a regular schedule, or proper disposal of household hazardous wastes. Public awareness through community education programs can greatly influence the availability of pollutants.

b) Detachment

b) Once a substance is available, it must be **detached** before it can become a pollutant. Pollutants can either be detached as solid particles, or they can be dissolved into water. Most solid particles are detached as a result of raindrop impact or overland flow of water. Erosion control Best Management Practices found in the Construction BMP section of this chapter are effective for preventing detachment of soil particles.

c) Transport

c) Transport is the final link in the pollutant delivery chain. Pollutants can be transported to lakes, streams, wetlands, and groundwater by surface water runoff, infiltration, or by wind. The transport of pollutants can be influenced by controlling the rate and path of runoff waters so that the pollutants are "captured" in transit before reaching lakes or streams. Many transport delaying BMPs can be found in the Urban Runoff section of this chapter.

4. What is a reasonable water quality goal?

Water quality goals will vary from community to community. For example, a reasonable aquifer protection policy for a town in central or western Massachusetts may not be attainable in some towns located within the Route 128 belt. Some factors such as land use activities can be modified to help improve water quality. The key word here is modified. A reasonable goal recognizes that not all land uses can be made totally compatible with good water quality objectives. In addition, some natural factors, such as hydro-geologic conditions that affect water quality, are uncontrollable.

It is also important to have realistic expectations of the time required for improvement in water quality, especially when dealing with lakes and groundwater. It can take many years for a polluted lake to recover even if all pollution is controlled.

5. What practices can be used to achieve the water quality goal?

Best Management Practices must be selected that address the water quality goals of the community. It may require several Best Management Practices working together as a system, to control nonpoint source pollution. The following considerations should be evaluated when deciding which practices will become part of a system to correct a water quality problem:

a) Ability of the practice to achieve the water quality goal-- To determine if a practice can achieve the water quality goal, the community will probably need to rely on research data to predict the results of the practice. We are still at the learning or data gathering phase of many best management practices as to their effectiveness in controlling nonpoint source pollution. In many cases, the impact of the practice may be unknown or be so site specific that a meaningful estimate is not possible. The DEP-Division of Water Pollution Control has compiled the results of some practices and is beginning to formulate data on others.

In general, there will always be some level of nonpoint source pollution. However, the proper combination and willingness to experiment can reduce the amount of pollution to tolerable levels.

b) Economic feasibility -- Obviously, economics is a high priority to the land user who is choosing appropriate practices and to the community that is requiring their use. For example, the cost or increase in profit for a golf course owner or farmer from certain practices such as nutrient management may be relatively easy to evaluate through savings in the cost of fertilizer. While on the other hand, the installation of such structures as retention ponds and sediment traps are much harder to analyze and deserve careful economic consideration. **Damage to the environment if the practice is not installed should be the first priority of a land user or community.** Cost versus benefit should be carefully evaluated and alternatives that are cost effective should be considered as higher priorities.

When evaluating the economics of BMPs, the limitations of the soils in question must be considered. It is unreasonable to expect that steep, easily erodible soils can support the same intensive land uses that can be used on flat erosion-resistant soils. It is unreasonable and not cost effective to use numerous Best Management Practices only to accommodate a land use in unsuitable geology. Communities need to seriously re-evaluate the intended land use if an unreasonable amount of funding has to be expended in an attempt to make the land use compatible with the environment.

c) Effect of the practice on groundwater -- It is important to evaluate all the effects of a proposed practice. It is sometimes possible to create a new problem, or shift the old problem to a new location. This is particularly true when considering groundwater. For example, practices that increase the amount of infiltration may have an adverse effect on groundwater quality. Retention ponds, infiltration ponds, and sediment basins store stormwater runoff carrying a variety of nonpoint source pollutants for slow release and infiltration thereby enhancing surface water while possibly jeopardizing groundwater supplies.

d) Suitability of the practice to a site -- If a practice is not suited to a site, there will be three affected parties; the land user, the community, and the environment.

The land user will have to expend great sums of money to install a practice that is not cost

effective and often times requires specialized equipment to construct.

The community can be left with a practice that has a high degree of maintenance and is a liability to an already extended community budget. Some recently constructed detention/retention ponds fall into this category.

The environment may suffer whenever a practice is selected that does not fit the site. For example, the construction that is required to create retention/detention ponds and sediment basins might create a disturbance of the environment greater than the event whose runoff they were to store. Avoiding the disturbance of slopes that are presently vegetated and stabilized should be considered when choosing BMPs for adjacent land uses. If at all possible it is advisable to evaluate the performance of the proposed BMP in similar circumstances in other communities.

This chapter contains a description of individual best management practices. The BMPs are organized by nonpoint source land use category and are listed in Table 4.1. For example, the category Urban Runoff includes descriptions of infiltration basins, detention ponds, and sediment basins.

This list is not exhaustive. New and innovative practices are continuously being developed. For technical information about BMP design standards and specifications consult references in Appendix C.



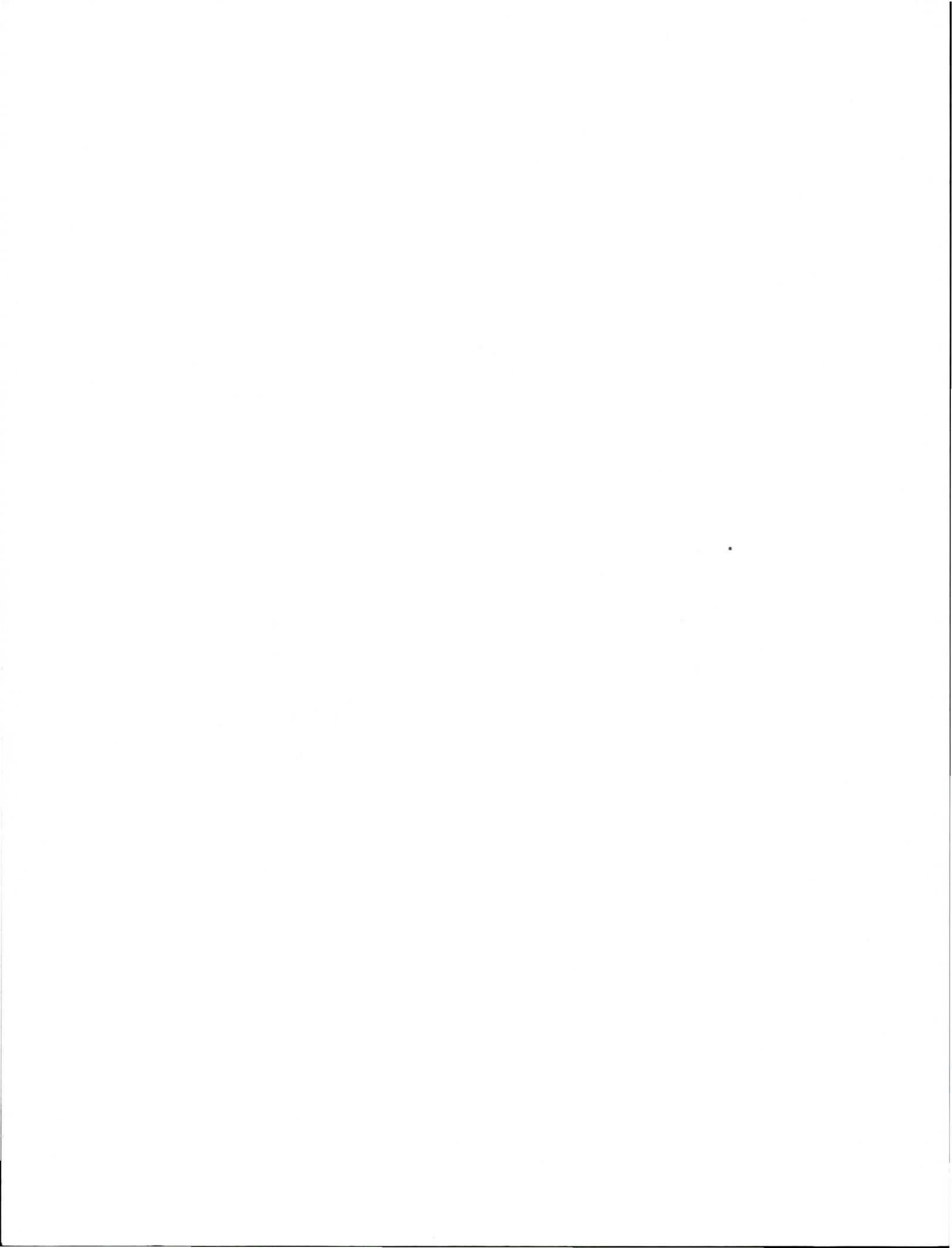
TABLE 4.1 - BMPs AND BMP ACRONYMS FOR CROSS REFERENCING

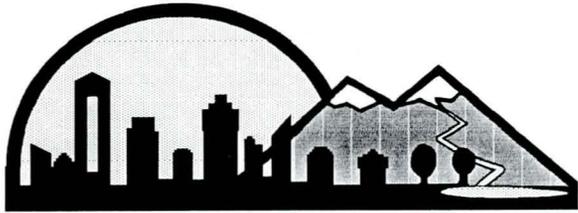
ACRONYMS	BMP	BMP CATEGORY	PAGE
AA	Algicide Application	Lake Rest./Mgt.	4-151
AC	Artificial Circulation	Lake Rest./Mgt.	4-149
AMP	Agricultural Management Practice	Agriculture	4-8
APZ	Agricultural Preservation Zoning	Zoning/Land Mgt.	4-120
AREC	Access Road Erosion Control	Forestry	4-17
AWH-H	Aquatic Weed Harvesting & Hydroraking	Lake Rest./Mgt.	4-147
BGI	Block and Gravel Inlet - Temporary	Construction	4-50
C-S	Clearing and Snagging	Hyd./Habitat Mod.	4-112
CAP	Critical Area Planting	Res. Extraction	4-102
CD	Check Dam	Construction	4-63
CRS	Construction Road Stabilization	Construction	4-60
CSS	Construction Sequence Schedule	Construction	4-25
D-F	Dilution and Flushing	Lake Rest./Mgt.	4-153
DC	Dust Control	Construction	4-64
DD	Diversion Dike-Perimeter Protection	Construction	4-40
DP	Detention Ponds	Urban Runoff	4-80
DS	Vegetative Dune Stabilization	Construction	4-37
DSWLA	Deep Stagnant Water Layer Aeration	Lake Rest./Mgt.	4-148
DSWLW	Deep Stagnant Water Layer Withdrawal	Lake Rest./Mgt.	4-156
E-SCS	Erosion and Sediment Control Standards	Zoning/Land Mgt.	4-138
EDI	Excavated Drop Inlet - Temporary	Construction	4-48
FDI	Fabric Drop Inlet - Temporary	Construction	4-49
FM	Floodplain Management	Zoning/Land Mgt.	4-128
FSSC	Filter Strip Sediment Control	Forestry	4-21
FZ	Flexible Zoning	Zoning/Land Mgt.	4-122
GLC	Grassed Lined Channel	Construction	4-42
GSGP	Guidelines for Sand and Gravel Pits	Res. Extraction	4-98
GSS	Grade Stabilization Structure	Construction	4-62
HA	Herbicide Application	Lake Rest./Mgt.	4-150
HMB	Hazardous Materials Bylaws	Zoning/Land Mgt.	4-135
IB	Infiltration Basins	Urban Runoff	4-83
ISL	Impervious Surface Limitations	Zoning/Land Mgt.	4-141
IT	Infiltration Trenches	Urban Runoff	4-82
LEC	Erosion Control on Landings	Forestry	4-18
LG	Land Grading	Construction	4-26
LS	Level Spreader	Construction	4-46
LSM	Land Smoothing	Res. Extraction	4-101
LW	Lined Waterway	Hyd./Habitat Mod.	4-116
M	Mulching	Construction	4-35
MPD	Multiple Purpose Dam	Hyd./Habitat Mod.	4-115
NLS	Nutrient Loading Standards	Zoning/Land Mgt.	4-139
O-SDS	On-Site Sewage Disposal Systems	Land Disposal	4-106
OSCZ	Open Space Community (Cluster) Zoning	Zoning/Land Mgt.	4-118
OSS	Outlet Stabilization Structure	Construction	4-47
PD	Permanent Diversions	Construction	4-39
PE	Public Education	Public Education	4-159
PF	Paved Flume - Chutes	Construction	4-45
PP	Porous Pavement	Urban Runoff	4-84
PS	Permanent Seeding	Construction	4-32
PSC	Permanent Stream Crossing	Construction	4-57
R-PC	Riprap-Lined and Paved Channels	Construction	4-43
RD	Rock Dam	Construction	4-55
RP	Retention Ponds	Urban Runoff	4-81
RPZ	River Protection Zoning	Zoning/Land Mgt.	4-129
RR	Rock Riprap	Construction	4-36
RRSP	Reduced Road Salt Policies	Zoning/Land Mgt.	4-134
RSMP	Road Salting Management Program	Zoning/Land Mgt.	4-133
RSSF	Road Salt Storage Facility	Urban Runoff	4-92



TABLE 4.1 - BMPs AND BMP ACRONYMS FOR CROSS REFERENCING (cont.)

ACRONYMS	BMP	BMP CATEGORY	PAGE
RWD	Right-of-Way Diversions - Water Bars	Construction	4-41
S-SC	Shading and Sediment Covers	Lake Rest./Mgt.	4-154
S-WF	Sand Fence - Wind Fence	Construction	4-65
SB	Sediment Basin	Construction	4-53
SBE	Soil Bioengineering	Hyd./Habitat Mod.	4-116a
SC	Street Cleaning	Urban Runoff	4-91
SCEC	Stream Crossing Erosion Control	Forestry	4-19
SCS	Stream Channel Stabilization	Hyd./Habitat Mod.	4-114
SDF	Sand Filters	Urban Runoff	4-92a
SDI	Sod Drop Inlet Protection	Construction	4-51
SDPR	Sewage Discharge Permitting Regulations	Land Disposal	4-108
SEDR	Sediment Removal	Lake Rest./Mgt.	4-152
SEW	Public Sewerage	Land Disposal	4-107
SF	Sediment Fence - Silt Fence	Construction	4-54
SM	Shallow Marsh Creation	Urban Runoff	4-90
SOD	Sodding	Construction	4-33
SP	Structural Practices	Agriculture	4-12
SPOSCA	Strategies for Preserving Open Space/Cons. Areas	Zoning/Land Mgt.	4-123
SPR	Site Plan Review	Zoning/Land Mgt.	4-124
SR	Surface Roughening	Construction	4-27
SSD	Subsurface Drain	Construction	4-61
SSS	Structural Streambank Stabilization	Construction	4-59
SSU	Septic System Upgrading/Maintenance	Land Disposal	4-109
STEC	Skid Trail Erosion Control	Forestry	4-16
STRP	Streambank Protection	Hyd./Habitat Mod.	4-113
SUZ	Scenic Upland Zoning	Zoning/Land Mgt.	4-130
T	Topsoiling	Construction	4-28
TD	Temporary Diversions	Construction	4-38
TGE	Temporary Gravel Construction Entrance/Exit	Construction	4-30
TPP	Tree Preservation and Protection	Construction	4-29
TS	Temporary Seeding	Construction	4-31
TSC	Temporary Stream Crossing	Construction	4-56
TSD	Temporary Slope Drains	Construction	4-44
TST	Temporary Sediment Trap	Construction	4-52
TSV	Trees, Shrubs, Vines, and Ground Covers	Construction	4-34
UF	Urban Forestry	Urban Runoff	4-89
USTR	Underground Storage Tank Regulations	Zoning/Land Mgt.	4-136
UIC	Underground Injection Control	Land Disposal	4-110
VFS	Vegetative Filter Strips	Urban Runoff	4-88
VS	Vegetative Swales	Urban Runoff	4-87
VSS	Vegetative Streambank Stabilization	Construction	4-58
VTP	Vegetative and Tillage Practices	Agriculture	4-10
W-SCB	Water and Sediment Control Basin	Res. Extraction	4-103
WLB	Well Location Bylaw	Zoning/Land Mgt.	4-125
WLD	Water Level Drawdown	Lake Rest./Mgt.	4-155
WPB	Wetlands Protection Bylaw	Zoning/Land Mgt.	4-132
WQI	Water Quality Inlets	Urban Runoff	4-86
WSPZ	Water Supply Protection Zoning	Zoning/Land Mgt.	4-126





AGRICULTURAL BMPs

<u>BMP</u>	<u>Page</u>
Agricultural Management Practice (AMP)	4-8
Vegetative and Tillage Practices (VTP)	4-10
Structural Practices (SP)	4-12

Sources

Minnesota Pollution Control Agency, Division of Water Quality. 1989. "Agriculture and Water Quality: Best Management Practices for Minnesota".

U.S.D.A. Soil Conservation Service. 1989. "Field Office Technical Guide - For the Design and Description of BMPs". Amherst, MA.



Definition: *Methods of conducting agricultural operations, including practices involving nutrient management, integrated pest management (IPM), proper pesticide use and irrigation water management.*

AGRICULTURAL MANAGEMENT PRACTICE (AMP)

Purpose:

- Nutrient management involves careful management of all aspects of soil fertility so that crop needs are met while minimizing losses to surface or groundwater. Using proper rates, placement, and timing of fertilizer application can reduce nitrogen and phosphorus losses by 50 to 90 percent.

- Integrated Pest Management strategies have been developed as methods to control crop pests without total reliance on chemical pesticides. It has been estimated that current pesticide use could be reduced by as much as 40 percent with IPM programs that are now available.

- Proper pesticide use involves practices that are used to manage pesticides in a manner that will make efficient use of the chemicals and prevent contamination of surface or groundwater.

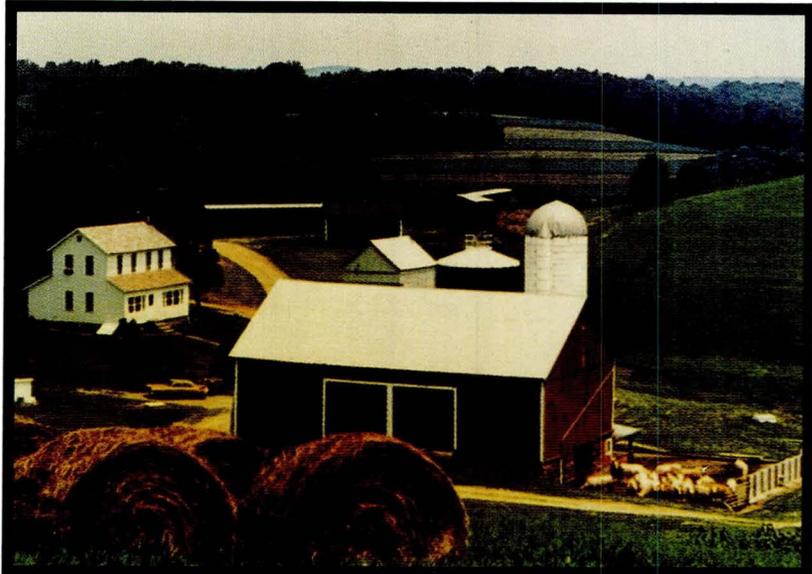
- Irrigation water management involves controlling the rate, timing, and amount of irrigation water so that crop moisture requirements are met while minimizing water losses. If water is over-applied, the excess water can cause soil erosion and leaching of nutrients and pesticides.

Conditions Where Practice Applies:

- This practice is applicable to all areas of agriculture that are presently contributing or have the potential to contribute to nonpoint source pollution from the application of fertilizers, pesticides, or irrigation water.

Planning Considerations:

- A soil test to determine nutrient levels is essential to nutrient management. Soil tests are required to determine proper fertilizer and lime requirements. Fertilizer application rates should be



calculated using the soil test results and Massachusetts Cooperative Extension recommendations. For more information on nutrient management contact your local Cooperative Extension or Soil Conservation Service Office (see Appendix A).

■ An Integrated Pest Management (IPM) program involves: identifying the specific pest; monitoring the pest population; determining the population that constitutes economic, medical, or aesthetic damage; selecting control measures with the least ecological impact; applying control measures at the appropriate times and places in the life cycle of the pest; evaluating the effectiveness of the control; and continuing population monitoring. Advice of a qualified IPM expert such as a Massachusetts Cooperative Extension specialist or crop consultant is vital for selecting IPM strategies. You can get information about IPM programs from your local Cooperative Extension Office.

■ Some planning tips concerning proper pesticide use include:

1. Minimizing groundwater and surface water contamination by **exactly following label directions**. The label's use instructions, approved by EPA, have been carefully developed after many years of study and testing.

2. Avoiding the temptation to use more product than the label directs. "**Overdosing**" will **not do a better job** of controlling the pests -- it will only increase both the cost of the pest control and the chance that the material may reach groundwater or a surface water body.

3. Creating one location as a mixing, loading, and storage area. Avoid locating loading and mixing areas near wells, high runoff areas or surface water bodies.

4. Applying pesticides when they are most effective in terms of temperature, wind, and moisture conditions.

5. Calibrating application equipment at the beginning of the growing season and then re-calibrating regularly during the growing season. The required quantity of pesticide should be carefully measured to insure proper application rates and to prevent leftover tank mixes.

6. Formulating comprehensive pest management plans that allow for safe pesticide use and reduce the potential for contamination of water resources.

7. Understanding that improper disposal of pesticide waste can cause surface or groundwater contamination. A good way to prepare containers for disposal is to pressure rinse them, returning the rinse water to the spray tank. Answers to pesticide waste disposal problems are complex. For more information about proper management of waste pesticides, contact the Massachusetts DEP-Division of Water Pollution Control or the Massachusetts Department of Food and Agriculture, Pesticide Bureau.

■ The potential for off-site movement of nutrients and pesticides to surface water and groundwater is minimized when irrigated water is applied at the proper times and in amounts that meet but do not exceed crop needs. Irrigation can be timed so that the maximum benefit is realized from pesticides and the chance of pesticide leaching is minimized. By matching irrigation water to crop needs, surface water runoff containing sediment, nutrients and pesticides during irrigation can be minimized.



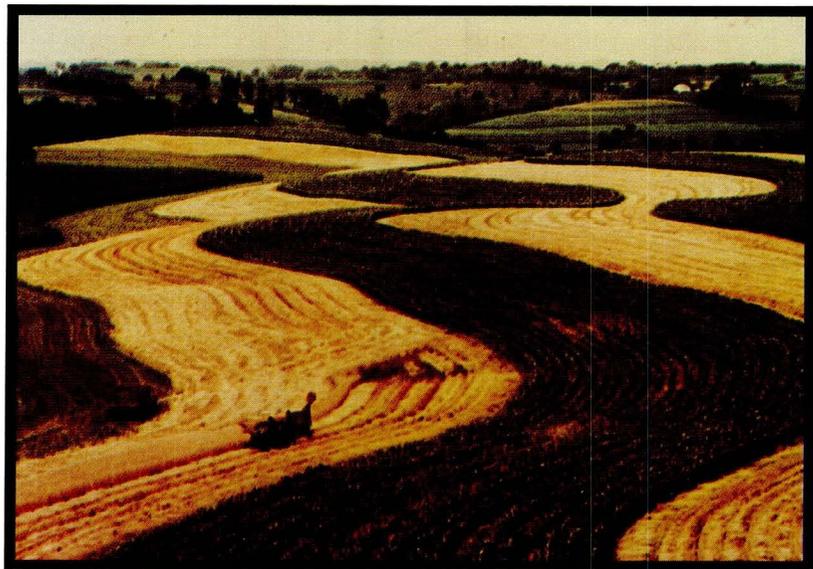
Definition: Practices applied to cropland, pastureland, and hayland to reduce erosion of soil due to water and wind by slowing the velocity of runoff water, increasing infiltration, and establishing vegetative and tree cover. Commonly used practices include conservation tillage, contour farming, stripcropping, filter strips, field borders, cover crops, crop rotation, field windbreaks, and pasture management.

VEGETATIVE AND TILLAGE PRACTICES (VTP)

Purpose:

- **Conservation tillage** is a generally inexpensive but effective practice that protects soil from wind and water erosion. Conservation tillage leaves at least 30 percent of the soil surface covered with crop residue after planting. Conservation tillage can reduce erosion rates by 40 to 60 percent.

- **Contour farming** is farming "on the level", around the slope rather than up and down the slope. Contour farming reduces erosion and increases infiltration. Contour farming can reduce erosion rates by 50 percent.



- **Stripcropping** involves planting crops in a systematic arrangement of straight or contoured strips to reduce wind or water erosion. The crops are arranged so that a strip of sod or close growing crop is alternated with a strip of row crops. Contour stripcropping on 2 to 7 percent slopes can reduce erosion by as much as 75 percent compared to farming up and down the hill.

- **Filter strips** are strips of grass or other close growing vegetation intended to remove sediment or other pollutants from runoff. They are normally planted in an area where water will pass over them as sheet flow. Sediment reductions of 30 to 50 percent can be expected for a properly designed filter strip.

- **Field borders** are strips of permanent vegetation established on the edge of a field, which help control erosion. A field border also provides some filtering of sheet flow that passes over it.

- A **Cover crop** is a crop of close growing grass, legumes, or small grain that is grown mainly to protect the soil over winter. This practice can reduce erosion by 40-60 percent.

- **Crop rotation** involves periodically changing the crops grown on a particular field. The rotation of row crops with grass or legumes can greatly reduce erosion on cropland.

■ A **Field windbreak** is a row of trees or shrubs planted in or adjacent to a field for protection from wind erosion.

■ **Pasture management** involves proper use and treatment of pasture so that the life of desirable forage species is prolonged thereby keeping the field in a good permanent vegetative cover. By preventing soil erosion on pastures, pollution from sediment and nutrients can be controlled.

Conditions Where Practice Applies:

■ This practice is applicable to all cropland, pasture land, and hayland that is presently contributing, or has the potential to contribute, to nonpoint source pollution in the normal course of agricultural activities.

Planning Considerations:

■ **Conservation tillage** must be done in conjunction with a sound nutrient and pest management program to reduce the threat to groundwater from increased infiltration. Under heavy residue conditions, well drained soils are generally better suited to conservation tillage than poorly drained soils.

■ Fields with slopes that break in many different directions are not practical for **contour farming**. Because contour farming increases the amount of infiltration, the potential for leaching of agricultural chemicals to groundwater is increased. This practice should also be done in conjunction with a sound nutrient and pest management program.

■ The width of **contour strips** are determined by the land slope and machinery widths.

■ **Filter strips** are not effective for removal of soluble nutrients or very fine suspended sediment. When used to control runoff from feedlots, filter strips can be very effective for removing solids, but only moderately effective for removing nutrients.

■ Vegetation selected for **field borders** should provide erosion control. The field border should be designed to be wide enough so that equipment can turn on it.

■ **Cover crops** are usually grown for less than one year. Cover crops should be planted as soon as possible after harvest; however, they will not be effective unless the cover has enough time to become established before winter.

■ When legumes are used in a **crop rotation**, the nitrogen formed by fixation should be taken into account when determining the nutrient needs for future crops to prevent over-application of nitrogen.

■ Plant species for **field windbreaks** should be selected that are appropriate for local soil conditions and that have a history of survival in the general area.

■ **Pasture management** involves the use of several practices or management techniques. These practices include: liming and fertilizing, rotation grazing, seasonal grazing, and weed control.



Definition: All agricultural practices requiring structural design and analysis that are to be used in all phases of farming and on all areas of agricultural land. These structural practices include: Agricultural Waste Management Systems, Runoff Management Systems, terraces, Water and Sediment Control Basins, Diversions, Livestock Exclusions (Fencing), Grade Stabilization Structures, Grassed Waterways, Streambank Protection, and Wetland Development.

STRUCTURAL PRACTICES (SP)

Purpose:

- An **Agricultural Waste Management System** is a combination of practices used temporarily to store manure and other wastes such as milk parlor wash water and feedlot runoff until they can be properly applied to cropland. Pollutant reductions of 50 to 75 percent can be achieved with these systems.

- A **Runoff Management System** is a system designed to control polluted runoff from a feedlot. If the feedlot is large and close to a lake or stream, the benefits can be significant.



- A **Terrace** is an earthen embankment that is constructed across a slope to intercept runoff. Terraces can reduce the sediment load to surface waters by as much as 90 percent.

- **Water and Sediment Control Basins** are earthen embankments constructed across a minor watercourse to form a sediment trap and detention basin. These basins can reduce suspended solids in runoff by as much as 40 to 60 percent.

- **Diversion** (See sections on Temporary Diversions (TD) (p. 4-38) and Permanent Diversions (PD) (p. 4-39) under Construction BMPs.)

- **Livestock Exclusion** involves fencing off areas where grazing would cause erosion of streambanks or allow water quality to be lowered by livestock activity in streams or lakes. Livestock exclusion can result in 50 to 90 percent reductions of suspended solids and total phosphorus originating in a stream reach.

- **Grade Stabilization Structure** (See section on Grade Stabilization Structures (GSS) (p. 4-62) under Construction BMPs.)

- A **Grassed Waterway** (See section on Grass-Lined Channels (GLC) (p.4-42) under Construction BMPs.)

■ **Streambank Protection** (See section on Vegetated Streambank Stabilization (VSS) (p. 4-58) and Structural Streambank Stabilization (SSS) (p. 4-59) under Construction BMPs.)

■ **Wetland Development** (See Shallow Marsh Creation (SM) (p. 4-90) under Urban Runoff BMPs.)

Condition Where Practice Applies:

■ This practice applies to all phases of agriculture and all agricultural lands where nonpoint source pollution from sediment, phosphorus, nitrogen, pesticides, bacteria, oxygen-demanding substances, and other pollutants, is presently, or has the potential to be, a threat to water resources.

Planning Considerations:

■ Three main considerations of an **Agricultural Waste Management System** are Waste Storage Ponds, Waste Storage Structures, and Solid Manure Storage. When a waste management structure is being considered, an overall waste management plan should be prepared. Agricultural waste management systems must be properly designed and constructed to prevent contamination of groundwater.

■ Some planning considerations of **Runoff Management Systems** consist of diversions, roof water collection and disposal, sediment basins, and vegetative filter strips. These structural considerations should be part of an overall waste management plan.

■ **Terraces** are best suited to uniform, gently to moderately sloping fields (2 to 12 percent) that have erosion problems. Terraces increase infiltration. The possible contamination of local groundwater should be considered in the planning process.

■ The adverse effects of **Water and Sediment Control Basins** on groundwater due to increased infiltration are not well documented, although they are not expected to be significant.

■ When planning a **Livestock Exclusion** system, an adequate water supply for livestock must be provided. If livestock are grazing on both sides of a stream, adequate stream crossings will also be needed.

■ **Diversions** can also be an important part of an agricultural waste system when used to prevent unpolluted runoff from entering a feedlot.

■ **Grassed Waterways** can serve as outlets for terraces or diversions as well as transport storm water across a field without erosion.

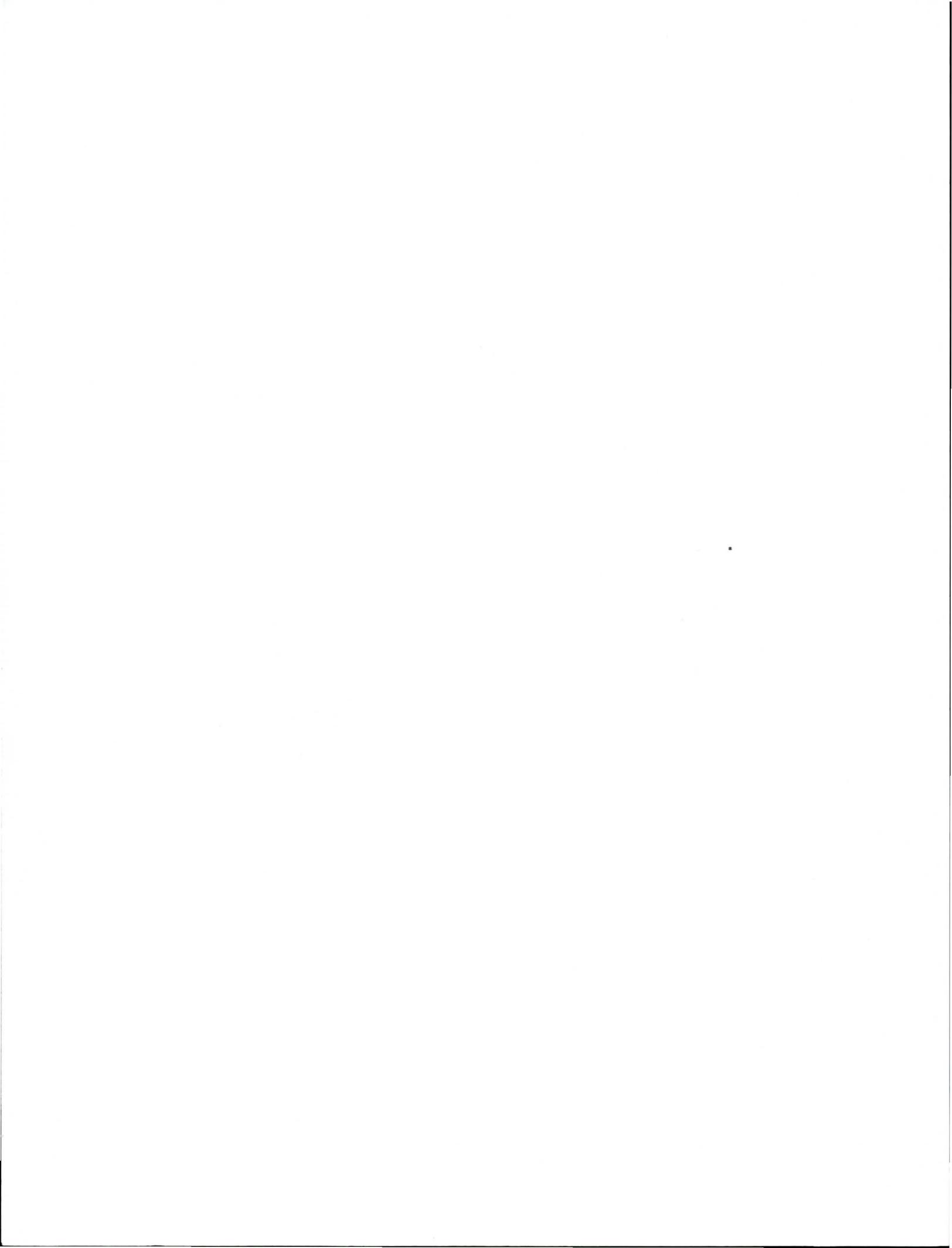
■ **Wetland Development** functions as a sediment trap; reduces peak flow rates; provides some removal of dissolved nutrients from runoff during the growing season but can become a nutrient source during other times of the year. When planning to construct a wetland for water quality benefits, the wetland surface area should be at least 3 percent of the contributing drainage area.

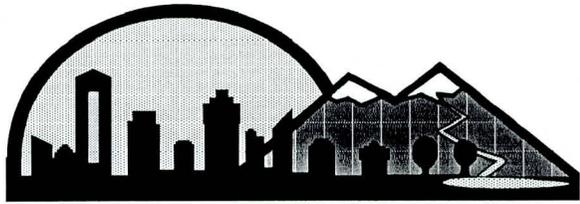
MANAGEMENT PRACTICES	POLLUTANTS								
	Sediment	Soluble Nutrients	Adsorbed Nutrients	Soluble Pesticides	Adsorbed Pesticides	O ₂ -Demanding Substances	Bacteria	Nitrogen Loss to Groundwater	Pesticide Loss to Groundwater
EFFECT OF PRACTICE									
Nutrient Mgt.	●	■	■	●	●	●	●	■	●
Integrated Pest Mgt.	●	●	●	■	■	●	●	●	■
Proper Pesticide Use	●	●	●	■	■	●	●	●	■
Irrigation Water Mgt.	□	□	□	□	●	●	●	□	□
EFFECT OF PRACTICE									
VEGETATIVE TILLAGE PRACTICES									
Conservation Tillage	■	●	■	●	■	●	●	★	★
Contour Farming	■	□	■	□	■	□	□	★	★
Stripcropping	□	□	□	□	□	□	□	●	●
Filter Strip	□	●	□	●	□	□	□	●	●
Field Border	□	●	□	●	□	□	□	●	●
Cover Crop	□	□	□	□	□	●	●	□	●
Crop Rotation	■	●	■	□	■	●	●	●	□
Field Windbreaks	□	●	□	●	□	●	●	●	●
Pasture Mgt.	□	●	□	●	●	□	□	●	●
EFFECT OF PRACTICE									
STRUCTURAL PRACTICES									
Agricultural Waste Mgt.	■	■	■	●	●	■	■	■	●
Runoff Mgt. System	■	■	■	●	●	■	■	■	●
Terrace	■	□	■	□	■	□	□	★	★
Water/Sediment Control Basin	■	●	■	●	■	□	●	★	★
Diversion	□	●	□	●	□	●	●	●	●
Livestock Exclusion	■	■	■	●	●	■	■	●	●
Grade Stabilization Structure	□	●	□	●	●	●	●	●	●
Grassed Waterway	□	●	□	●	□	●	●	●	●
Streambank Protection	■	●	■	●	●	●	●	●	●
Wetland Development	■	□	■	●	■	■	□	●	●

Adapted for Massachusetts from "Agriculture and Water Quality: Best Management Practices for Minnesota". Minnesota Pollution Control Agency, 1989.

KEY: ● - LOW EFFECT IN POLLUTANT REDUCTION ■ - HIGH EFFECT IN POLLUTANT REDUCTION
 □ - MEDIUM EFFECT IN POLLUTANT REDUCTION ★ - MAY INCREASE POLLUTANT LOADING

TABLE 4.2 - SUMMARY OF AGRICULTURAL BEST MANAGEMENT PRACTICES





FORESTRY BMPs

<u>BMP</u>	<u>Page</u>
Skid Trail Erosion Control (STEC)	4-16
Access Road Erosion Control (AREC)	4-17
Erosion Control on Landings (LEC)	4-18
Stream Crossing Sediment Control (SCEC)	4-19
Filter Strip Erosion Control (FSSC)	4-21

Sources

Kittridge, D. and M. Parker. 1989. "Massachusetts Best Management Practices: Timber Harvesting Water Quality Handbook". Massachusetts Cooperative Extension Service, Amherst, MA.



Definition: A planned approach to controlling the erosion of the forest floor by the dragging or hauling of cut logs through the harvest area.

SKID TRAIL EROSION CONTROL (STEC)

Purpose:

- To prevent erosion of the forest floor by limiting log hauling activities on certain slopes.
- To provide for a planned approach to the location and installation of water bars (shallow ditches cut across a skid trail to divert surface water runoff).

Conditions Where Practice Applies:

- In any forested area that will experience the creation of log hauling roads.
- In any forested area that will experience activities involving log hauling equipment (skidders, forwarders).

Planning Considerations:

- Avoid driving up steep slopes that are greater than 10%.
- Throw tops into wet spots and depressions rather than hauling around them; thereby limiting the total area of disturbance.
- Leave brush or limbs on skid trails after final use to slow the flow of water and prevent erosion.
- Seed disturbed areas as soon as possible after final skid trail use.
- The activity must be conducted in accordance with an approved forest cutting plan, as required under the Forest Cutting Practices Act (**MGL c. 132, § 40-46**)
- In the absence of an approved forest cutting plan or agricultural exemption under the Forest Cutting Practices Act, the activity may be regulated by the Wetlands Protection Act (**MGL c. 131, § 40**): This act requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent must file a "Determination of Applicability" or "Notice of Intent" with the local Conservation Commission.



Definition: A planned approach to controlling the erosion of the forest floor by the creation of ingress and egress routes for the movement of log hauling and associated vehicles.

ACCESS ROAD EROSION CONTROL (AREC)

Purpose:

- To establish a planned environmentally safe procedure for the creation of logging road systems.
- To establish a planned and hydraulically sound procedure for the selection of culverts for the safe, non-erosive transfer of surface water runoff.

Conditions Where Practice Applies:

- This practice pertains to all roads passable to log trucks, between a publicly maintained road and the landing, over which log trucks pass carrying forest products.



Planning Considerations:

- Avoid all grades of more than 5 percent.
- Leave crowns on all roads where possible to break up the road drainage area and to shed water to adjacent roadside ditches.
- "Broad based dips" should be used wherever possible to move water laterally and prevent erosion due to increases in amount and velocity of surface water runoff.
- Culverts may need to be placed periodically along woods roads to move water from one side of the road to the other. The Forest Cutting Practices Act (**MGL c. 132, § 40-46**) requires that adequate culverts be provided.
- The activity must be conducted in accordance with an approved forest cutting plan, as required under the Forest Cutting Practices Act (**MGL c. 132, § 40-46**)
- In the absence of an approved forest cutting plan or agricultural exemption under the Forest Cutting Practices Act, the activity may be regulated by the Wetlands Protection Act (**MGL c. 131, § 40**): This act requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent must file a "Determination of Applicability" or "Notice of Intent" with the local Conservation Commission.

Definition: A planned approach to controlling the erosion of the forest floor at any location where logs are stored and loaded to hauling vehicles.

EROSION CONTROL ON LANDINGS (LEC)

Purpose:

- To establish an environmentally safe procedure for the protection of the forest floor from erosion, during the hauling and loading process, in and around the selected landings during this stage of the harvesting operations.

Conditions Where Practice Applies:

- On any piece of forested property that is being considered for the harvesting and collection of forest products. These forest products are transported to the



landing by a skidder or forwarder, and are loaded onto a truck at this point for transportation over publicly maintained roads to a location for processing into wood products.

Planning Considerations:

- Locate the landing on gently sloping ground that has good drainage, to prevent water from ponding.
- Set the landing back at least 100 feet from streams, ponds, lakes or marshes.
- Locate water bars or diversions so as to divert water away from landings.
- After logging operations have been completed, smooth the landing prior to seeding and mulching.
- The Forest Cutting Practices Act (**MGL c. 132, § 40-46**) requires that access roads from landings be graveled or mulched to prevent erosion and to keep mud from being tracked onto public ways.
- The activity must be conducted in accordance with an approved forest cutting plan, as required under the Forest Cutting Practices Act (**MGL c. 132, § 40-46.**)
- In the absence of an approved forest cutting plan or agricultural exemption under the Forest Cutting Practices Act, the activity may be regulated by the Wetlands Protection Act (**MGL c. 131, § 40**): This act requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent must file a "Determination of Applicability" or "Notice of Intent" with the local Conservation Commission.

Definition: A planned approach to minimizing the disturbance from log hauling equipment to constantly flowing and intermittent streams and/or wetlands, from the aspect of bank erosion, bed erosion, stream redirection, and water quality.

STREAM CROSSING EROSION CONTROL (SCEC)

Purpose:

- To prevent the degradation of either permanent flow or intermittent streams and marshland from erosion and sedimentation, and/or gasoline and oil spills.
- To prevent the disturbance of stabilized stream banks.
- To restrict the number of stream crossings to an absolute minimum necessary to accomplish the required harvesting.



Conditions Where Practice Applies:

- This best management practice should be used when encountering any body of running water, including brooks and streams, which move in a definite channel in the ground and which flow within, into, or out of an area subject to protection under the **Wetlands Protection Act (MGL c. 131, § 40)**.
- This practice should also be used when a portion of the stream flows through a culvert or under a bridge.

Planning Considerations:

- Stream crossings should be avoided if at all possible.
- Good judgement should be used when planning a stream crossing. This practice should be used along with the skid road and access road best management practices.
- The Forest Cutting Practices Act (**MGL c. 132, § 40-46**) requires that all channel crossings be stabilized to prevent erosion. Some channel stabilization methods include:

1. right angle stream crossings,

2. avoidance of steep or undercut banks,
3. use of stream crossing locations with a good solid bottom,
4. use of tree tops, poles, culverts or bridges may be required for temporary crossings.

■ In the absence of an approved forest cutting plan or agricultural exemption under the Forest Cutting Practices Act, the activity is regulated by the Wetlands Protection Act (**MGL c. 131, § 40**): This act requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent must file a "Determination of Applicability" or "Notice of Intent" with the local Conservation Commission.

Definition: *Filter strip sediment control as used in conjunction with forestry practices can be defined as "An area of forest land, adjoining the bank of a water body, where no more than 50% of the basal area is cut at any one time--and where a waiting period of three years must elapse before another cut is made" (Forest Cutting Practices Regulations, 3:04 CMR 11.04). Filter strips are a common practice used in conjunction with all the categories of nonpoint source pollution. The definition of "Filter Strip Sediment Control" will vary slightly from one category to another; however, its primary purpose of sediment control is consistent.*

FILTER STRIP SEDIMENT CONTROL (FSSC)

Purpose:

- To reduce environmental damage to water bodies from the effects of sediment-laden water.
- To set aside certain areas of the forest as non-travel areas and to channelize log hauling equipment to selected set-aside crossing locations.
- To provide a last line of defense to keep sediment from getting into the stream. The vegetation and tree cover in this area slows the velocity of surface water runoff allowing for the deposition of sediment.



Conditions Where Practice Applies:

- Adjoining the banks of any water body including brooks, streams, ponds, lakes, and wetlands which could be impacted by the operations of a timber harvest program or other forest disturbing activities.

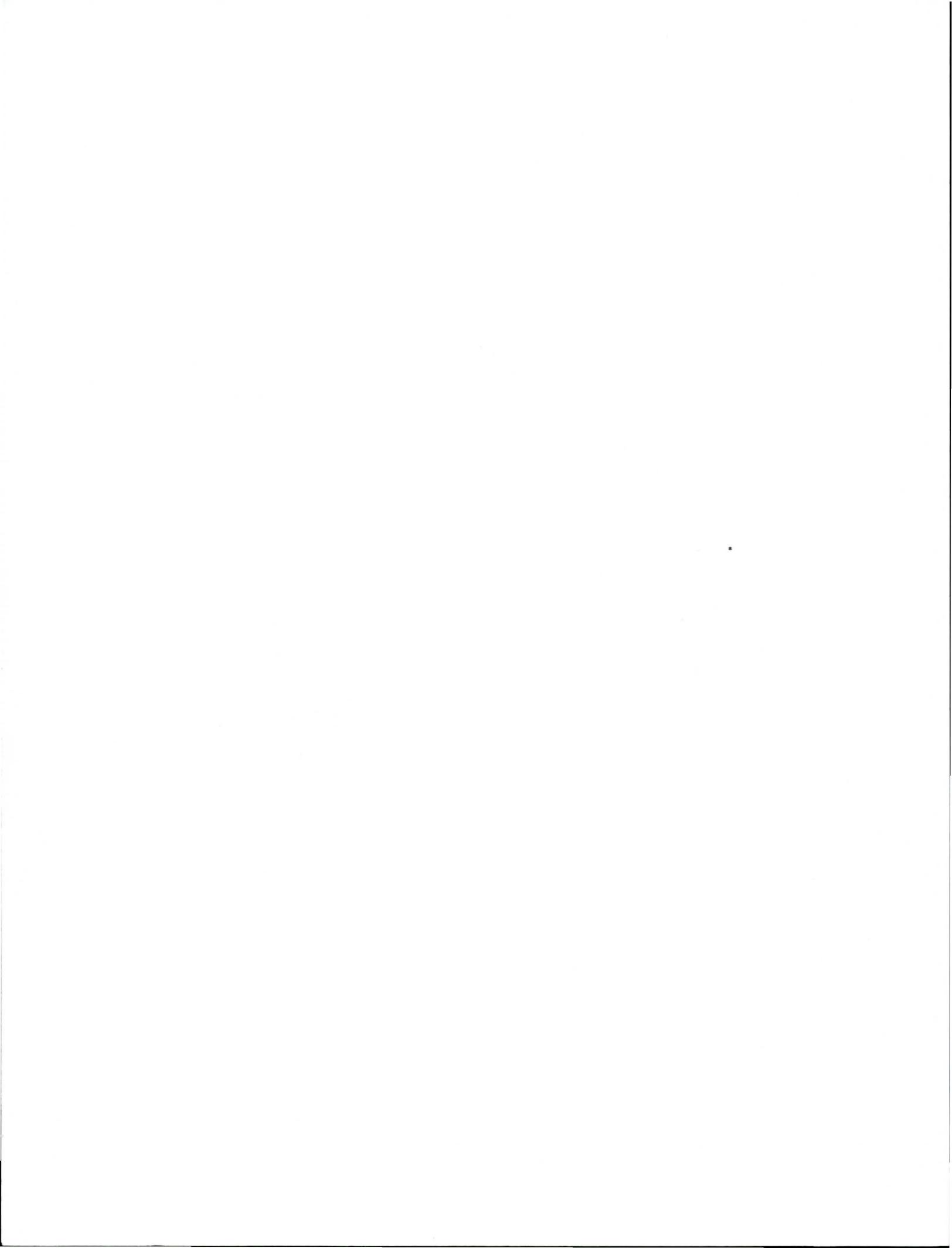
Planning Considerations:

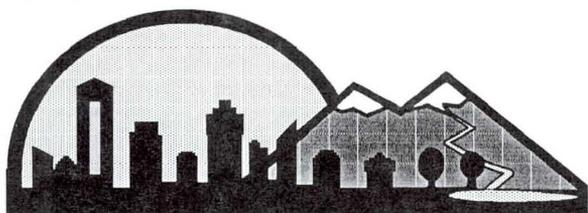
- The activity must be conducted in accordance with an approved forest cutting plan, as required under the Forest Cutting Practices Act (MGL c. 132, § 40-46).
- To prevent soil compaction, no equipment should be allowed to travel within the filter strip area. Uncompacted soil encourages percolation and minimizes rapid surface runoff in order to stop



sediment before it can enter the water body.

- The Forest Practices Cutting Act requires a filter strip of 50 feet from the bank of all water bodies. Within this filter strip area no more than 50% of the basal area is to be cut at any given time. Although not required by law, wider filter strips should be used on steeper slopes.
- Under the Massachusetts Forest Practices Cutting Act, wetlands will not be operated upon except when the ground is frozen, dry, or otherwise stable.
- In the absence of an approved forest cutting plan or agricultural exemption under the Forest Cutting Practices Act, the activity is regulated by the Wetlands Protection Act (**MGL c. 131, § 40**): This act requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent must file a "Determination of Applicability" or "Notice of Intent" with the local Conservation Commission.





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Sources

North Carolina Department of Natural Resources and Community Development, Division of Land Resources, Land Quality Section. 1988. "Erosion and Sediment Control Planning and Design Manual". North Carolina Sediment Control Commission.

U.S.D.A. Soil Conservation Service. 1989. "Field Office Technical Guide - For the Design and Description of BMPs". Amherst, MA.

Definition: *A specified work schedule that coordinates the timing of land-disturbing activities and the installation of erosion and sediment control measures.*

CONSTRUCTION SEQUENCE SCHEDULE (CSS)

Purpose:

- To reduce on-site erosion and off-site sedimentation when performing land-disturbing activities and installing erosion and sedimentation control practices in accordance with a planned schedule.

Conditions Where Practice Applies:

- All land-development projects.
- Potential statewide sediment and erosion control regulations or local bylaws may further define where practices apply.

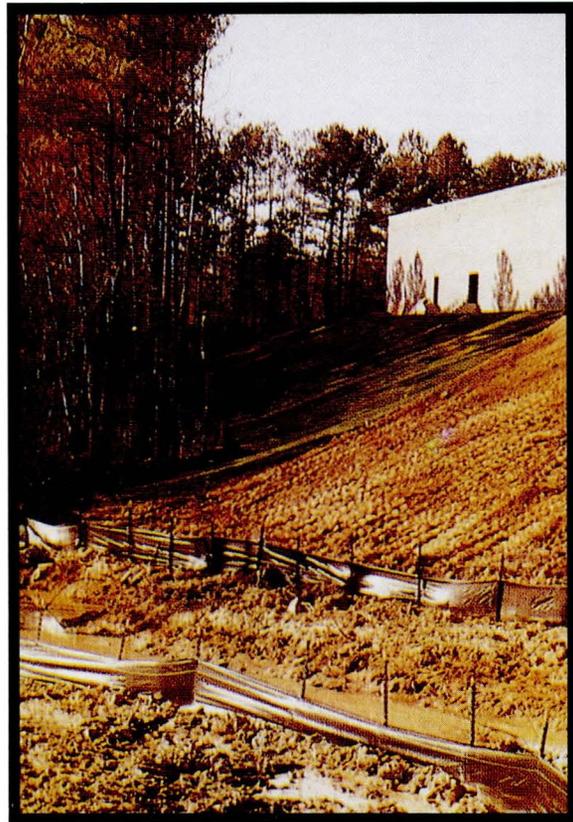
Planning Considerations:

- Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction.

- The removal of surface ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing, provide the timely installation of erosion and sediment controls, and restore protective cover quickly can significantly reduce the erosion potential of a site. The construction sequence schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.

Note: See sample erosion control plan at the end of the construction BMPs (p. 4-66). A construction sequence schedule is shown as part of this plan.



Definition: Reshaping the ground surface to planned grades as determined by engineering survey, evaluation, and layout.

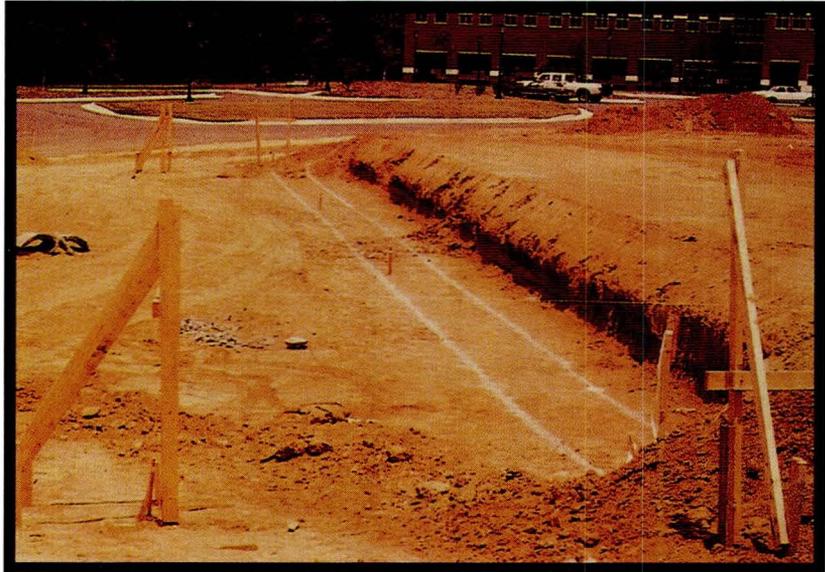
LAND GRADING (LG)

Purpose:

- To provide more suitable topography for buildings, facilities, and other land uses, to control surface runoff, and to minimize soil erosion and sedimentation both during and after construction.

Conditions Where Practice Applies:

- This practice is applicable where grading to a planned elevation is necessary and practical for the proposed development of a site and for proper operation of sedimentation control practices.



Planning Considerations:

- Fitting a proposed development to the natural configuration of an existing landscape reduces the erosion potential of the site and the cost of installing erosion and sedimentation control measures.
- The grading plan establishes drainage areas, directs drainage patterns, and affects runoff velocities. The plan should include all necessary erosion and sedimentation control measures such as sediment basins, diversions, mulching, vegetation, vegetated and lined waterways, grade stabilization structures, and surface and subsurface drains.
- The grading plan forms the basis of the erosion and sedimentation control plan. Key considerations that affect erosion and sedimentation include deciding which slopes are to be graded, when the work will start and stop, the degree and length of finished slopes, where and how excess material will be placed, and where borrow is needed.

Definition: Roughening a bare soil surface with horizontal grooves running across the slope, stair stepping, or tracking with construction equipment.

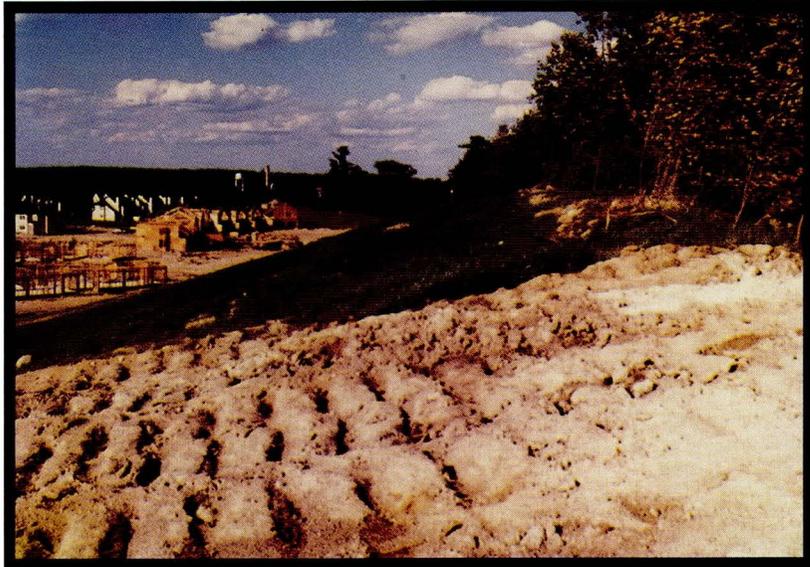
SURFACE ROUGHENING (SR)

Purpose:

- To aid the establishment of vegetative cover from seed, to reduce runoff velocity and increase infiltration, and to reduce erosion and provide for sediment trapping.

Conditions Where Practice Applies:

- All construction slopes require surface roughening to facilitate stabilization with vegetation, particularly slopes steeper than 3:1. This practice should also be done prior to forecasted storm events and before leaving a job site for a weekend.



Planning Considerations:

- Roughening a sloping bare soil surface with horizontal depressions helps control erosion by aiding the establishment of vegetative cover with seed, reducing runoff velocity, and increasing infiltration. The depressions also trap sediment on the face of the slope.
- Consider surface roughening for all slopes. The amount of roughening required depends on the steepness of the slope and the type of soil. Stable, sloping rocky faces may not require roughening or stabilization, while erodible slopes steeper than 3:1 require special surface roughening.
- Roughening methods include stair-step grading, grooving, and tracking. Equipment such as bulldozers with rippers or tractors with disks may be used. The final face of slopes should not be bladed or scraped to give a smooth hard finish.

Definition: Preserving and using topsoil to enhance final stabilization with vegetation.

TOPSOILING (T)

Purpose:

- To provide a suitable growth medium for vegetation.

Conditions Where Practice Applies:

- Where the subsoil or areas of existing surface soil present the following problems:

1. The structure, pH, or nutrient balance of the available soil cannot be amended by reasonable means to provide an adequate growth medium for the desired vegetation.
2. The soil is too shallow to provide adequate rooting depth or will not supply necessary moisture and nutrients for growth of desired vegetation.
3. The soil contains substances toxic to the desired vegetation.

- Where a sufficient supply of quality topsoil is available.
- Where slopes are 2:1 or flatter.

Planning Considerations:

- Topsoil provides the major zone for root development and biological activities for plants and should be stockpiled and used wherever practical for establishing permanent vegetation.
- Advantages of topsoil include higher organic matter and greater available water-holding capacity and nutrient content.
- Topsoiling may be required to establish vegetation on shallow soils, soils containing potentially toxic materials, very stony areas, and soils of critically low pH.
- Do not place topsoil on slopes steeper than 2:1 to avoid slippage.



Definition: Practices to preserve and protect desirable trees from damage during project development.

TREE PRESERVATION AND PROTECTION (TPP)

Purpose:

- To preserve and protect trees that have present or future value for their use in protection from erosion, for their landscape and aesthetic value, or for other environmental benefits.

Conditions Where Practice Applies:

- On development sites containing trees or stands of trees.

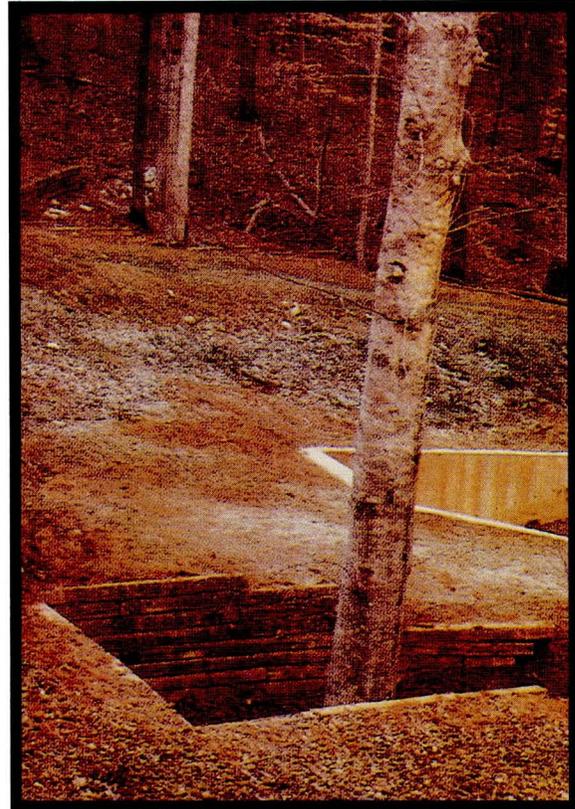
Planning Considerations:

- Preserving and protecting trees and other natural plant groups often results in a more stable and aesthetically pleasing development. Trees stabilize the soil and help to prevent erosion, decrease stormwater runoff, moderate temperature, provide buffers and screens, filter pollutants from the air, supply oxygen, provide habitat for wildlife, and increase property values.

- Some desirable characteristics to consider in selecting trees to be protected include: tree vigor, tree species, tree age, tree size and shape, and use as wildlife food source.

- Construction activities are likely to injure or kill trees unless adequate protective measures are taken. Direct contact by equipment is the most obvious problem, but damage is also caused by root zone stress from filling, excavating, or compacting too close to trees.

- Trees to be saved should be clearly marked so that no construction activity will take place within the dripline of the tree.



Definition: A graveled area or pad located at points where vehicles enter and leave a construction site.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT (TGE)

Purpose:

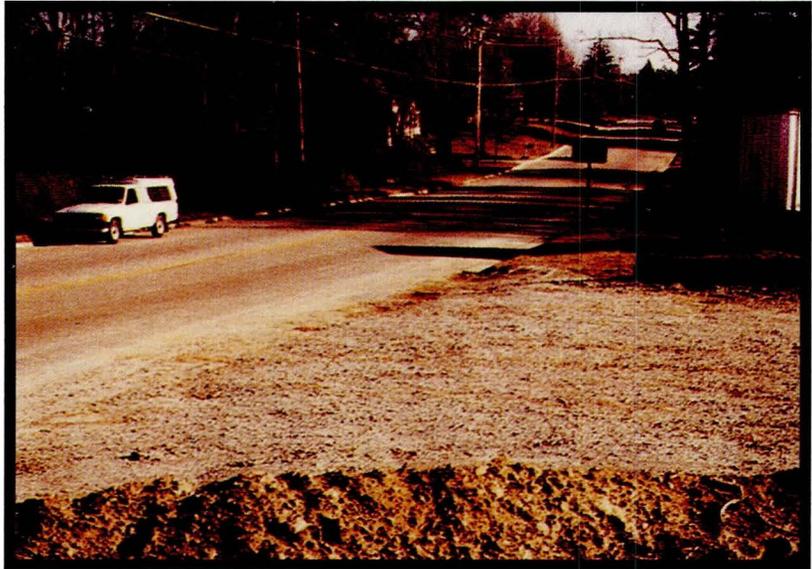
- To provide a buffer area where vehicles can drop their mud and sediment to avoid transporting it onto public roads.
- To control erosion from surface runoff.
- To help control dust.

Conditions Where Practice Applies:

- Wherever traffic will be leaving a construction site and moving directly onto a public road or other paved off-site area.
- Construction plans should limit traffic to properly constructed entrances.

Planning Considerations:

- A graveled area should be located where vehicles enter and leave a construction site to provide a buffer for the deposition of mud and sediment. This is especially important where vehicles exit construction areas directly onto public roads or other off-site paved areas.
- Make the gravel pad the full width of the construction entrance area, sufficiently long for vehicles to drop their mud and sediment and stable enough for construction traffic. Avoid entrances on steep grades or at curves in public roads.
- In some cases it may be necessary to wash vehicles tires in this area. Stabilize the graveled area well at these points and provide drainage to a sediment trap.



Definition: *Planting rapid-growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed areas.*

TEMPORARY SEEDING (TS)

Purpose:

- To temporarily stabilize denuded areas that will not be brought to final grade for a period of more than 30 working days.
- Temporary seeding controls runoff and erosion until permanent vegetation or other erosion control measures can be established.



Conditions Where Practice Applies:

- On any cleared, unvegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year. Applications of this practice include diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles.

Planning Considerations:

- Protective cover must be established on all disturbed areas within 30 days after a phase of grading is completed. Temporary seeding and mulching are the most common methods used to meet this requirement.
- Annual plants that are adapted to site conditions and that sprout and grow rapidly should be used for temporary plantings. Proper seedbed preparation and the use of quality seed are also important.
- Because temporary seedings provide protective cover for less than one year, areas must be reseeded annually or planted with perennial vegetation.
- Temporary seeding is used to protect earthen sediment control practices and to stabilize denuded areas that will not be brought into final grade for several weeks or months. Temporary seeding can provide a nurse crop for permanent vegetation, provide residue for soil protection and seedbed preparation, and help prevent dust production during construction.

Note: Contact your local Soil Conservation Service office for further assistance with temporary seeding.



Definition: Controlling runoff and erosion on disturbed areas by establishing perennial vegetative cover with seed.

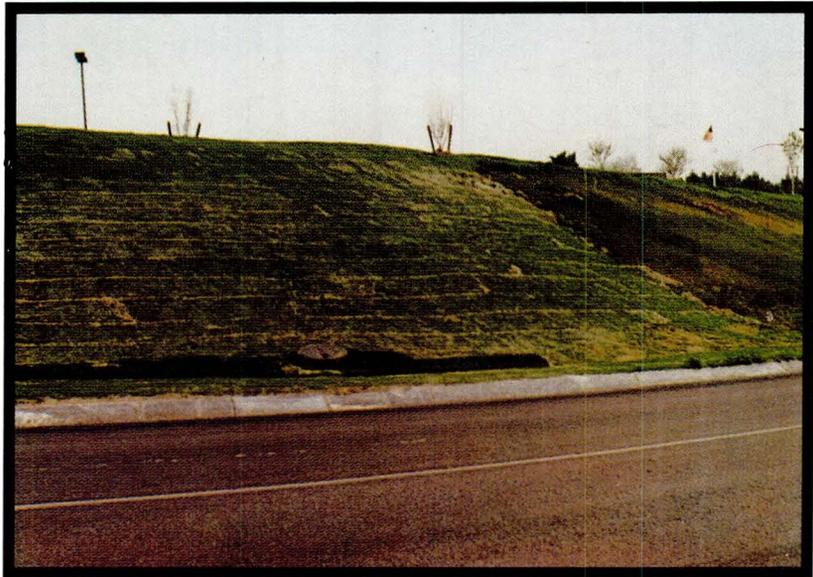
PERMANENT SEEDING (PS)

Purpose:

- To reduce erosion and decrease sediment yield from disturbed areas, and to permanently stabilize such areas in a manner that is economical, adapts to site conditions, and allows selection of the most appropriate plant materials.

Conditions Where Practice Applies:

- Fine graded areas on which permanent, long lived vegetative cover is established is the most practical or most effective method of stabilizing the soil. Permanent seeding may also be used on rough-graded areas that will not be brought to final grade for a year or more.



Planning Considerations:

- Permanent vegetation controls erosion by physically protecting a bare soil surface from raindrop impact, flowing water, and wind. Vegetation binds soil particles together with a dense root system and reduces the velocity and volume of overland flow. It is the preferred method of surface stabilization wherever site conditions permit.

- Permanent seeding of grasses and legumes is the most common and economical means of establishing protective cover. The advantages of seeding over other means of establishing plants include the relatively small initial cost, wide variety of grasses and legumes available, lower labor input, and ease of application. Problems to consider are potential for erosion during the establishment period, the need to reseed areas, seasonal limitations on seeding dates, weed competition, and the need for water during germination and early growth.

- Give special attention to selecting the most suitable plant material for the site and intended purpose. Good seedbed preparation, adequate liming and fertilization, and timely planting and maintenance are also important.

Note: See your local Soil Conservation Service office for further assistance with permanent seeding.

Definition: Permanently stabilizing areas by laying a continuous cover of grass sod.

SODDING (SOD)

Purpose:

■ To prevent erosion damage from sediment and runoff by stabilizing the soil surface with permanent vegetation where goals are:

1. to provide immediate vegetative cover of critical areas,
2. to stabilize disturbed areas with a suitable plant material that cannot be established by seed,
3. to stabilize drainageways and channels and other areas of concentrated flow where velocities will not exceed that specified for a grass lining.



Conditions Where Practice Applies:

■ Disturbed areas requiring immediate and permanent vegetative cover. Locations best suited to stabilization with sod are:

1. waterways and channels carrying intermittent flow at acceptable velocities,
2. areas around drop inlets, when the drainage area has been stabilized,
3. residential or commercial lawns and golf courses where prompt use and aesthetics are important, and
4. steep critical areas.

Planning Considerations:

■ Some advantages of sod are nearly year-round establishment capability, less chance of failure, freedom from weeds, and immediate protection of steep slopes. Disadvantages include high installation costs, especially on large areas, and the necessity for irrigation in the early weeks. Sod also requires careful handling and is sensitive to transport and storage conditions. Soil preparation, installation, and proper maintenance are as important with sod as with seed.

■ Choosing the appropriate type of sod for site conditions and intended use is of the utmost importance.

Note: See your local Soil Conservation Service office for further assistance with sodding.



Definition: Stabilizing disturbed areas by establishing a vegetative cover of trees, shrubs, vines, or ground covers.

TREES, SHRUBS, VINES AND GROUND COVERS (TSV)

Purpose:

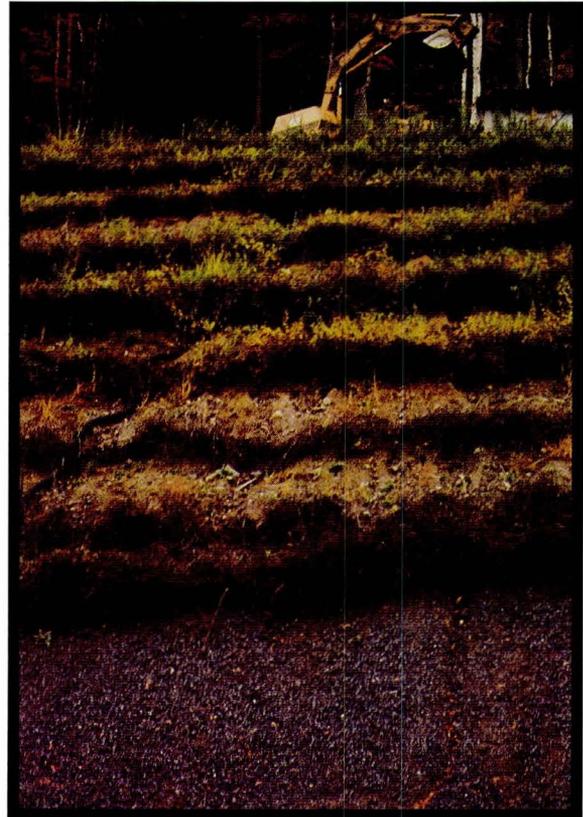
- To stabilize the soil with vegetation other than grasses or legumes.
- To provide food and shelter for wildlife.
- To provide windbreaks or screens.

Conditions Where Practice Applies:

- Trees, shrubs, vines, and ground covers may be used:
 1. on steep or rocky slopes,
 2. where mowing is not feasible,
 3. as ornamentals for landscaping purposes, or
 4. in shaded areas where grass establishment is difficult.

Planning Considerations:

- Trees, shrubs, vines, and ground covers can provide superior, low-maintenance, long-term erosion protection. They may be particularly useful where site aesthetics are important.
- There are many different species of plants from which to choose, but care must be taken in their selection. It is essential to select planting material suited to both the intended use and specific site characteristics.
- None of these plants, however, is capable of providing the rapid cover possible by using grass and legumes. Vegetative plans must include close-growing plants or an adequate mulch with all planting of trees, shrubs, vines, and ground covers.



Definition: Application of a protective blanket of straw or other plant residue, gravel, or synthetic material to the soil surface.

MULCHING (M)

Purpose:

- To protect the soil surface from the forces of raindrop impact and overland flow.
- Mulch fosters the growth of vegetation, reduces evaporation, insulates the soil, and suppresses weed growth.
- Mulch is frequently used to accent landscape plantings.

Conditions Where Practice Applies:

- Mulch should be used to protect both temporary and permanent seedings immediately after planting.
- Areas that cannot be seeded because of the season should be mulched to protect the soil surface.
- Mulch around plantings of trees, shrubs, or ground covers to stabilize the soil between plants.

Planning Considerations:

- Surface mulch is the most effective, practical means of controlling erosion on disturbed areas before establishing vegetation. Mulch protects the soil surface, reduces runoff velocity, increases infiltration, slows soil moisture loss, helps prevent soil crusting, and moderates soil temperature.
- Organic mulches such as straw, wood chips, and shredded bark are effective for general use where vegetation is to be established. A variety of mats and fabrics have been developed that make effective mulches for use in critical areas such as waterways and channels.
- Mechanical mulches such as gravel are used in critical areas where conditions preclude the use of vegetation for permanent stabilization.



Definition: *A layer of stone designed to protect and stabilize areas subject to erosion.*

ROCK RIPRAP (RR)

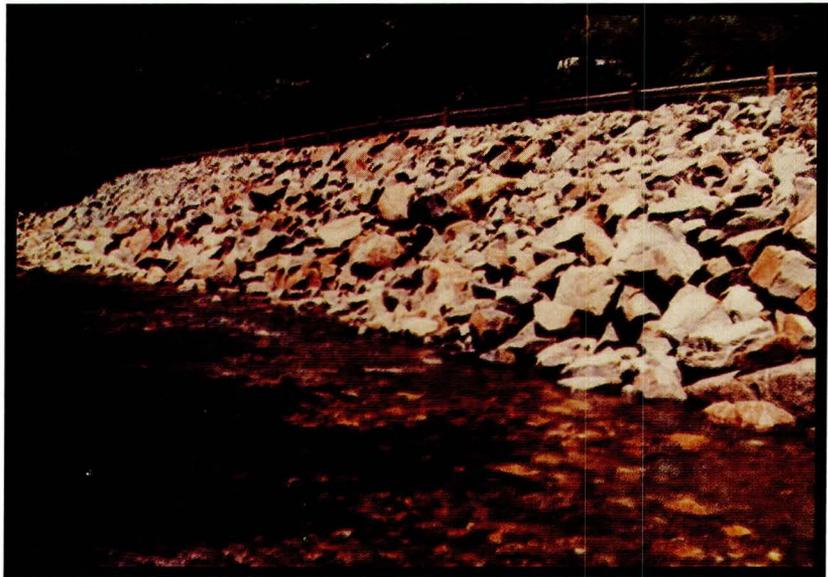
Purpose:

- To protect the soil surface from erosive forces.
- To improve stability of soil slopes that are subject to steepness, seepage or have poor soil structure.

Conditions Where Practice Applies:

- Riprap is used for the following applications:

1. cut or fill slopes subject to seepage or weathering, particularly where conditions prohibit establishment of vegetation,
2. channel side slopes and bottom,
3. inlets and outlets for culverts, bridges, slope drains, grade stabilization structures, and storm drains,
4. stream banks and stream grades,
5. shorelines subject to wave action.



Planning Considerations:

- Well graded riprap forms a dense, flexible, self-healing cover that will adapt well to uneven surfaces.
- Care must be exercised in the design so that stones are of good quality, sized correctly, and placed to proper thickness.
- Riprap should be placed on a proper filter material of sand, gravel, or fabric to prevent soil from "piping" through the stone.
- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.

Definition: *The use of adapted vegetation and mechanical means to catch and hold sand, and build or repair dunes.*

VEGETATIVE DUNE STABILIZATION (DS)

Purpose:

- To maintain a barrier dune system that protects low-lying backshore areas during storms of short duration.
- To stabilize sandy areas disturbed by construction activities.
- To protect roads, buildings, and valued areas from encroachment by blowing sand.
- To act as barriers to waves, as energy dissipaters, and as reservoirs of sand that reduce shoreline erosion during storms.



Conditions Where Practice Applies:

- On coastal dunes or in areas on barrier islands, away from the frontal dune area, where stabilization of sand is necessary.

Planning Considerations:

- Coastal dunes protect backshore areas from ocean storms, shoreline erosion, and encroachment by migrating sand. Adapted native vegetation can be used to stabilize coastal dunes and sandy areas disturbed by construction, and to rebuild frontal dunes.
- Primary considerations when planning dune grass plantings include finding a source of plant material and timing plantings so they have maximum chance of success. American beachgrass (*Ammophila breviligulata*) is excellent for initial dune stabilization.
- Sand fences accelerate sand accumulation and can be used in combination with vegetation to rebuild frontal dunes. Dune grasses grow upward through accumulating sand to hold it as the dune grows.

Definition: A temporary ridge or excavated channel or combination ridge and channel constructed across sloping land on a predetermined grade.

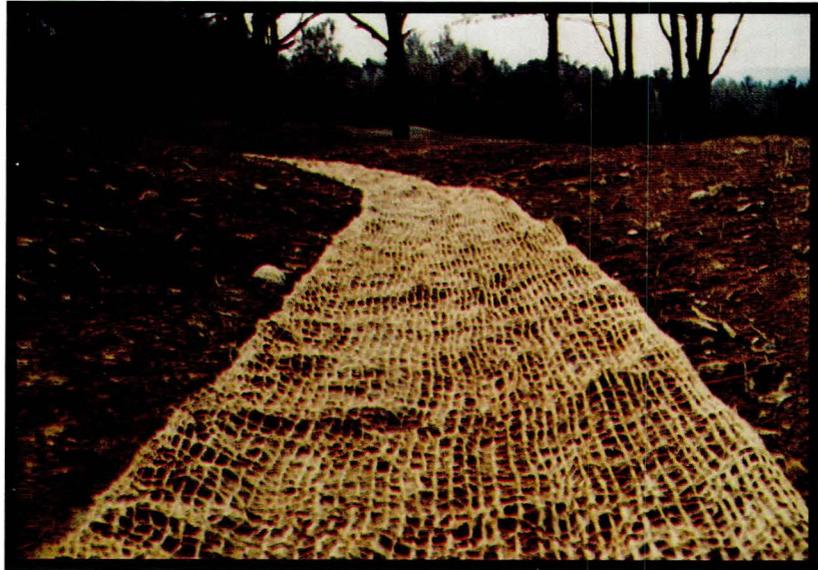
TEMPORARY DIVERSIONS (TD)

Purpose:

- To protect work areas from upslope runoff.
- To divert sediment-laden water to appropriate traps or stable outlets.

Conditions Where Practice Applies:

■ This practice applies to construction areas where runoff can be diverted and disposed of properly to control erosion, sedimentation, or flood damage. Specific locations and conditions include:



1. above disturbed existing slopes, and above cut or fill slopes to prevent runoff over the slope,
2. across unprotected slopes, as slope breaks, to reduce slope length,
3. below slopes to divert excess runoff to stabilized outlets,
4. where needed to divert sediment-laden water to sediment traps,
5. at or near the perimeter of the construction area to keep sediment from leaving the site,
6. temporary diversion may also serve as sediment traps and can be used in conjunction with a sediment fence.

Planning Considerations:

- Diversions are among the most effective and least costly practices for controlling erosion and sedimentation.
- Temporary diversions may be planned to function one year or more or may be rebuilt at the end of each day's operation to protect freshly graded cuts or fills.

Definition: A permanent ridge or channel or a combination ridge and channel constructed on a designed grade across sloping land.

PERMANENT DIVERSIONS (PD)

Purpose:

- To divert water from areas where it is in excess to locations where it can be used or released without erosion or flood damage.

Conditions Where Practice Applies:

- This permanent site development practice applies to construction areas where runoff can be diverted and used, or disposed of safely to prevent flood damage or erosion and sedimentation damage. Specific locations and conditions include:



1. above steep slopes to prevent runoff onto the slope,
2. across long slopes to reduce slope length to prevent gully erosion,
3. below steep grades where flooding, seepage problems, or sediment deposition may occur, and
4. around buildings or areas that are subject to damage from runoff.

Planning Considerations:

- Permanent diversions subdivide a development site and control the direction and velocity of runoff throughout the life of the development.
- They should be located during initial site planning and sloped and stabilized as appropriate to enhance site appearance.
- Permanent diversions may be used as temporary diversions until the site is stabilized.
- Functional need, velocity control, outlet stability, site aesthetics, and maintenance requirements are key considerations in the planning and design of permanent diversions.

Definition: A dike or dike and channel constructed along the perimeter and upslope of a disturbed construction area.

DIVERSION DIKE - PERIMETER PROTECTION (DD)

Purpose:

- To prevent storm runoff from entering the work area.
- To prevent sediment-laden water from leaving the construction site.

Conditions Where Practice Applies:

- Diversion dikes may be located at the upslope side of a construction site to prevent surface water runoff from entering the disturbed area.



- Diversion dikes may be located at the downslope side of the work area to divert sediment-laden water to on-site traps or basins.
- Diversion dikes normally do not encircle the entire construction site.
- The upslope dike can improve working conditions at the construction site by reducing the amount of water that has to be handled.
- The downslope diversion dike assures that sediment-laden water will not leave the site without treatment.

Planning Considerations:

- The diversion dike is a special application of a temporary or permanent diversion. It differs from the other diversions in that the location and grade are usually fixed, and the design cross section, method of stabilization, and outlet requirements are designed for the existing topography at the work boundary or property boundary.
- Caution must be exercised in the design to be certain that the diverted flow will not cause flood damage in adjacent areas.
- Diversion dikes must be vegetated immediately after construction and the channel area stabilized according to flow conditions.
- Frequent maintenance and immediate damage repair is of prime importance.

Definition: A ridge or ridge and channel constructed diagonally across a sloping road or utility right-of-way that is subject to erosion.

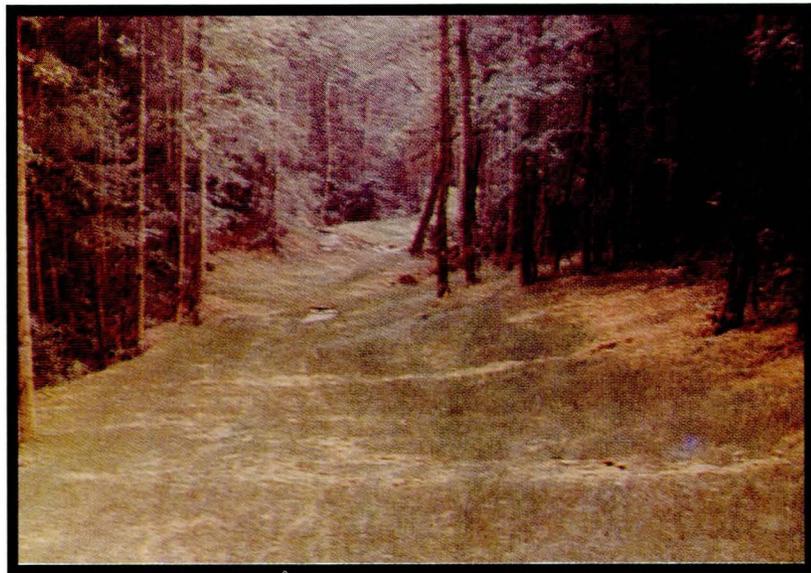
RIGHT-OF-WAY DIVERSIONS WATER BARS (RWD)

Purpose:

- To limit the accumulation of erosive volumes of water by diverting surface runoff at predesigned intervals.

Conditions Where Practice Applies:

- Where runoff protection is needed to prevent erosion on sloping access right-of-ways.
- On sloping areas generally less than 100 feet in width.



Planning Considerations:

- Narrow rights-of way on long slopes used by vehicles can be subject to severe erosion. Surface disturbance and tire compaction promote gully formation by increasing the concentration and velocity of runoff.
- Water bars are constructed by forming a ridge or ridge and channel diagonally across the sloping right-of-way. Each outlet should be stable, and should be able to handle the cumulative effect of upslope diversion outlets. The height and side slopes of the ridge and channel are designed to divert water and to allow vehicles to cross.

Definition: A channel with vegetated lining constructed to design cross section and grade for the conveyance of runoff.

GRASS-LINED CHANNEL (GLC)

Purpose:

- To convey and dispose of concentrated surface water runoff without damage from erosion, deposition, or flooding.

Conditions Where Practice Applies:

- This practice applies to construction sites where:

1. concentrated runoff will cause damage from erosion or flooding,
2. a vegetated lining can provide sufficient stability for the channel cross section and grade,
3. slopes are generally less than 5 percent, and
4. space is available for a relatively large cross section.

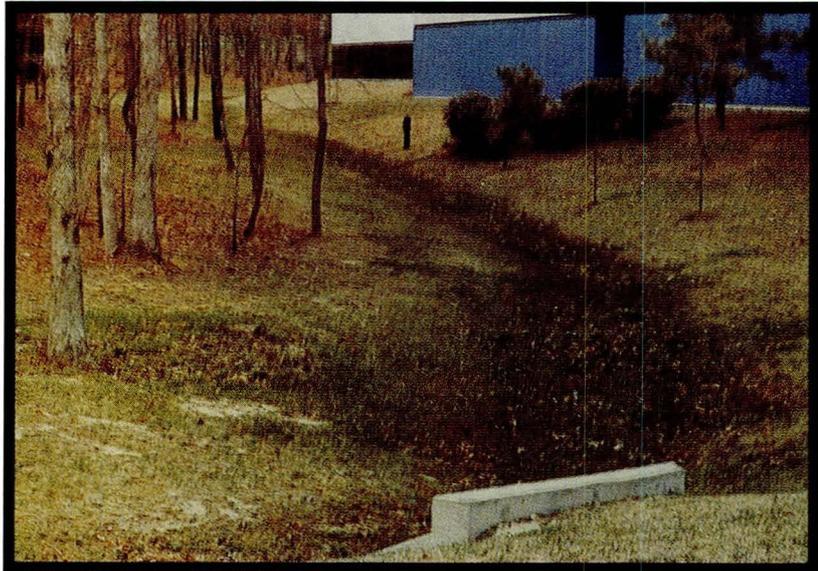
- Typical uses include roadside ditches, channels at property boundaries, and outlets for diversions.

Planning Considerations:

- Grass-lined channels resemble natural systems and are usually preferred where design velocities are suitable. Select appropriate vegetation and construct channels early in the construction schedule before grading and paving increase runoff rates.

- Generally grass-lined channels are constructed in stable, low areas to conform with the natural drainage system.

- The channel cross section should be wide and shallow with relatively flat side slopes so surface water can enter over the vegetated banks without causing erosion.



Definition: Channels with erosion resistant linings of riprap, paving, or other structural material designed for the conveyance and safe disposal of excess water.

RIPRAP-LINED AND PAVED CHANNELS (R-PC)

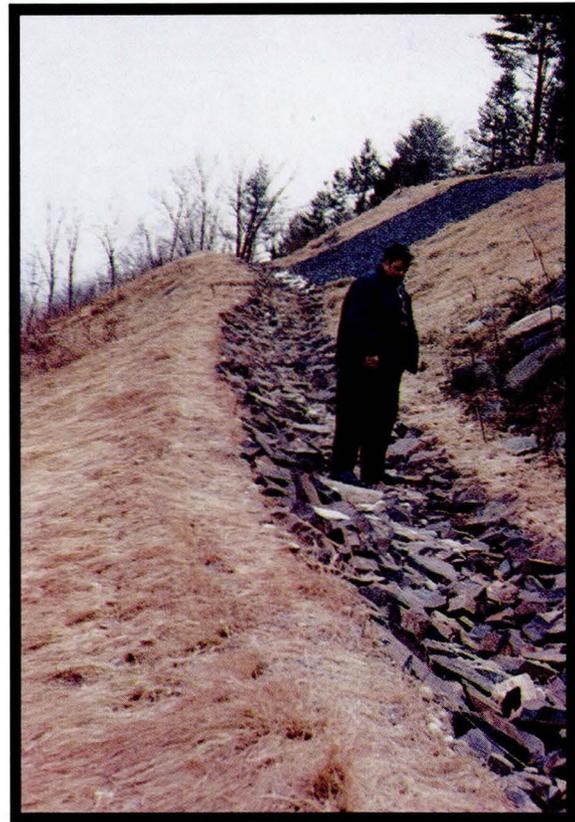
Purpose:

- To convey concentrated surface water runoff without erosion.

Conditions Where Practice Applies:

■ This practice applies where channel flow velocities exceed those acceptable for a grass lined waterway and/or conditions are unsuitable for the establishment of grass lined waterways. Specific conditions include:

1. channels where slopes over 5 percent predominate,
2. continuous or prolonged flows occur,
3. potential for damage from traffic (people or vehicles) exists,
4. soils are erodible and soil properties are not suitable for vegetative protection,
5. design velocity exceeds that allowable for a grass lined channel,
6. property value justifies the cost to contain runoff in a limited space.



Planning Considerations:

- Riprap liners are considered flexible and are usually preferred to rigid liners.
- Riprap is less costly, adjusts to unstable foundation conditions, is less expensive to repair, and reduces outlet flow velocity.
- Riprap or paved channels can be constructed with grass lined slopes where site conditions warrant.

Definition: A flexible tubing or conduit extending temporarily from the top to the bottom of a cut or fill slope.

TEMPORARY SLOPE DRAINS (TSD)

Purpose:

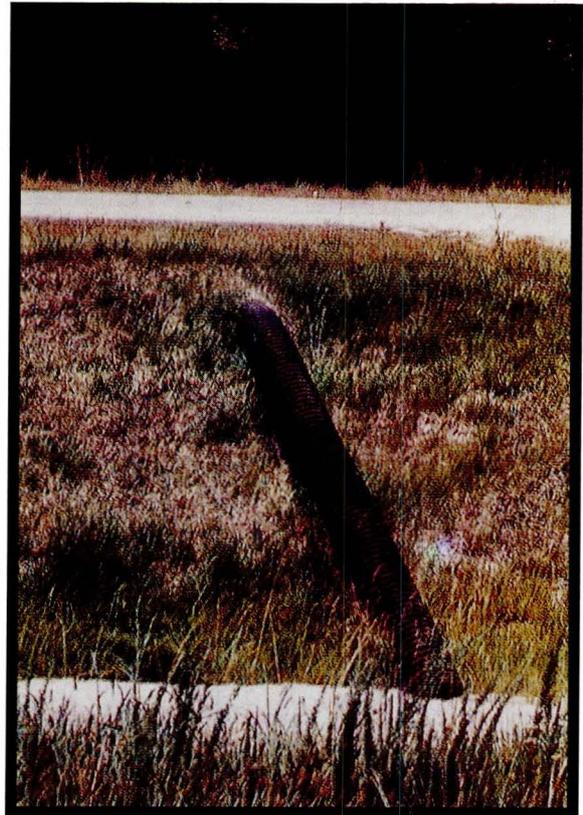
- To convey concentrated runoff down the face of a cut or fill slope without causing erosion.

Conditions Where Practice Applies:

- This practice applies to construction areas where storm water runoff above a cut or fill will cause erosion if allowed to flow over the slope.
- Temporary slope drains are generally used in conjunction with diversions to convey runoff down a slope until permanent water disposal measures can be installed.

Planning Considerations:

- Temporary slope drains are an effective gully prevention practice especially in the early stages of project development.
- It is important that these temporary structures be sized, installed, and maintained properly since their failure will usually result in severe erosion of the slope.
- Slope drains must extend downslope to stable outlets, or special outlet protection must be provided.
- Temporary slope drains should be replaced with more permanent structures as soon as construction activities permit.



Definition: A small concrete lined channel to convey water on a relatively steep slope.

PAVED FLUME - CHUTES (PF)

Purpose:

- To conduct concentrated runoff safely down the face of a cut or fill slope without causing erosion.

Conditions Where Practice Applies:

- Where concentrated storm water runoff must be conveyed from the top to the bottom of a cut or fill slope as part of a permanent erosion control system.
- Paved flumes serve as stable outlets for diversions, drainage channels, or natural drainageways that are located above relatively steep slopes.

Planning Considerations:

- Paved flumes are part of the permanent erosion control system for a development and as such should be designed early in the project and included in the construction schedule.
- Paved flumes or chutes can be readily installed in most locations, offer large capacity at low cost, are less subject to failure from blockage than closed drains, and require little maintenance.
- The upper portions of the side slopes may be grassed to improve appearance and reduce cost.



Definition: A non-erosive outlet for concentrated runoff constructed to disperse flow uniformly across a slope.

LEVEL SPREADER (LS)

Purpose:

- To convert concentrated flow to sheet flow and release it uniformly over a stabilized area.

Conditions Where Practice Applies:

- Where sediment free storm water runoff can be released in sheet flow down a stabilized slope without causing erosion.
- Where a level lip can be installed without filling.
- Where the area below the spreader lip is uniform with a slope of 10 percent or less and is stable for anticipated flow conditions, preferably well-vegetated.
- Where the runoff water will not re-concentrate after release.
- Where there will be no traffic over the spreader.

Planning Considerations:

- Level spreaders are relatively low cost structures designed to release small volumes of water safely.
- The drainage area should be limited to 5 acres, and the size of the spreader based on design runoff.
- Construct level spreaders in undisturbed soils.
- Water containing high sediment loads should enter a sediment trap before release in a level spreader.

Definition: A structure designed to control erosion at the outlet of a channel or conduit.

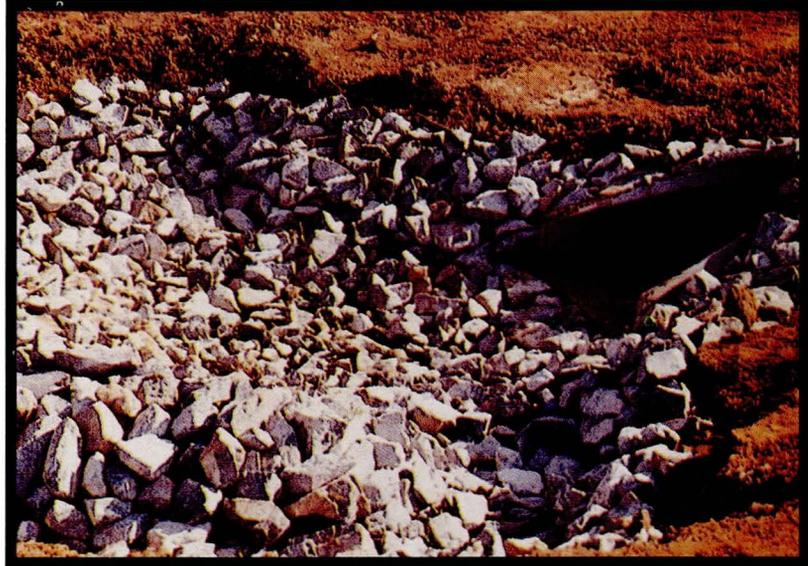
OUTLET STABILIZATION STRUCTURE (OSS)

Purpose:

- To prevent erosion at the outlet of a channel or conduit by reducing the velocity of flow and dissipating the energy.

Conditions Where Practice Applies:

- This practice applies where the discharge velocity of a pipe, box culvert, diversion, open channel, or other water conveyance structure exceeds the permissible velocity of the receiving channel or disposal area.



Planning Considerations:

- Erosion at the outlet of channels, culverts, and other structures is common and can cause structural failure with serious downstream problems.
- A riprap lined apron is the most commonly used structure for this purpose, because it has relatively low cost and can be installed easily on most sites.
- Other types of outlet stabilization structures include riprap stilling basins, concrete impact basins, and paved outlets.

Definition: An excavated area in the approach to a storm drain drop inlet or curb inlet.

EXCAVATED DROP INLET PROTECTION TEMPORARY (EDI)

Purpose:

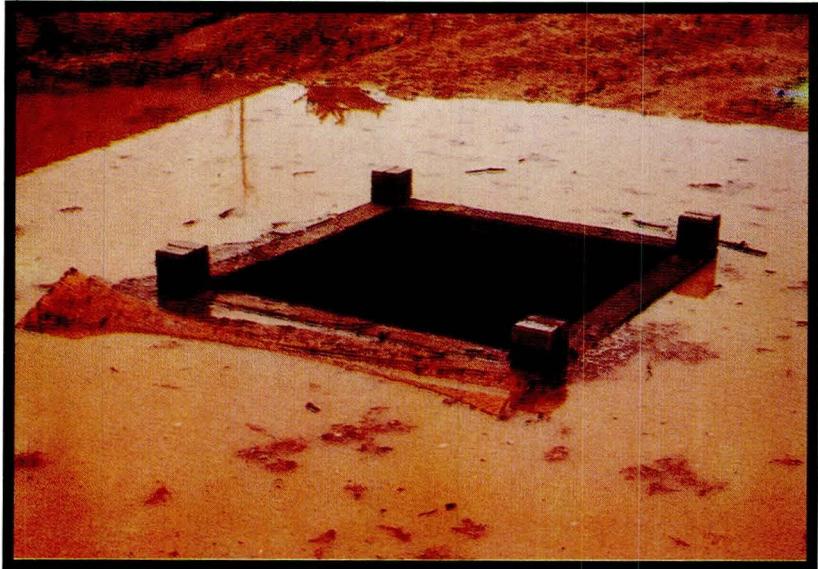
- To trap sediment at the approach to the storm drainage systems.
- This practice allows use of the permanent storm water conveyances at an early stage of site development.

Conditions Where Practice Applies:

- Where storm drain drop inlets are to be made operational before permanent stabilization of the disturbed drainage area.
- This method of inlet protection is applicable where relatively heavy flows are expected and overflow capability is needed.
- Frequent maintenance of this practice is necessary for proper functioning throughout its use.

Planning Considerations:

- The early use of storm drains during project development significantly reduces erosion problems.
- The drainage area for a protected drain should be limited to 1 acre, and the size, shape, and depth of excavation are designed for optimal sediment trapping.



Definition: A temporary device consisting of porous fabric supported by posts and placed around a drop inlet.

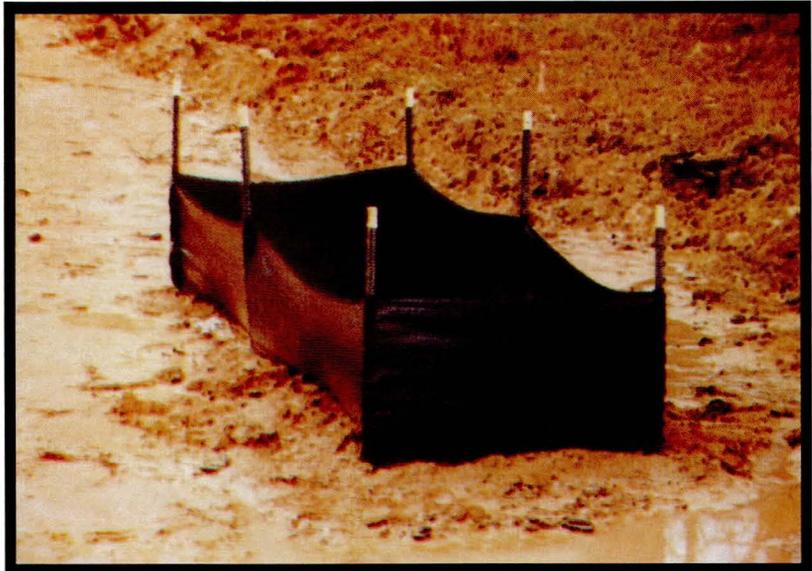
FABRIC DROP INLET PROTECTION TEMPORARY (FDI)

Purpose:

- To help prevent sediment from entering storm drains during construction operations. This practice allows for early use of the drainage system.

Conditions Where Practice Applies:

- Where storm drains are to be made operational before permanent stabilization of the disturbed drainage area.
- This method of inlet protection is effective where the inlet drains a small, nearly level area with slopes generally less than 5 percent and where shallow sheet flows are expected.
- The immediate land area around the inlet should be relatively flat (less than 1%) and located so that accumulated sediment can be easily removed.



Planning Considerations:

- This practice requires frequent maintenance particularly after storm events.
- When properly braced and sealed at the bottom, the fabric restricts flow rate, forming a sedimentation pool at the approach to the inlet. The fabric allows the pool to drain slowly, protecting the storm drain from sediment.
- This device is most effective for small, nearly level drainage areas, less than 1 acre.

Definition: A sediment control barrier formed around a storm drain inlet by the use of standard concrete block and gravel.

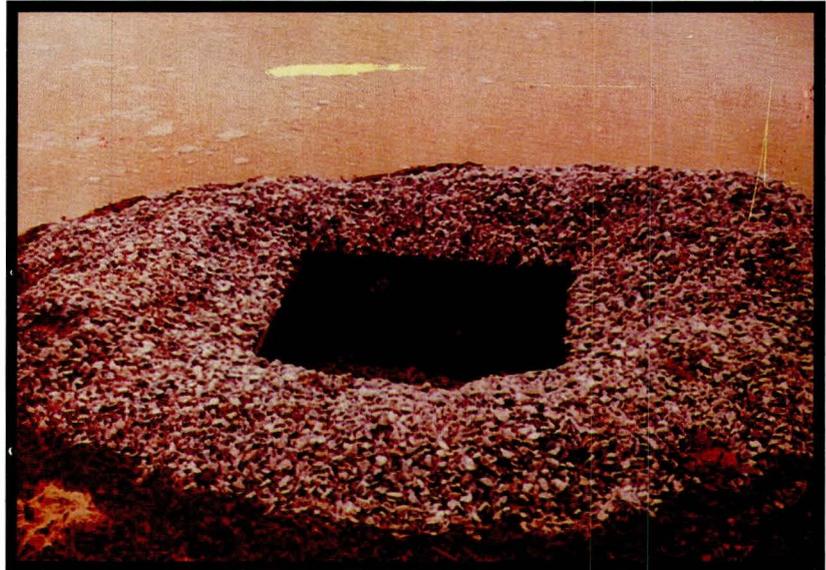
BLOCK AND GRAVEL INLET PROTECTION -TEMPORARY (BGI)

Purpose:

- To help prevent sediment from entering storm drains before stabilizing the contributing watershed. This practice allows for early use of the storm drainage system.

Conditions Where Practice Applies:

- This method of inlet protection is valuable where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area.



- This method of inlet protection applies to both drop inlets and curb inlets where heavy flows are expected and an overflow capacity is necessary to prevent excessive ponding around the structure.

Planning Considerations:

- This method uses standard concrete block and gravel to provide a small, sturdy barrier to trap sediment at the entrance to a storm drain.
- Concrete blocks are laid closely without mortar around the perimeter of the drain. Gravel is then placed around the outside of the blocks to restrict the flow and form a sediment pool. For slower drainage and therefore more settlement time, the concrete blocks could be eliminated and the device made entirely of gravel.
- Drainage area for this practice should be limited to 1 acre and pool depth should be limited to a maximum of 2 feet.
- Frequent maintenance is vital for this practice.

Definition: A permanent grass sod filter area around a storm drain drop inlet in a stabilized, well vegetated area.

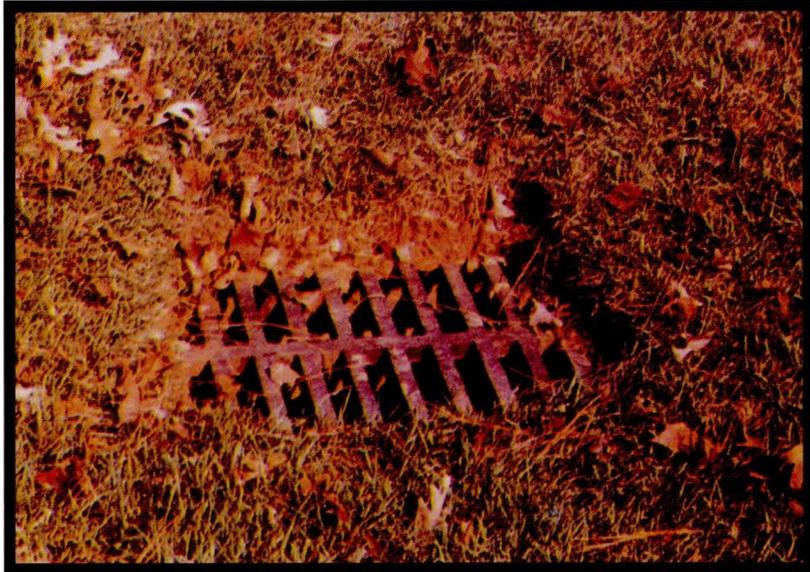
SOD DROP INLET PROTECTION (SDI)

Purpose:

- To limit sediment from entering storm drainage systems as a protection measure.

Conditions Where Practice Applies:

- This practice requires that the drainage area of the drop inlet be permanently seeded and mulched and that the immediate surrounding area remain in dense vegetation.
- This practice is well suited for lawns adjacent to large buildings.



Planning Considerations:

- Grass sod properly placed around a storm drain inlet can provide permanent stabilization of the drain entrance under certain site conditions:
 1. the drainage area should not exceed 2 acres,
 2. the entrance flow velocity must be low, and
 3. the general area around the inlet should be planned for vegetation.

Definition: A small, temporary ponding basin formed by an embankment or excavation to capture sediment.

TEMPORARY SEDIMENT TRAP (TST)

Purpose:

- To detain sediment laden runoff and trap the sediment to protect receiving streams, lakes, drainage systems, and protect adjacent property.

Conditions Where Practice Applies:

- At the outlets of diversions, channels, slope drains, or other runoff conveyances that discharge sediment laden water.
- Below areas that are 5 acres or less.
- Where access can be maintained for sediment removal and proper disposal.
- In the approach to a storm water inlet located below a disturbed area as part of an inlet protection system.

Planning Considerations:

- Locate sites where emergency bypass flow is possible during large storm events and potential damage from failure is low.
- The trap is usually formed by constructing an earthen embankment across a low area to form a sedimentation pool during rainfall-runoff events. It may also be made by excavation or a combination of excavation and fill. The outlet spillway section is constructed of stone, and provides drainage for the pool. The inside face of the outlet section is lined with gravel to slow the release of drainage water and to improve sediment trap efficiency.



Definition: *An earthen embankment suitably located to capture sediment.*

SEDIMENT BASIN (SB)

Purpose:

- To retain sediment on the construction site and prevent sedimentation in off-site streams, lakes, and drainageways.

Conditions Where Practice Applies:

- Sediment basins are needed where erosion control measures are not adequate to prevent off-site sedimentation. Specific planning guides for installation of a sediment basin are as follows:



1. Keep the drainage area less than 100 acres.
2. Ensure that basin location allows access for sediment removal and proper disposal under all weather conditions.
3. Ensure that basin location provides a convenient concentration point for sediment laden flows from the area served.
4. Keep the basin life limited to 3 years, unless it is designed as a permanent structure.
5. Locate sediment basins only in upland areas.

Planning Considerations:

- Sediment basins are usually constructed by building a low earthen dam across a drainageway to form a temporary sediment storage pool. A properly designed spillway outlet with adequate freeboard is essential.

- Sediment basins may also be formed by excavation, but these are usually more costly. A combination embankment/excavated basin is often utilized.

- Basins are located to capture sediment from as much of the disturbed area of the site as possible and should be installed before clearing and grading begin. Ease of basin cleanout and spoil disposal should be considered in site selection.

- To improve trap efficiency the basin should have the maximum surface area possible, and sediment should enter the basin as far from the outlet as possible.

Definition: A temporary sediment barrier consisting of filter fabric buried at the bottom, stretched and supported by posts.

SEDIMENT FENCE - SILT FENCE (SF)

Purpose:

- To retain sediment from small disturbed areas by reducing the velocity of sheet flows to allow sediment deposition.

Conditions Where Practice Applies:

- Below small disturbed areas less than 1/4 acre per 100 feet of fence.
- Where runoff can be stored behind the sediment fence without damaging the fence, or the submerged area behind the fence.

- Do not install sediment fences across streams, ditches, or waterways.

Planning Considerations:

- Because sediment fences are not designed to withstand high heads, the drainage area must be restricted and the fence located so that water depth does not exceed 1.5 feet at any point.
- Sediment fences may be designed to store all the runoff from the design storm or located to allow bypass flow when the temporary sediment pool reaches a predetermined level.
- Check sediment fences after each significant rainfall, remove the necessary sediment, and make repairs promptly. The design life of the sediment fence is 6 months or less.



Definition: A rock embankment located to capture sediment.

ROCK DAM (RD)

Purpose:

- To retain sediment on the construction site and prevent sedimentation in offsite streams, lakes, and drainage ways.

Conditions Where Practice Applies:

- The rock dam may be used instead of the standard sediment basin. The height of the dam should be limited to 8 feet, and drainage area should be limited to 50 acres.



- The rock dam is preferred where a stable, earthen embankment would be difficult to construct, and riprap and gravel are readily available.
- The rock dam should be located for ease in the periodic removal of sediment.
- A rock dam should not be located across a stream.

Planning Considerations:

- A rock dam is intermediate in size between the sediment basin and the sediment trap.
- The rock dam spillway is designed with a long weir crest to keep flow shallow and discharge velocities low. The inside face of the dam is lined with gravel to reduce seepage velocity and maintain a sedimentation pool during runoff events. The pool should drain slowly between runoff events.

Definition: A bridge, ford, or temporary structure installed across a stream or watercourse for short-term use by construction vehicles or heavy equipment.

TEMPORARY STREAM CROSSING (TSC)

Purpose:

- To provide a means for construction vehicles to cross streams or watercourses without moving sediment into streams, damaging the streambed or channel, or causing flooding.

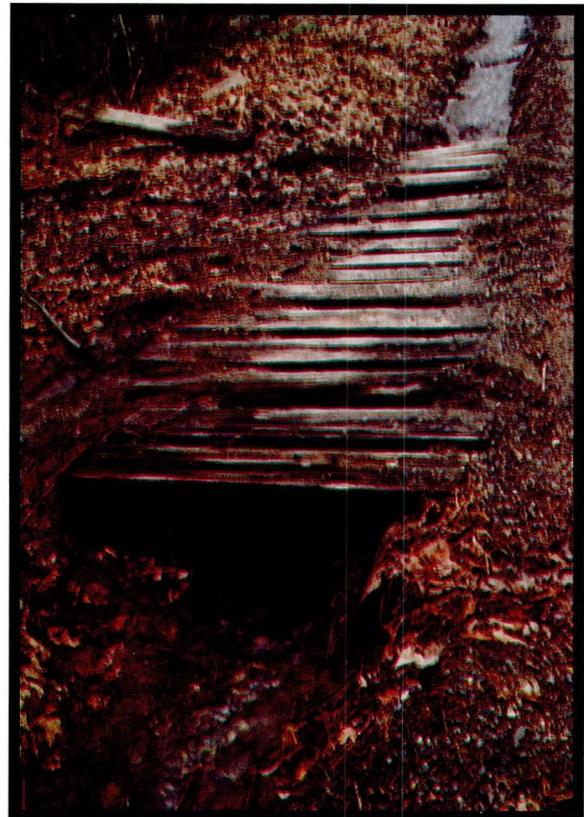
Conditions Where Practice Applies:

- Where heavy equipment must be moved from one side of a stream to another.
- Where light-duty construction vehicles must cross the stream channel frequently for a short period of time.

Planning Considerations:

- Stream crossings are of three types: bridges, culverts, and fords. In selecting a stream crossing practice consider: frequency and kind of use; stream channel conditions; overflow areas; potential flood damage; and surface runoff control.

- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.



Definition: A structure installed across a stream or watercourse.

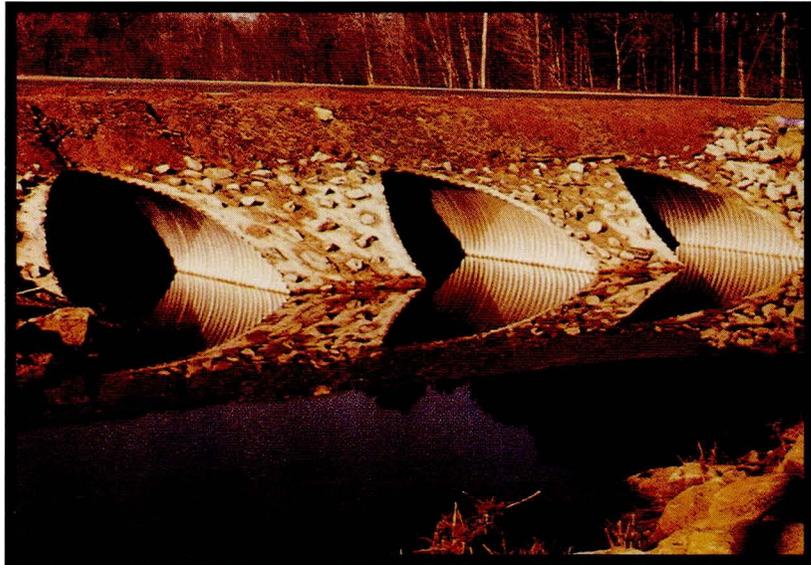
PERMANENT STREAM CROSSING (PSC)

Purpose:

- To provide a suitable means for construction and post-construction traffic to cross a watercourse.

Conditions Where Practice Applies:

- Where heavy-duty equipment and light-duty construction vehicles must be moved from one side of the stream to another or must make frequent but short period crossings.



- At suitable locations across a stream to allow post construction vehicles proper and safe access.

Planning Considerations:

- Planning considerations for permanent stream crossings are essentially the same as for temporary stream crossings except that permanent stream crossings should be subject to less frequent overflow.
- Flooding and erosion can be minimized by locating permanent stream crossings in higher, better drained stream sections.
- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.

Definition: *Stabilization and protection of eroding streambanks with selected vegetation.*

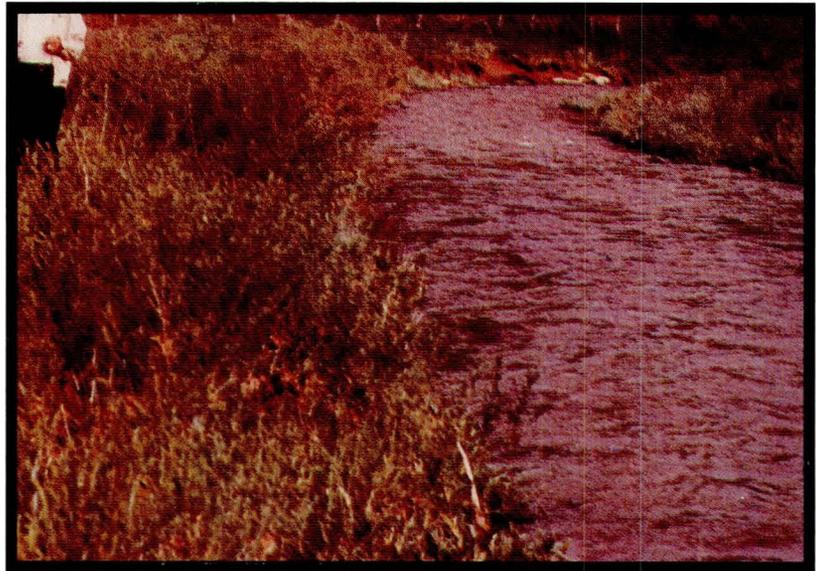
VEGETATIVE STREAMBANK STABILIZATION (VSS)

Purpose:

- To protect streambanks from the erosive forces of flowing water and provide a natural, pleasing appearance.

Conditions Where Practice Applies:

- At sections of streambanks subject to erosion from excess runoff.
- This practice is generally applicable where bankfull flow velocity does not exceed 6 ft/sec. and soils are erosion resistant. Above 6 ft/sec, structural measures are generally required.



Planning Considerations:

- Upstream development accelerates streambank erosion by increasing the velocity, frequency, and duration of flow. As a result, many natural streams that were stable become unstable following urbanization.
- Wherever possible, it is best to protect banks with living plants that are adapted to the site (soil bio-engineering). Natural plant communities are aesthetically pleasing, provide a habitat for fish and wildlife, afford a self-maintaining cover, and are less expensive and damaging to the environment.
- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.

Definition: Stabilization of eroding streambanks by the use of designed structural measures.

STRUCTURAL STREAMBANK STABILIZATION (SSS)

Purpose:

- To protect streambanks from the erosive forces of flowing water.

Conditions Where Practice Applies:

- Sections of streambank that are subject to erosion due to excessive runoff from construction activities.
- Generally applicable where flow velocities exceed 6 ft/sec or where vegetative streambank protection is inappropriate.



Planning Considerations:

- Channel reaches are often made stable by establishing vegetation where erosion potential is low and installing structural measures where the attack is more severe, such as the outside of channel bends and where the natural grade steepens.
- Riprap is the most common structural method used, but other methods such as gabions, deflectors, reinforced concrete, log cribbing, and grid pavers should be considered, depending on site conditions.
- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.

Definition: The stabilization of temporary construction access routes, on-site vehicle transportation routes, and construction parking areas.

CONSTRUCTION ROAD STABILIZATION (CRS)

Purpose:

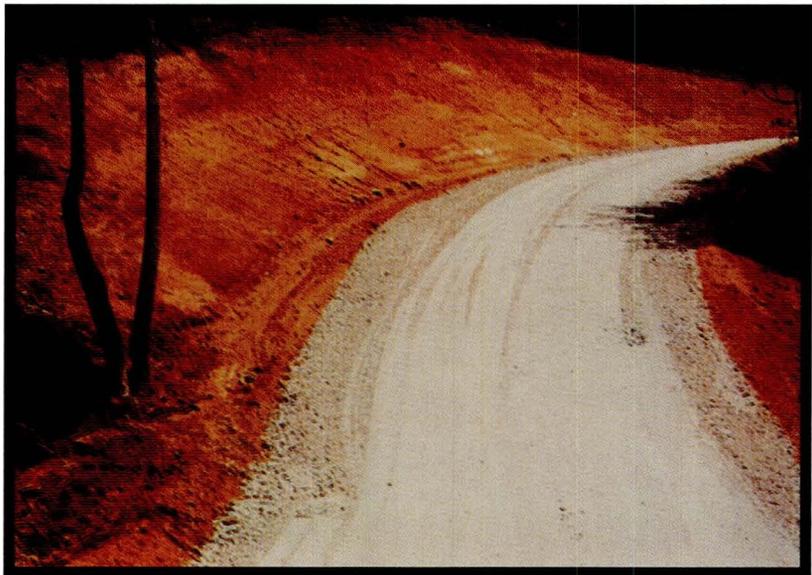
- To control erosion on temporary construction routes and parking areas.

Conditions Where Practice Applies:

- All traffic routes and parking areas for temporary use by construction traffic.

Planning Considerations:

- Ensure that construction routes follow the natural contour of the terrain where possible.
- Avoid steep slopes, excessively wet areas, and highly erodible soils.
- Controlling surface runoff from the road surface and adjoining area is a key erosion control consideration. Provide surface drainage and divert excess runoff to stable areas.
- Proper grading and stabilization of construction roads and parking areas with stone, reduces erosion, prevents dust problems, and improves the overall efficiency of the construction operation.



Definition: A perforated conduit or pipe installed to a design depth and grade below ground surface, to intercept, collect, and convey excess ground water to a satisfactory outlet.

SUBSURFACE DRAIN (SSD)

Purpose:

- To improve soil and water conditions for vegetative growth.
- To prevent sloughing of steep slopes due to ground water seepage.
- To improve stability of structures with shallow foundations by lowering the water table.



Conditions Where Practice Applies:

- The soil should have depth and sufficient permeability to permit installation of an effective drainage system at a depth of 2 to 6 feet.
- An adequate outlet for the drainage system must be available either by gravity or by pumping. The quantity and quality of discharge should not damage the receiving stream.

Planning Considerations:

- Subsurface drains (tile drainage) usually consists of perforated, flexible conduit installed in a trench at designed depth and grade. The conduit is often placed in a sand-gravel filter or gravel envelope and sized to carry the design flow. Backfill over the drain should be an open, granular soil of high permeability.
- Properly designed and installed drains require little maintenance.

Definition: A structure designed to reduce channel grade in natural or constructed watercourses.

GRADE STABILIZATION STRUCTURE (GSS)

Purpose:

- To prevent erosion of a channel that results from excessive grade in the channel bed.
- This practice allows the designer to adjust channel grade to fit soil conditions.

Conditions Where Practice Applies:

- This practice applies where structures are required to prevent head cutting or stabilize gully erosion. Specific locations are:

1. where head cutting or gully erosion is active in natural or constructed stream channels,
2. where beds of intersecting channels are at different elevations,
3. where a flatter grade is needed for stability in a proposed channel or water disposal system.

Planning Considerations:

- Grade stabilization structures may be vertical drop weir spillways, chutes, or pipe drop structures and may be made of reinforced concrete, steel sheet piling, concrete block, riprap, corrugated metal, plastic, or concrete pipe, depending on site conditions.
- These structures should be located in straight channel sections.
- Maintenance of grade stabilization structures should be minimal, but it is important that inspections be made periodically and after all major storms throughout the life of the structure.
- Wetlands Protection Act (**MGL c. 131, § 40**) -- For any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, requires that the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.



Definition: Small temporary stone dams constructed across a drainageway.

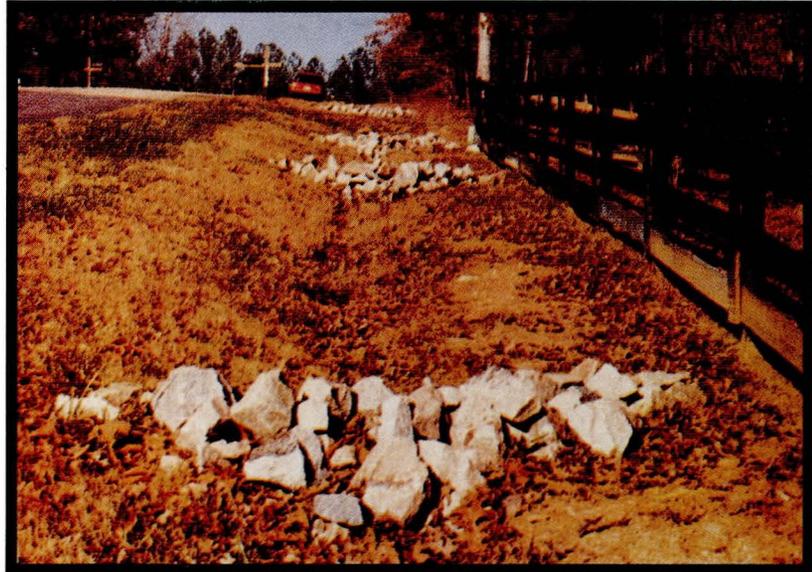
CHECK DAM (CD)

Purpose:

- To reduce erosion in a drainage channel by restricting the velocity of flow in the channel.

Conditions Where Practice Applies:

- This practice may be used as a temporary or emergency measure to limit erosion by reducing flow in small open channels.
- This practice should be used with drainage areas of 2 acres or less.
- Check dams may be used:
 1. to reduce flow in small temporary channels that are presently undergoing degradation,
 2. where permanent stabilization is impractical due to the temporary nature of the problem, and
 3. to reduce flow in small eroding channels where construction delays or weather conditions prevent timely installation of non-erosive liners.



Planning Considerations:

- Check dams are usually made of stone. The center section must be lower than the edges. The dams should be spaced so that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
- Ensure that overflow areas along the channel are resistant to erosion from out-of-bank flow caused by the check dams.
- The drainage area to a check dam should be limited to 5 acres or less.

Definition: The control of dust resulting from land disturbing activities.

DUST CONTROL (DC)

Purpose:

- To prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety problems.

Conditions Where Practice applies:

- On construction routes and other disturbed areas subject to surface dust movement and dust blowing where off-site damage occurs if dust is not controlled.



Planning Considerations:

- Large quantities of dust can be generated during land grading activities for commercial, industrial, or subdivision development, especially during dry, windy weather.
- In planning for dust control, it is important to schedule construction activities so that the least area of disturbed soil is exposed at one time.
- For disturbed areas not subject to traffic, vegetation provides the most practical and efficient means of dust control. For other areas control measures include mulching, sprinkling, spraying adhesive or calcium chloride, and wind barriers.
- Maintain dust control measures properly through dry weather periods until all disturbed areas have been permanently stabilized.

Definition: An artificial barrier of evenly spaced wooden slats or approved fabric erected perpendicular to the prevailing wind and supported by posts.

SAND FENCE - WIND FENCE (S-WF)

Purpose:

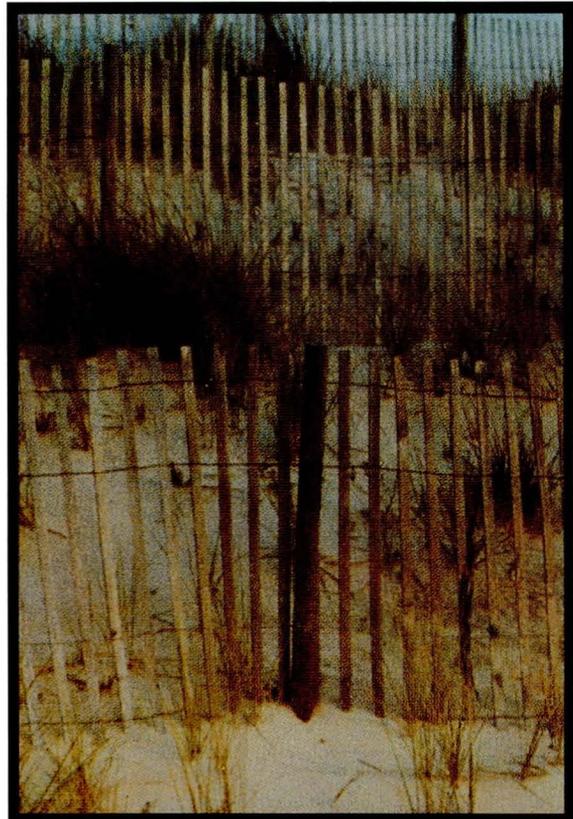
- To reduce wind velocity at the ground surface and trap blowing sand.

Conditions Where practice Applies:

- Across open bare, sandy soil areas subject to frequent winds, where the trapping of blowing sand is desired.
- Wind fences are used primarily to build frontal ocean dunes (to control erosion from wave overwash and flooding).
- Sand fences can also be used to prevent sand from blowing off disturbed areas onto roads or adjacent property.

Planning Considerations:

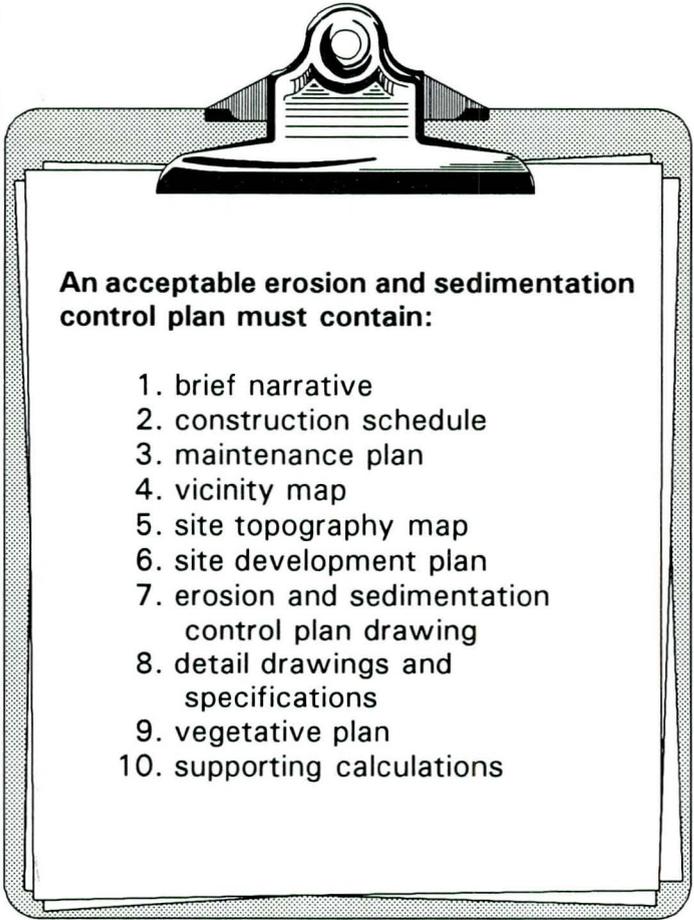
- Sand fences are usually made commercially of light wooden slats wired together with spaces between the slats. The fences are erected 2 to 4 feet high in parallel rows spaced 20 to 40 feet apart over the area to be protected. Fences are supported by wooden or metal posts.
- When wind fences are approximately two-thirds full, another series of fences is erected. In this manner, dunes can be built 2 to 6 feet high or more during a single season. When the dune has reached the approximate height of other mature dunes or when the building process slows significantly, stabilize with appropriate vegetation.



The following is a sample erosion and sedimentation control plan for the fictitious ANYTOWN, Massachusetts adapted from N.C. Dept. of Natural Resources, 1988.

SAMPLE EROSION AND SEDIMENTATION CONTROL PLAN

■ This sample plan was developed for instructive purposes only. The specific number of maps, practices, drawings, specifications, and calculations required depends on the size and complexity of the development. The designer (or town official issuing orders of conditions) should select the most practical and efficient practices to control erosion and prevent sediment from leaving the site. The plan should be organized and presented in a clear, concise manner. Sufficient design and background information should be included to facilitate review by erosion control personnel. Construction details should be precise and clear for use by an experienced general contractor.



An acceptable erosion and sedimentation control plan must contain:

1. brief narrative
2. construction schedule
3. maintenance plan
4. vicinity map
5. site topography map
6. site development plan
7. erosion and sedimentation control plan drawing
8. detail drawings and specifications
9. vegetative plan
10. supporting calculations

(Since this manual does not provide design criteria or construction standards and specifications, the following sections of the erosion and sedimentation control plan have been omitted from this sample: vicinity map, site topography map, site development plan, erosion and sedimentation control plan drawing, detail drawings and specifications for the selected practices, vegetation plan, and supporting calculations.)



SAMPLE

EROSION AND SEDIMENTATION CONTROL PLAN

ABC INDUSTRIES, INC.

ANYTOWN, MASSACHUSETTS

JULY 1990

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Detail Drawings and Specifications for Practices	(not shown)
Vegetation Plan	(not shown)
Supporting Calculations	(not shown)



NARRATIVE

■ PROJECT DESCRIPTION:

The purpose of the project is to construct two large commercial buildings with associated paved roads and parking area. Another building will be added in the future. Approximately 6 acres will be disturbed during this construction period. The site consists of a total of 11.1 acres and is located in ANYTOWN, Massachusetts.

■ SITE DESCRIPTION:

The site has rolling topography with slopes generally 4 to 6 percent. Slopes steepen to 10 to 20 percent in the northwest portion of the property where a small healed-over gully serves as the principal drainageway for the site. The site is now covered with woody vegetation, predominantly white pines, 15 to 20 feet high. There is no evidence of significant erosion under present site conditions. The old drainage gully indicates severe erosion potential and receives flow from 5 acres of woods off-site. There is one large oak tree, located in the western central portion of the property, and a buffer area, fronting Terri Road, that will be protected during construction.

■ ADJACENT PROPERTY:

Land use in the vicinity is commercial/industrial. The land immediately to the west and south has been developed for industrial use. Areas to the north and east are undeveloped and heavily wooded, primarily in white pine. Hocutt Creek, the off-site outlet for runoff discharge, is presently a well stabilized, gently-flowing perennial stream. Sediment control measures will be taken to prevent damage to Hocutt Creek. Approximately 5 acres of wooded area to the east contribute runoff into the construction area.

■ SOILS:

The soil in the project area is mapped as Paxton (see Soil Conservation Service, soil survey for your town) fine sandy loam in B and C slope classes. Paxton soils are considered moderately well to somewhat poorly drained with permeability rates greater than 6 inches/hour at the surface but less than 0.1 inches/hour in the subsoil. The subsurface is pale brown sandy loam, 6 inches thick. The subsoil consists of a pale brown and brownish yellow sandy clay loam ranging to light gray clay, 36 inches thick. Below 36 inches is a layer of fine sandy loam to 77 inches. The soil erodibility (K factor; see soil survey for an explanation) ranges from 0.20 at the surface to 0.37 in the subsoil. Due to the slow permeability of the subsoil that will be exposed during grading, a surface wetness problem with high runoff is anticipated following significant rainfall events. No groundwater problem is expected. The tight clay in the subsoil will make vegetation difficult to establish. Some topsoil exists on-site and will be stockpiled for landscaping.

■ PLANNED EROSION AND SEDIMENTATION AND CONTROL PRACTICES

1. Sediment Basin (SB)

A sediment basin will be constructed in the northwest corner of the property. All water from disturbed areas, about 6 acres, will be directed to the basin before leaving the site. (NOTE: The undisturbed areas to the east and north could have been diverted, but this was not proposed because it would have required clearing to the property line to build the diversion and the required outlet structure.)

2. Temporary Gravel Construction Entrance/Exit (TGE)

A temporary gravel construction entrance will be installed near the north-west corner of the property. During wet weather it may be necessary to wash vehicle tires at this location. The entrance will be graded so that runoff water will be directed to an inlet protection structure and away from the steep fill area to the north.

3. Temporary Block and Gravel Drop Inlet Protection (BGI)

A temporary block and gravel drop inlet protection device will be installed at the drop inlet located on the south side of the construction entrance. Runoff from the device will be directed into the sediment basin. (NOTE: The presence of this device reduces the sediment load on the sediment basin and provides sediment protection for the pipe. In addition, sediment removal at this point is more convenient than from the basin.)

4. Temporary Diversions (TD)

Temporary diversions will be constructed above the 3:1 cut slopes south of buildings A and B to prevent surface runoff from eroding these banks. (NOTE: Sediment free water may be diverted away from the project sediment basin.) A temporary diversion will be constructed near the middle of the disturbed area to break up this long, potentially erosive slope should the grading operation be temporarily discontinued. A temporary diversion will be constructed along the top edge of the fill slope at the end of each day during the filling operation to protect the fill slope. This temporary diversion will outlet to the existing undisturbed channel near the north edge of the construction site and/or to the temporary inlet protection device at the construction entrance as the fill elevation increases.

5. Level Spreader (LS)

A level spreader will serve as the outlet for the diversion east of building A and south of building B. The area below the spreader is relatively smooth and heavily vegetated with a slope of approximately 4 percent.

6. Tree Preservation and Protection (TPP)

A minimum 2 foot high protective fence will be erected around the large oak tree at the dripline to prevent damage during construction. Sediment fence materials may be used for this purpose.

7. Land Grading (LG)

Heavy grading will be required on approximately 6 acres. The flatter slope after grading will reduce the overall erosion potential of the site. The buildings will be located on the higher cut areas, and the access road and open landscaped areas will be located on fill areas.

All cut slopes will be 3:1 or flatter to avoid instability due to wetness, provide fill material, give an open area around the buildings, and allow vegetated slopes to be mowed. Cut slopes will be fine graded immediately after rough grading; the surface will be disked and vegetated according to the Vegetation Plan.

Fill slopes will be 2:1 with fill depths as much as 12 to 15 feet. Fill will be placed in layers not to exceed 9 inches in depth and compacted.

The fill slope in the north portion of the property is the most vulnerable area to erosion on the site. Temporary diversions will be maintained at the top of this fill slope at all times, and the filling operation will be graded to prevent overflow to the north. Filling will be done as a continuous operation until final grade is reached. The paved road located on the fill will be sloped to the south and will function as a permanent diversion. The area adjacent to the roads and parking area will be graded to conduct runoff to the road culverts. Runoff water from the buildings will be guttered to the vegetated channels. The finished slope face to the north will not be back-bladed. The top 2 to 6 inches will be left in a loose and roughened condition. Plantings will be protected with mulch, as specified in the Vegetation Plan.

A minimum 15 foot undisturbed buffer will be maintained around the perimeter of the disturbed area. (NOTE: This will reduce water and wind erosion, help contain sediment, reduce dust, and reduce final landscaping costs.)

8. Temporary Sediment Trap (TST)

A small sediment trap will be constructed at the intersection of the existing road ditch and channel number 3 to protect the road ditch. Approximately 2 acres of disturbed area will drain into this trap.

9. Sediment Fence (SF)

A sediment fence will be constructed around the topsoil stockpile and along the channel berm adjacent to the deep cut area, as necessary, to prevent sediment from entering the channels.

10. Sod Drop Inlet Protection (SDI)

Permanent sod drop inlet protection will replace the temporary block and gravel structure when the contributing drainage area has been permanently seeded and mulched.

11. Grass Lined Channel (GLC)

Grass lined channels with temporary straw-net liners will be constructed around buildings A and B to collect and convey site water to the project's sediment basin.

Should the disturbed areas adjoining the channels not be stabilized at the time the channels are vegetated, a sediment fence will be installed adjacent to the channel to prevent channel siltation.

12. Riprap-Lined and Paved Channels (R-PC)

A riprap channel will be constructed in the old gully along the north side of the property starting in the northwest corner after all other construction is complete. This channel will replace the old gully as the principal outlet from the site.

13. Construction Road Stabilization (CRS)

As soon as final grade is reached on the entrance road, the subgrade will be sloped to drain to the south and stabilized with a 6 inch course of 3/4 inch stone. The parking area and its entrance road will also be stabilized with 3/4 inch stone to prevent erosion and dust during the construction of the buildings and prior to paving.

14. Outlet Stabilization Structure (OSS)

A riprap apron will be located at the outlet of the three culverts to prevent scour.

15. Surface Roughening (SR)

The 3:1 cut slopes will be lightly roughened by disking just prior to vegetating, and the surface 4 to 6 inches of the 2:1 fill slopes will be left in a loose condition and grooved on the contour.

16. Surface stabilization will be accomplished with vegetation and mulch as specified in the Vegetation Plan. One large oak tree southwest of building A and a buffer area between the parking lot and Terri Road will be preserved. Roadway and parking lot base courses will be installed as soon as finished grade is reached.

17. Dust control is not expected to be a problem due to the small area of exposure, the undisturbed perimeter of trees around the site, and the relatively short time of exposure (not to exceed 9 months). Should excessive dust be generated, it will be controlled by sprinkling.

CONSTRUCTION SCHEDULE

1. Obtain plan approval and other applicable permits.
2. Flag the work limits and mark the oak tree and buffer area for protection.
3. Hold a pre-construction conference at least one week prior to starting construction.
4. Install the sediment basin as the first construction activity.
5. Install the storm drain with the block and gravel inlet protection at the construction entrance/exit.
6. Install the temporary gravel construction entrance/exit.
7. Construct the temporary diversions above the proposed building sites. Install the level spreader and sediment trap and vegetate disturbed areas.
8. Complete site clearing except for the old gully in the northwest portion of the site. This area will be cleared during the last construction phase for the installation of the riprap channel.
9. Clear the waste disposal area in the northeast corner of the property, only as needed.
10. Rough grade site, stockpile topsoil, construct channels, install culverts and outlet protection, and install sediment fence as needed. Maintain diversions along the top of the fill slope daily.
11. Finish the slopes around the buildings as soon as rough grading is complete. Leave the surface slightly roughened and vegetate and mulch as soon as possible.
12. Complete the final grading for roads and parking and stabilize with gravel.
13. Complete the final grading for the buildings.
14. Complete the final grading of grounds, topsoil critical areas, and permanently vegetate, landscape, and mulch.
15. Install the riprap outlet channel and extend riprap to pipe outlet under entrance road.
16. After the site is stabilized, remove all temporary measures and install permanent vegetation on the disturbed areas.
17. Estimated time before final stabilization is 9 months.

MAINTENANCE PLAN

1. All erosion and sediment control practices will be checked for stability and operation following every runoff-producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.
2. The sediment basin will be cleaned out when the level of sediment reaches 2 feet below the top of the riser. Gravel will be cleaned or replaced when the sediment pool no longer drains properly.
3. Sediment will be removed from the sediment trap and block and gravel inlet protection device when storage capacity has been approximately 50 percent filled. Gravel will be cleaned or replaced when the sediment pool no longer drains properly.
4. Sediment will be removed from behind the sediment fence when it becomes about 1/2 foot deep at the fence. The sediment fence will be repaired as necessary to maintain a barrier.
5. All seeded areas will be fertilized, reseeded as necessary, and mulched according to specifications in the Vegetation Plan to maintain a vigorous, dense vegetative cover.

■ NOTE:

The appropriate official from Anytown, Massachusetts should conduct regular (weekly or bi-weekly) inspections of the site and BMPs to ensure proper functioning. Orders should be issued if any BMP is observed to be malfunctioning or incorrectly built.

Table 4.3 is a guide for selecting construction best management practices to control sediment for differing construction considerations and site characteristics. (N.C. Dept. Nat'l Res., 1988)

SELECTION GUIDE TO CONSTRUCTION BMPs

Table 4.3 - Selection Guide to Construction Best Management Practices

Construction Considerations	Site Characteristics	Principal Control Practices
Installing Access Routes/ Controlling Road Runoff	Slopes < 5%	<p>Site Preparation</p> <ul style="list-style-type: none"> -tree preservation -construction entrance/exit -road stabilization <p>Surface Stabilization</p> <ul style="list-style-type: none"> -temporary seeding -mulching -riprap <p>Runoff Control</p> <ul style="list-style-type: none"> -temporary diversions -water bars <p>Runoff Conveyance</p> <ul style="list-style-type: none"> -all practices <p>Outlet Protection</p> <ul style="list-style-type: none"> -outlet stabilization <p>Inlet Protection (storm drains)</p> <ul style="list-style-type: none"> -excavated -fabric -block and gravel
	Slopes 5-12%	<p>same as above except:</p> <p>Runoff Conveyance</p> <ul style="list-style-type: none"> -riprap/paved channels -not recommended: grass lined channel



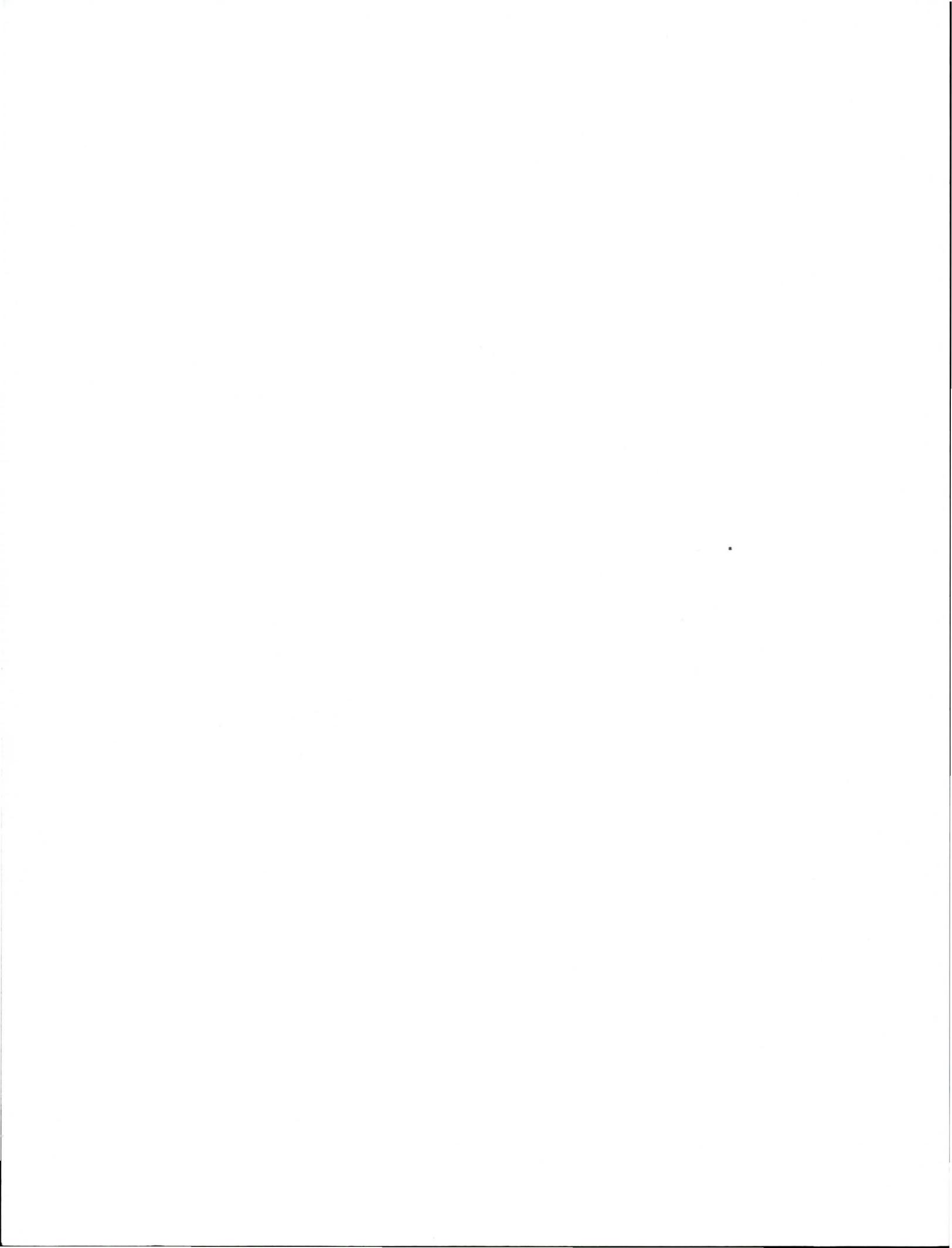
Construction Considerations	Site Characteristics	Principal Control Practices
Sediment Retention (measures installed before major land disturbances begin)	Disturbed areas < 2 acres Disturbed areas 2-5 acres Disturbed areas > 5 acres	Sediment Traps/Barriers -temporary sediment trap -sediment fence Sediment Traps/Barriers -temporary sediment trap -sediment basin -rock dam Sediment Traps/Barriers -sediment basin -rock dam
Runoff Disposal	Slopes < 5% Drainage area < 20 acres Slopes > 5% Drainage area < 20 acres Drainage area > 20 acres	Runoff Conveyance -all practices Outlet Protection -all practices Inlet Protection (storm drains) -all practices Runoff Control Measures -all practices same as above except: Runoff Conveyance -riprap paved channels -not recommended: grass-lined channels Special Considerations
Stabilizing Streambanks	Design Velocity < 6 ft/sec Design Velocity > 6 ft/sec	Stream Protection -vegetated streambank stabilization. Stream Protection -structural streambank stabilization.

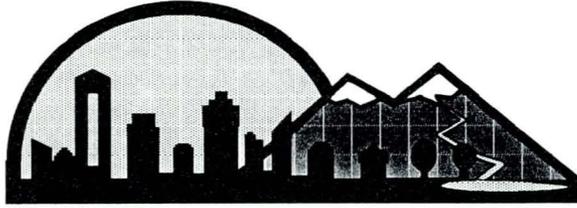


Construction Considerations	Site Characteristics	Principal Control Practices
Borrow and Waste Disposal/ Topsoil Piles	Disturbed Areas	Surface Stabilization -temporary seeding -permanent seeding -trees, shrubs, vines -mulching Runoff Control -temporary diversions Sediment Traps/Barriers -temporary sediment trap -sediment trap
Special Site Problems	Seepage Areas/ High Water Table Unstable Temporary Channels Unstable Permanent Channels Rill and Gully Erosion Blowing Dust or Sand Dune Reinforcement/Stabilization	Other Related Practices -subsurface drainage Other Related Practices -check dams Runoff Conveyance -riprap/paved channels Other Related Practices -grade stabilization structure Runoff Control -all practices Runoff Conveyance -riprap/paved channels -temporary slope drains -paved flumes Outlet Protection -outlet stabilization structure Surface Stabilization -all practices Other Related Practices -dust control -sand fence Surface Stabilization -vegetated dune stabilization Other Related Practices -sand fence



Construction Considerations	Site Characteristics	Principal Control Practices
Final Site Stabilization	Disturbed Areas	<p>Surface Stabilization</p> <ul style="list-style-type: none"> -permanent seeding -sodding -trees, shrubs, vines -mulching -riprap <p>Runoff Control</p> <ul style="list-style-type: none"> -permanent diversions <p>Runoff Conveyance</p> <ul style="list-style-type: none"> -grass-lined channels -riprap/paved channels -paved flume <p>Outlet Protection</p> <ul style="list-style-type: none"> -outlet stabilization structure <p>Inlet Protection</p> <ul style="list-style-type: none"> -sod drop inlet protection





URBAN RUNOFF BMPs

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Road Salt Storage Facility (RSSF)	4-92
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Schueler, T.R. 1987. "Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs". Metropolitan Washington Council of Governments, Washington, D.C.

Schueler, T.R., P.A. Kumble and M.A. Heraty. 1992. "A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zone". Anacosta Restoration Team. Metropolitan Washington Council of Governments, Washington, D.C.

New Jersey Department of Environmental Protection. 1981. "New Jersey Stormwater Quantity/Quality Management Manual".

Massachusetts Department of Environmental Protection. 1985. "Road Salts and Water Supplies - Best Management Practices". Boston, MA.



Definition: An earthen embankment or excavated pond whose main purposes are the temporary detention of stormwater to control peak runoff rates and for the settlement of particulate pollutants.

DETENTION PONDS (DP)

Purpose:

- Effective means of removing pollutants by settling.
- Control of downstream bank erosion due to reduced velocities.
- Can be applied in most new development situations.
- 60-70% of urban sediments settle out within the first 6 hours of detention.
- 40-50% of the total phosphorus can settle out within the first 6 to 8 hours of detention.



- 40-50% of the total organic matter can settle out within the first 6 to 8 hours of detention.
- Approximately 75% of trace metals can settle out within the first 6 to 8 hours of detention.
- 60-70% of all hydrocarbons can settle out within the first 6 to 8 hours of detention.

Conditions Where Practice Applies:

- Located in upland areas; down gradient of a development and up gradient to a stream or pond.

Planning Considerations:

- If stormwater is detained for 24 hours or more, as much as 90% removal of pollutants by settlement is possible.
- Degree of removal of pollutants can be increased if inundated area of the pond is managed as a shallow marsh.
- Occasional nuisance problems in the form of odor, debris, and weeds may arise.
- Can be a moderate to high maintenance item for the responsible party (sediment removal, erosion, vegetation, etc.).
- Removal is high if the pollutant is in particulate form; removal is low if the pollutant is in soluble forms (nitrogen).
- Every detention pond should be accompanied by a landscaping plan.

Definition: An earthen embankment or excavated pond that usually contains a permanent pool whose main purpose is the retention of storm water runoff and for the settlement of particulate pollutants.

RETENTION PONDS (RP)

Purpose:

- An extremely effective water quality best management practice.
- High removal rate of sediment, BOD, organic nutrients, and trace metals.
- Can remove soluble nutrients through the use of aquatic plants and algae.
- Permanent pool reduces the occurrence of resuspension of already settled out particles.



Conditions Where Practice Applies:

- Located in upland areas; down gradient of a development and up gradient to a stream or pond.

Planning Considerations:

- Perhaps more than any other BMP, these ponds require careful planning and thoughtful design, and regular maintenance.
- Larger retention ponds remove pollutants better than smaller ones.
- Can be an attractive feature in well-planned residential communities.
- Can be an attractive habitat for fish and wildlife.
- Occasional nuisance problems in the form of odor, debris, and weeds may arise.
- Can be a moderate to high maintenance item for the responsible party (sediment removal, erosion, vegetation, etc.).
- The management/maintenance plan should include measures to prevent mosquito breeding.
- Can be a safety liability for the responsible party.
- Every retention pond should be accompanied by a landscaping plan.

Definition: A shallow excavated trench, generally 2 to 10 feet in depth backfilled with a coarse stone aggregate, which allows for temporary storage of urban storm water runoff.

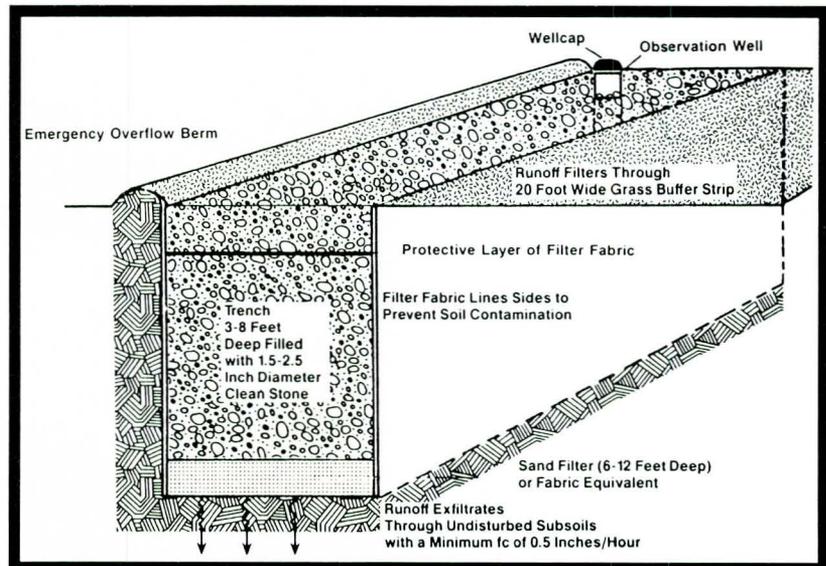
INFILTRATION TRENCHES (IT)

Purpose:

- Effective for the removal of both soluble and particulate pollutants.
- Can provide groundwater recharge by diverting 60-90% of annual urban runoff back into the soil.

Conditions Where Practice Applies:

- Generally used on relatively small drainage areas or in combination with other methods.



Schueler, 1987

- Can be used on residential lots (dry wells, etc.), commercial areas, parking lot perimeters, and highway median strips.
- One of the few BMPs that provide pollutant removal on small sites.

Planning Considerations:

- Not intended to trap coarse sediments- will cause clogging of the system.
- Grass buffers or similar schemes must be installed in association with this practice to capture coarse sediments.
- Generally limited to drainage areas of 5 to 10 acres.
- Only feasible when soils are permeable (i.e., sand and gravel) and the water table and bedrock are situated well below the bottom of the trench.
- Trench must be completely replaced if it has become severely clogged. Critical period exists during the construction phase of the project.
- Possible risk of groundwater contamination from very soluble pollutants such as nitrates, chlorides, and gasoline.

Definition: A water impoundment made by constructing an earthen embankment or by excavating down to relatively permeable soils (sands and gravels).

INFILTRATION BASINS (IB)

Purpose:

- To temporarily store urban storm water runoff.
- To increase ground water recharge.
- Effective in removing both soluble and fine particulate pollutants.

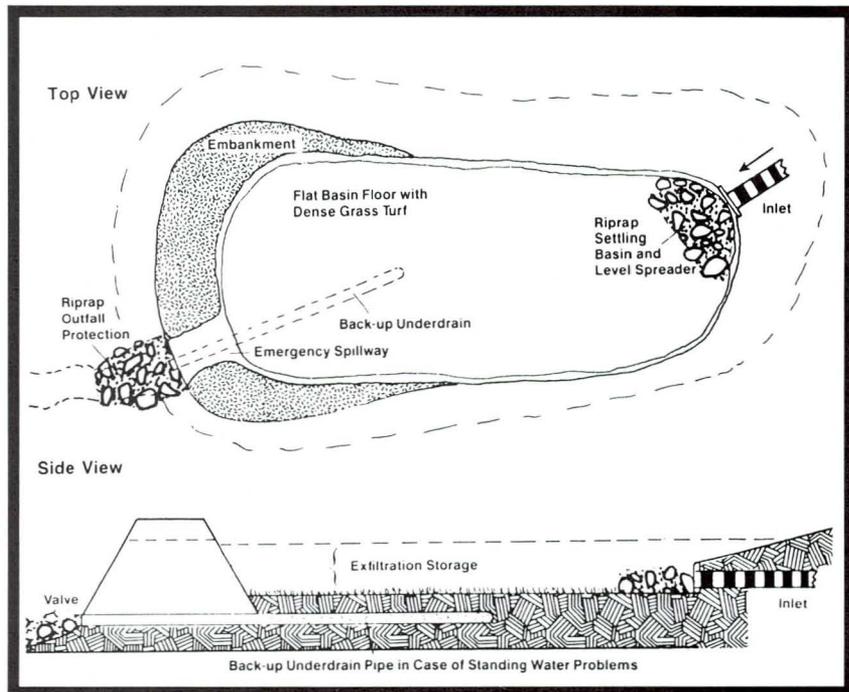
Conditions Where Practice Applies:

- Located in upland areas, down gradient of a development and above the groundwater table.

Planning Considerations:

- Generally limited to drainage areas of 5 to 50 acres.

- Can be used as part of a detention basin.
- Coarse grained pollutants must be removed before entering the basin (can cause clogging of the system).
- Can serve relatively large drainage areas (up to 50 acres).
- Can produce significant groundwater recharge.
- Feasible option where the soils are permeable (i.e., sand and gravel) and the water table and bedrock are situated well below the soil surface.
- Can produce nuisances such as odors and mosquitoes.
- Can be a high maintenance item if there is a frequent need for the removal of sediment (needs to be inspected regularly).
- Possible risk of groundwater contamination from very soluble pollutants such as nitrates, chlorides, and gasoline.
- Every infiltration basin should be accompanied by a landscaping plan.



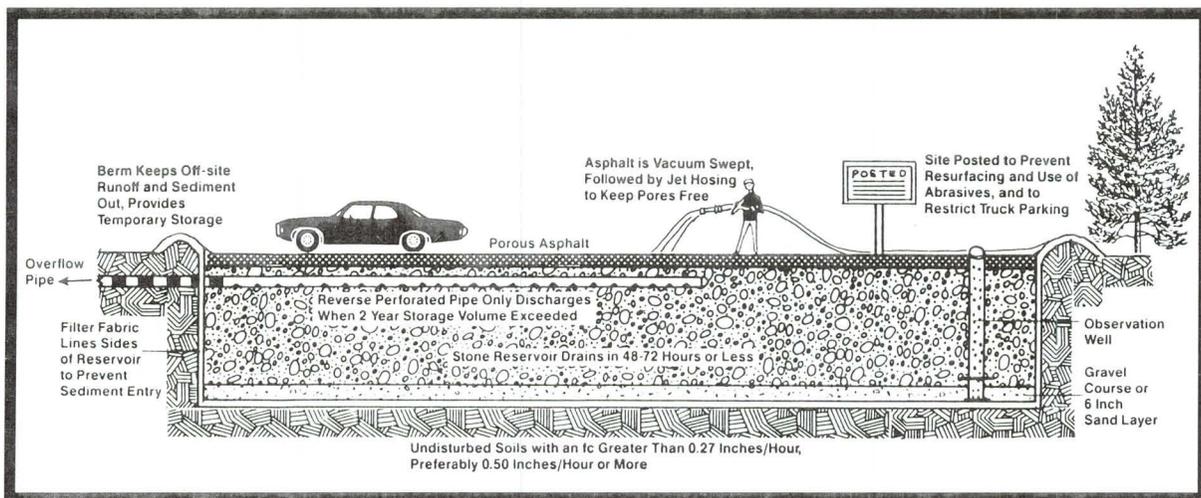
Schueler, 1987

Definition: Porous pavement refers to porous asphaltic paving material with a high void aggregate base that allows for rapid infiltration and temporary storage of urban storm water runoff.

POROUS PAVEMENT (PP)

Purpose:

- High capability of removing both soluble and fine particulate pollutants.
- Provides groundwater recharge.
- 60-90% of the annual rainfall on the pavement can be diverted to groundwater.
- Greatly reduces the volume of surface water runoff due to development.



Schueler, 1987

Conditions Where Practice Applies:

- Low traffic volume roads.
- Parking lots, driveways, residential developments.
- Parking aprons, taxiways, and runway shoulders at airports.
- Emergency stopping and parking lanes on highways.

Planning Considerations:

- Only feasible on sites with flat slopes, permeable soils, and relatively deep water table and bedrock levels.
- Need to keep off-site runoff contributions to a minimum.
- Extremely important that care be taken during the installation phase (very high level of construction workmanship is required).

- Not intended to remove coarse particulate pollutants.
- Difficult to rehabilitate once it becomes clogged.
- Needs maintenance attention more frequently than conventional pavement due to clogging potential (vacuum sweeping is preferred).
- Possible risk of groundwater contamination from polluted runoff infiltrating through the pavement.
- Not advisable to site porous pavement sites near groundwater drinking supplies.

Definition: A structure whose purpose is to separate oil and sediments from parking lot and street runoff.

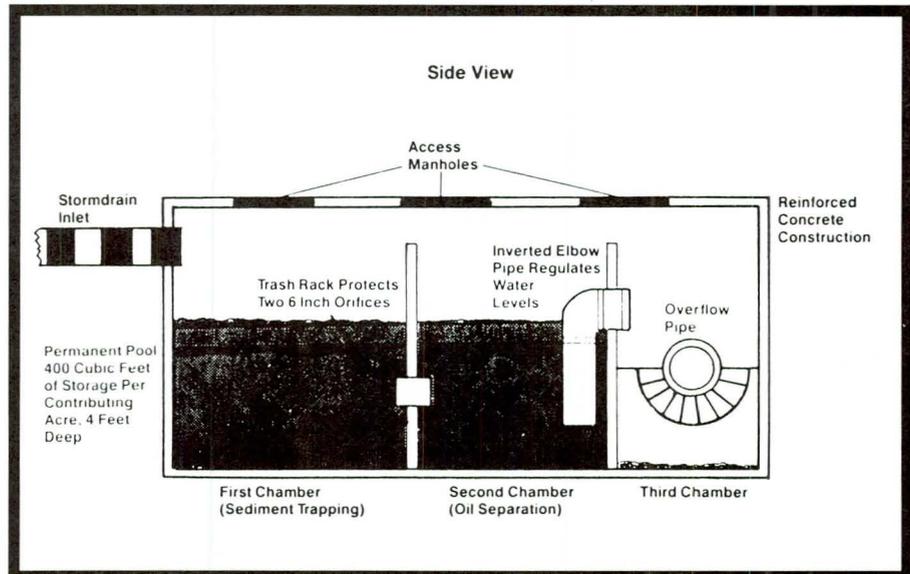
WATER QUALITY INLETS (WQI)

Purpose:

- To remove sediment and hydrocarbon loadings before they are conveyed to the storm drainage network or to an infiltration basin.

- Good protective pretreatment device for larger, more complicated BMPs.

- Good for sites that are expected to receive a great deal of vehicular traffic or petroleum inputs (gas stations and roads).



Schueler, 1987

Conditions Where Practice Applies:

- At the lower end of a parking lot or in-line and adjacent to catch basins.

Planning Considerations:

- Have limited capacity for storm water storage; runoff passes through the structure very quickly.
- Due to short storage time only moderate removal of coarse sediment, oil/grease, and debris can be expected.
- Typically serve parking lots one acre or less in size.
- High maintenance item since the inlets must be cleaned periodically to remove trapped pollutants.
- Need to find a place for disposal of accumulated sediments.

Definition: Grassed water courses whose purpose is to retard or impound concentrated runoff to induce infiltration and decrease velocities.

VEGETATED SWALES (VS)

Purpose:

- To reduce runoff velocities based upon length and slope.
- To provide an additional area for infiltration.
- To provide for moderate removal of particulate pollutants during small storm events.
- To act as a directional flow device when used in conjunction with other BMPs.



Conditions Where Practice Applies:

- Most applicable in residential areas of low to moderate density where the percentage of impervious cover is relatively small.
- Usually located in a drainage easement at the side or back of residential lots.
- Used also along highway medians as an alternative to curb and gutter drainage systems.

Planning Considerations:

- Have limited capacity to accept runoff from large storms.
- Can also provide for some filtering of particulate pollutants.
- Not generally capable of removing soluble pollutants.
- In residential areas maintenance involves normal lawn activities such as mowing, watering, and fertilizing.
- Can be used as a conveyance device in combination with other BMPs.

Definition: An area of vegetated cover through which runoff containing sediments and other pollutants may flow before it leaves a site or enters a stormwater management practice.

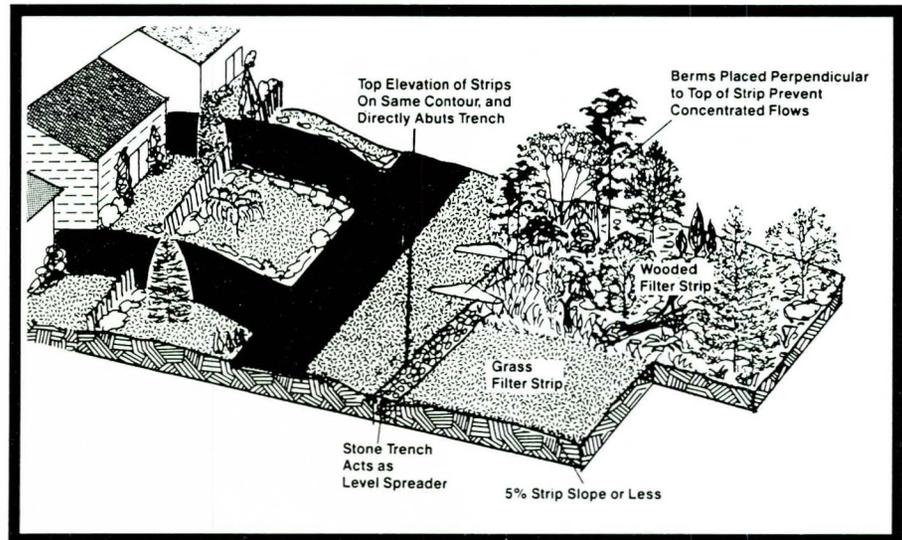
VEGETATED FILTER STRIPS (VFS)

Purpose:

- To reduce the velocity of storm water runoff.
- To remove sediments and pollutants by filtering, adsorption, and gravity sedimentation.
- To protect infiltration trenches from clogging.

Conditions Where Practice Applies:

- Surrounding stormwater runoff infiltration structures to reduce the sediment load to be delivered.



Schueler, 1987

- Up gradient of watercourses, wetlands, and other water bodies.
- Along the tops and toes of slopes.
- At the outlets of stormwater management structures.

Planning Considerations:

- Difficult to keep maintained in a flat, uniformly graded state.
- Used only in areas where runoff can be maintained in a non-concentrated flow state (sheet flow condition).
- Can remove a high degree of particulate pollutants if constructed and maintained properly.
- Relatively inexpensive to establish.
- Generally viewed as one component of a stormwater management system.
- Can be effective in the removal of sediment, organic material, and trace metals.
- Filter strips will not function as designed on slopes greater than 15%; work best on slopes 5% or less.

Definition: The protection of trees and forest land during the construction phase of development; the planting of trees after the site has been cleared; or homeowner landscaping after the site has been fully developed.

URBAN FORESTRY (UF)

Purpose:

- To reduce the volume of surface water runoff generated by development.
- To reduce the velocity and to allow for the infiltration of stormwater runoff.
- To reduce the impact of heavy rainfall due to tree canopy.

Conditions Where Practice Applies:

- Generally on residential development sites.



Planning Considerations:

- The cost and degree of maintenance is generally quite low.
- Urban forested areas may produce 30-50% less runoff than grassed lawns.
- Can remove pollutants by plant uptake.
- Can prevent soil loss due to erosion.
- Should be part of an overall landscaping plan.

Definition: A shallow marsh around the perimeter or at the entrance end of a detention pond, retention pond, infiltration basin, or sediment basin.

SHALLOW MARSH CREATION (SM)

Purpose:

- To allow for the settlement of particulate pollutants.
- To allow for the biological uptake of pollutants by wetland plants.
- To allow for the removal of nutrients.

Conditions Where Practice Applies:

- Generally at the entrance end of detention ponds, retention ponds, infiltration basins, and sediment basins.



Planning Considerations:

- Can be used as a landscaping device for a pond or basin if carefully designed.
- Careful site selection is necessary to maintain the shallow marsh in a wetland state.
- Careful construction grading is necessary to maintain a constant shallow depth (generally with water depths of 1 foot or less).
- The larger the surface area of the marsh, the greater the degree of nutrient removal.

Definition: The cleaning of paved vehicular traffic areas by the use of sweeping, vacuuming, or flushing equipment/methods.

STREET CLEANING (SC)

Purpose:

- To physically remove contaminants from the street by the use of street sweepers or vacuum equipment.
- To reduce pollution loads in some streams draining significant urban areas.

Conditions Where Practice Applies:

- On all paved vehicular traffic areas including but not limited to parking lots, alley ways, driveways. Especially necessary for paved streets having curbs and gutters.



Planning Considerations:

- **Mechanical Sweepers** utilize brushes at high speeds to dislodge particles from the street surface for removal. Dust is controlled by spraying water on the street afterwards.
- Three types of mechanical **Vacuum Sweepers** are used. The conventional vacuum sweeper sweeps the material within its path into a narrow windrow. Only the material in this windrow is sucked up by the vacuum. A second type utilizes vacuum action over its entire path with the assistance of a gutter broom to increase its range. The third type of vacuum sweeper blows air downward to suspend particulates which are then sucked up.
- Existing street cleaning techniques are ineffective for removing fine solids which contain the majority of nutrients, oxygen-demanding, and toxic contaminants.
- Overall efficiency: (largely dependent upon the operator)
Mechanical Sweepers - 50 percent
Vacuum Sweepers - 70-90 percent

Definition: An enclosed (roofed) structure constructed on flat sites and on impervious surfaces to protect road salt from entering surface water runoff and to prevent accidental spills during mixing and loading operations.

ROAD SALT STORAGE FACILITY (RSSF)

Purpose:

- To prevent road salt as a potential nonpoint source pollutant from entering surface waters or from leaching down to groundwater.
- To keep the chemicals dry through proper storage.
- To keep handling area unobstructed and clean of spilled chemicals.
- To shield truck-loading and unloading operations from wind and weather.



Conditions Where Practice applies:

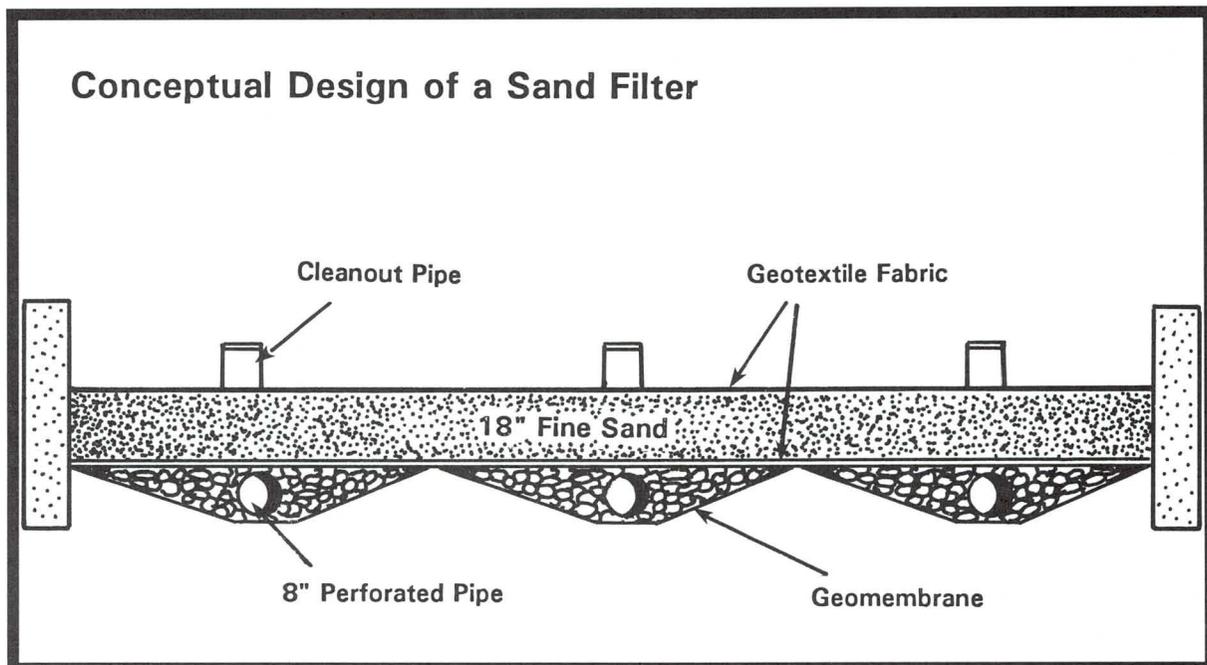
- In any area where the storage of road salts could cause environmental damage by entering surface waters or leaching to nearby groundwater.
- Particularly recommended for areas where road salt is stored on highly pervious materials (sands and gravels).
- This practice should be required without exception if road salts must be stored in Zone I or Zone II areas.

Planning Considerations:

- The area immediately adjacent to the storage structure should also be made impervious.
- Drainage should be designed and installed to divert surface water runoff away from the structure and to collect any brine that may develop.
- Salt storage facilities should not be located within public water supply watersheds.
- Rainfall on an exposed salt pile can cause a loss of up to 10% of the pile's volume.
- In lieu of a structure all salt piles should be covered with a waterproof cover and sited on an impervious pad.
- Monitoring wells should be established around the storage facility.

Definition: A self-contained bed of sand underlain with pipe that is designed to treat the first flush of stormwater runoff. Runoff filters through the sand bed, collects in the underground pipe system and is then directed to the receiving water. Sand filters may be enhanced by layers of peat, limestone and/or topsoil and may be overplanted with grass.

SAND FILTERS (SDF)



Redrawn from Schueler, et. al., 1992.

Purpose:

- Sand filters are most effective in removing sediment and trace metals from the first flush of stormwater runoff. Sand filter removal rates are moderate for nutrients, BOD and coliform bacteria. Enhanced sand filters may have higher removal rates. Pollutant removal is achieved by straining pollutants through the sand or peat and by settling on top of the sand-bed.
- Sand filters are particularly useful for groundwater protection.

Conditions Where Practice Applies:

- Sand filters can be adapted to most development sites and have few constraining factors. They can be used in areas of poor soil infiltration or where groundwater concerns restrict the use of infiltration techniques.
- Maximum watershed size for effective treatment is no more than 50 acres. Contributing watersheds of one-half to ten acres in size have been used most frequently in sand filter designs.

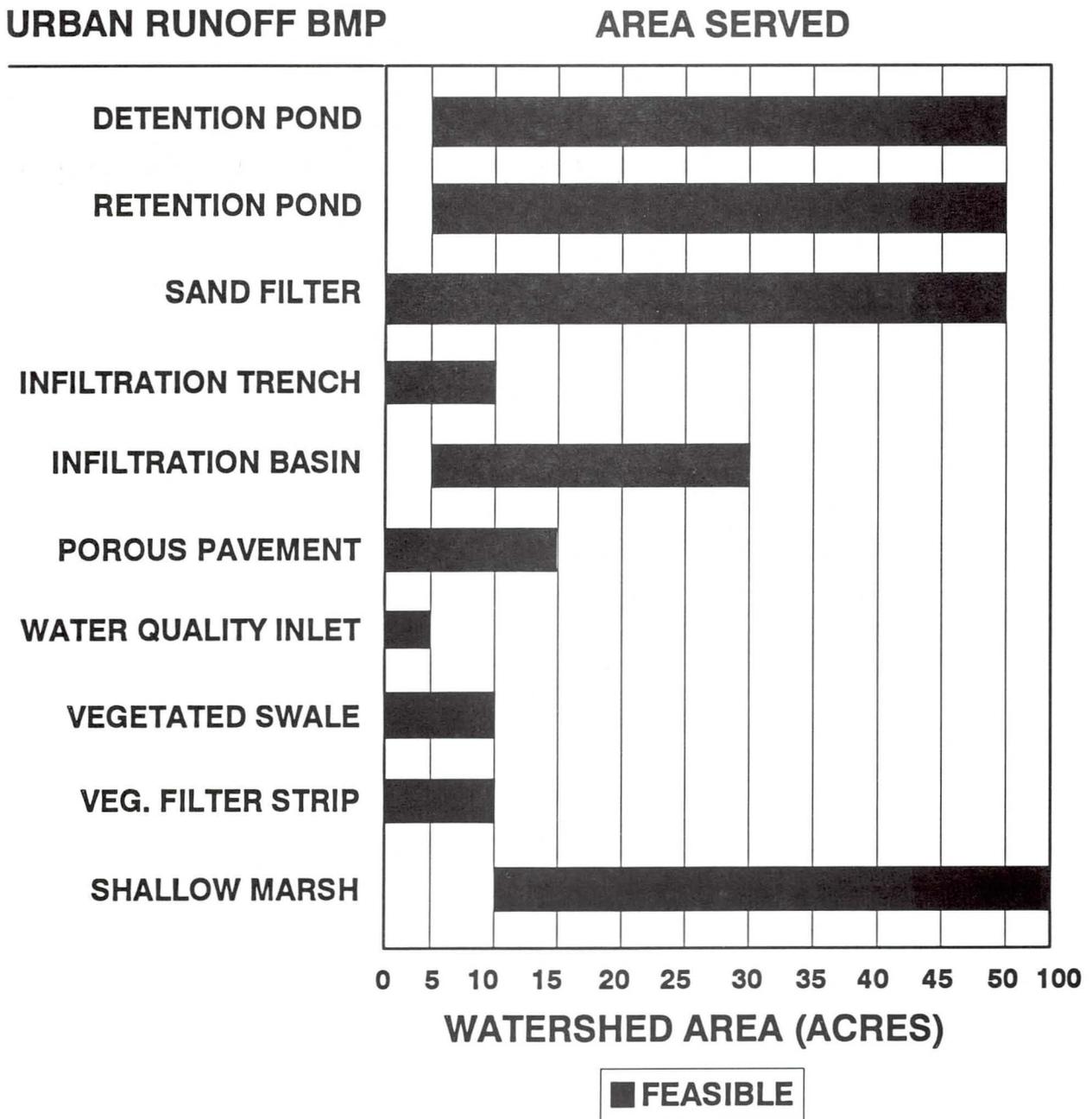
- Sand filters and enhanced sand filters can be used to treat runoff from small developments and small parking lot areas in urban areas where space is limited.
- Sand filters may be retrofitted for end of pipe treatments for certain sites.
- The sand filter may not be applicable for use in colder climates.
- Sand filters are a widely applicable and adaptable urban BMP that can provide significant pollutant removal at the small sites that often characterize coastal development.

Planning Considerations:

- Sand filters require frequent maintenance, more often by manual rather than mechanical means, so design should accommodate appropriate access.
- A pretreatment pool or settling device may be required to remove large particles and enhance removal efficiency and longevity of the filter.
- Sand filters are designed only to improve water quality, and should not be used to control storm water quantity.
- Some sand filters may be a source of odors and be generally unattractive.
- Sand filters should be surrounded by a fence to reduce safety hazards.
- Sand filters are a costly practice, but appear to be long-lived and possess a reasonable maintenance burden.
- Pollutant removal rates that have been experienced are: 85% for sediment, 35% for nitrogen, 40% for dissolved phosphorus, 40% for fecal coliforms and 50-70% for trace metals.



WATERSHED AREA RESTRICTIONS FOR URBAN RUNOFF BMPs

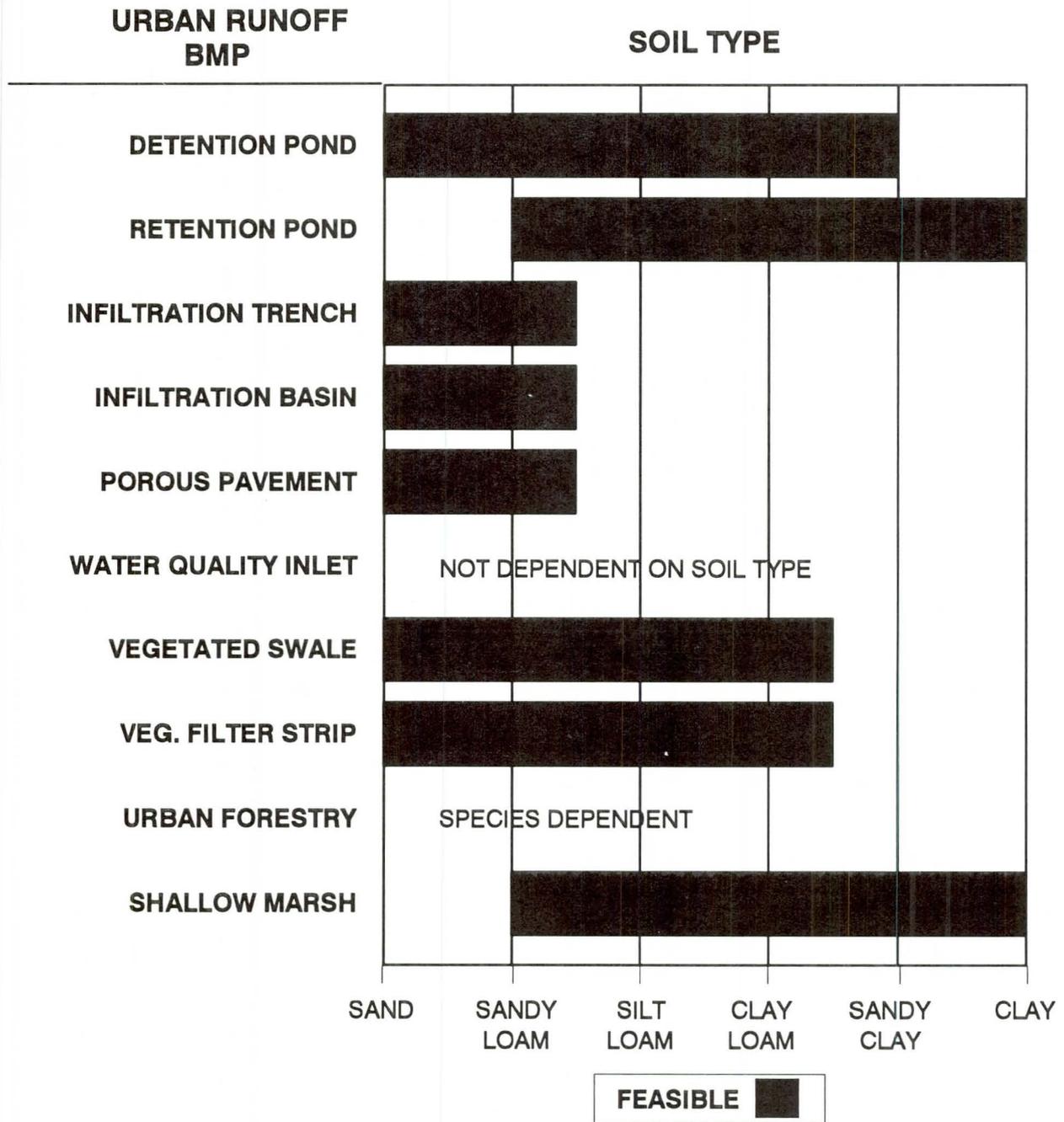


THESE RESTRICTIONS ARE GENERALIZATIONS AND ARE INTENDED TO PROVIDE THE AVERAGE RANGE OF USE.

ADAPTED FROM "CONTROLLING URBAN RUNOFF", T.R.Schueler, 1987 and
"A CURRENT ASSESSMENT OF URBAN BEST MANAGEMENT PRACTICES", T.R.Schueler, et.al.,1992

Figure 4.1

SOIL PERMEABILITY RESTRICTIONS FOR URBAN RUNOFF BMPs



THESE RESTRICTIONS ARE GENERALIZATIONS AND ARE INTENDED TO PROVIDE THE AVERAGE RANGE OF USE.

ADAPTED FROM "CONTROLLING URBAN RUNOFF", T.R.Schueler, 1987

Figure 4.2

COMMON SITE RESTRICTIONS FOR URBAN RUNOFF BMPs

URBAN RUNOFF BMP	RESTRICTIONS								
	SLOPE	HIGH WATER TABLE	NEAR BEDROCK	PROXIMITY TO FOUNDATIONS	SPACE NEEDS	MAX. DEPTH	RESTRICTED LAND USES	HIGH SEDIMENT INPUT	THERMAL IMPACTS
DETENTION POND	●	●	■	●	▲	●	●	■	●
RETENTION POND	●	●	■	●	▲	▲	●	■	▲
INFILTRATION TRENCH	▲	▲	▲	▲	●	▲	●	▲	●
INFILTRATION BASIN	■	▲	▲	■	■	▲	●	▲	●
POROUS PAVEMENT	▲	▲	▲	▲	▲	▲	▲	▲	●
WATER QUALITY INLET	●	●	▲	▲	●	▲	▲	▲	●
VEGETATED SWALE	▲	▲	■	■	●	●	▲	▲	●
VEG. FILTER STRIP	■	■	■	■	●	●	■	▲	●
URBAN FORESTRY	●	■	■	●	■	●	●	●	●
SHALLOW MARSH	●	●	■	■	▲	■	■	■	■

- ▲ MAY PRECLUDE THE USE OF A BMP
- CAN BE OVERCOME WITH CAREFUL SITE DESIGN
- GENERALLY NOT A RESTRICTION

THESE RESTRICTIONS ARE GENERALIZATIONS AND ARE INTENDED TO PROVIDE THE AVERAGE RANGES OF USE.

ADAPTED FROM "CONTROLLING URBAN RUNOFF", T.R. Schueler, 1987

Figure 4.3

COMPARISON OF BENEFITS OF URBAN RUNOFF BMPs

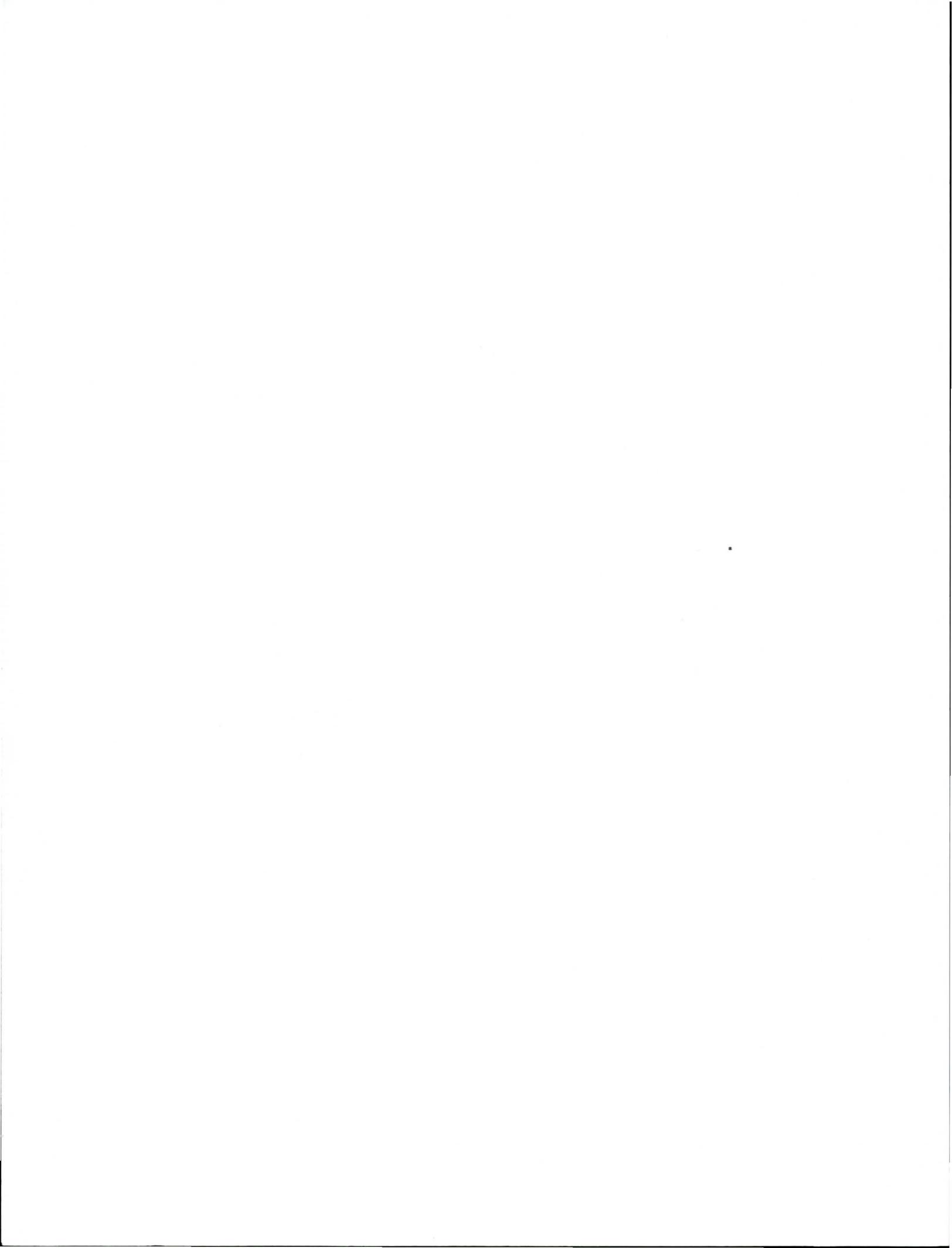
URBAN RUNOFF BMPs	ENVIRONMENTAL/COMMUNITY BENEFITS								STORMWATER BENEFITS					
	STREAMBANK EROSION CONTROL	AQUATIC HABITAT CREATION	WILDLIFE HABITAT CREATION	LANDSCAPE ENHANCEMENT	RECREATIONAL BENEFITS	HAZARD REDUCTION	AESTHETICS	COMMUNITY ACCEPTANCE	LOW FLOW MAINTENANCE	GROUNDWATER RECHARGE	VOLUME CONTROL	2-YEAR STORM CONTROL	10-YEAR STORM CONTROL	100-YEAR STORM CONTROL
DETENTION POND	●	△	●	△	△	△	△	△	□	□	□	●	●	●
RETENTION POND	□	●	●	●	●	△	△	●	□	□	△	●	●	●
INFILTRATION TRENCH	△	□	□	□	□	●	□	●	●	●	●	●	△	□
INFILTRATION BASIN	△	□	●	△	△	●	□	△	●	●	●	●	△	□
POROUS PAVEMENT	△	□	□	□	□	●	□	●	●	●	●	●	△	□
WATER QUALITY INLET	□	□	□	□	□	●	□	●	□	□	□	□	□	□
VEGETATED SWALE	□	□	△	△	□	●	△	●	△	△	△	△	□	□
VEG. FILTER STRIP	□	□	●	△	□	●	△	●	△	△	△	△	□	□
URBAN FORESTRY	△	□	△	●	△	△	●	●	□	△	□	□	□	□
SHALLOW MARSH	□	●	●	△	□	△	△	△	□	□	△	●	△	□

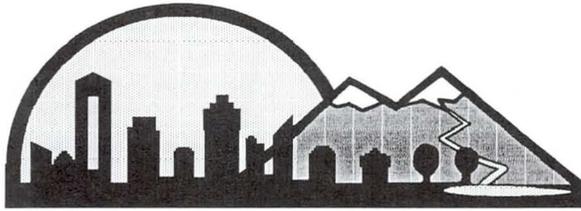
Figure 4.4

SELDOM BENEFICIAL
 SOMETIMES BENEFICIAL WITH CAREFUL DESIGN
 USUALLY BENEFICIAL

ADAPTED FROM "CONTROLLING URBAN RUNOFF",
T.R.Schueler, 1987







RESOURCE EXTRACTION BMPs

<u>BMP</u>	<u>Page</u>
Guidelines for Sand and Gravel Pits (GSGP) . . .	4-98
Land Smoothing (LSM)	4-101
Critical Area Planting (CAP)	4-102
Water and Sediment Control Basin (W-SCB) . .	4-103

Sources

U.S.D.A. Soil Conservation Service. 1977. "Guidelines for Soil and Water Conservation in Urbanizing Areas of Massachusetts". Amherst, MA.

U.S.D.A. Soil Conservation Service. 1989. "Field Office Technical Guide - For the Design and Description of BMPs". Amherst, MA.



Definition: *Guidelines for sand and gravel pits are necessary to protect surface water from unchecked erosion and to protect groundwater from contamination from soluble pollutants introduced as a result of uncontrolled soil removal during sand and gravel operations.*

GUIDELINES FOR SAND AND GRAVEL PITS (GSGP)

Open sand and gravel pits can contribute a large amount of sediment to adjacent water courses due to unchecked erosion. Sand and gravel also provide very porous media for transporting soluble pollutants to the underlying groundwater. Many sand and gravel operations are located within or near the recharge area of public and private wells. A major threat to groundwater exists when excavation activities take place in these areas. Exposure of the saturated zone in recharge areas can leave groundwater resources vulnerable to contamination because this action decreases the potential filtering capacity of the overlying soils. An added problem is that abandoned excavation pits have been used for the unregulated disposal of solid and liquid wastes and salt-laden snow.

Controlling the removal of soil in recharge areas is a commonly used technique to minimize groundwater impacts. Many municipalities statewide have adopted earth removal bylaws which limit excavation within varied distances to the water table (ranging from 4 feet to 10 feet). When regulating excavation activities, the seasonal and annual fluctuations in the water table should be considered. To insure maximum groundwater protection, local controls should be designed to incorporate more conservative groundwater table estimates.

310 CMR 22.21 (2)(b)6 prohibits the removal of soil, loam, sand, gravel or other mineral substance within 4 feet of the historical high groundwater table elevation. The regulations do allow for removal of soil provided the same soil is replaced at a final grade greater than 4 feet above the historical high water mark within 45 days. This is intended to facilitate necessary, short term excavation/soil movement activities while insuring that sand and gravel deposits associated with favorable groundwater areas are not replaced with materials of poorer quality. Building foundations and utility work are also given exemptions under this provision (DEP-Division of Water Supply, fact sheet #10 - Soil Removal).

■ **Every active sand and gravel operation should have the following information on file:**

1. Existing topography based on a current survey showing five foot contour intervals (2 foot contour levels should be provided whenever possible). Elevations should be related to USGS data.
2. A log of soil borings taken to the depth of the proposed excavation. The number of borings taken will vary with the size and geological make-up of the site.
3. A topographical map showing final grades, drainage facilities, etc., after excavation.

■ **Operation Standards:**

1. No excavation will be closer than 200 feet to an existing public way unless specifically permitted by the Selectmen or other authorized official; and no

excavation will approach neighboring lot lines closer than 50 feet where excavation is not permitted. Natural vegetation shall be left and maintained on the undisturbed land for screening and noise reduction purposes.

2. Operation hours shall be only between 7:00 a.m. and 5:00 p.m. on weekdays and loaded trucks may leave described premises only within such hours. All loaded vehicles shall be suitably covered to prevent dust and contents from spilling and blowing from the load.
3. The active gravel removal operation area shall not exceed a total area of five (5) acres at any one time.
4. All trucking routes and methods will be subject to approval by the Chief of Police.
5. All access roads leading to public ways shall be treated with stone, or other suitable material to reduce dust and mud for a distance of 200 feet back from said public way. Any spillage on public ways should be cleaned up by the operator.
6. Access roads shall be constructed at an angle to the public way or constructed with a curve so as to help screen the operation from public view.
7. No gravel shall be removed closer than 4 feet to spring high water table. This elevation shall be established from test pits or soil borings and the level related to a permanent monument on the property. This information shall show on the topographic plan.
8. During operations, when an excavation is located closer than 200 feet from a residential area or public way and where the excavation will have a depth of more than 15 feet with a slope in excess of 1:1, a fence at least four (4) feet high shall be erected to limit access to this area.
9. No area shall be excavated so as to cause accumulation of free standing water. Permanent drainage shall be provided as needed in accordance with good construction best management practices (see construction best management practices). Drainage shall not lead directly into streams or ponds.
10. All topsoil and subsoil shall be stripped from the operation area and stockpiled for use in restoring the area after the removal operation has ceased.
11. Any temporary shelters or buildings erected on the premises for use by personnel or storage of equipment shall be screened from public view as much as possible. These structures shall be removed from the premises within 30 days after they are no longer needed.
12. The Selectmen or their agents shall be free to inspect the premises at any time.
13. No excavation shall be allowed closer than 100 feet from a natural stream. Check with your local Conservation Commission for information on required permits.

■ **Restoration Standards:**

1. No slope shall be left with a slope steeper than 3:1 (33%).
2. All debris, stumps, boulders, etc., shall be removed from the site and disposed of in an approved location, or in the case of inorganic material, buried and covered with a minimum of two (2) feet of soil.



3. Following excavation and as soon as possible thereafter, ground levels and grades shall be established as shown on the completed topographical plan.
4. Retained subsoil and topsoil shall be respread over the disturbed area to a minimum depth of four (4) inches. This soil shall be treated with three (3) tons of lime per acre and 1,000 pounds of 10-10-10 fertilizer per acre and seeded with a grass or legume mixture designed for the specific site. Trees or shrubs of prescribed species will be planted to provide screening, natural beauty, and erosion control during the establishment period.
5. Upon completion of the operation, the land shall be left so that natural storm drainage leaves the property within the original watercourses that existed prior to construction. The rate and volume of surface water runoff should not be increased as a result of the excavation operations.
6. Within six months after termination of excavation operations, all equipment, buildings, structures, and unsightly evidence of construction shall be removed from the premises.

It is suggested that a sand and gravel removal permit be issued for an initial three (3) year period. A renewal permit would be necessary after each three (3) year period. A performance bond of some predetermined and adequate amount should be required for each acre on which the permit has been granted. This would be released only after the land has been restored as outlined in the plan.

Adoption of regulations or bylaws/ordinances is only part of controlling nonpoint source pollution from sand and gravel operations. Someone or some agency must be responsible for enforcing compliance with the established rules. In some small towns where busy Selectmen are the responsible enforcement agency, review and inspection duties have been given to the Conservation Commission. Some towns have the town engineer, highway superintendent and police chief alerted to report compliance or violations. Regardless of who inspects the operations, it is paramount that inspections be thorough and regulations enforced in an unbiased manner.

Definition: Removing irregularities from a resource extraction area (i.e., sand and gravel operation) on the land surface by the use of special equipment. This practice consists of operations classified as "rough" grading. This differs from the Land Grading BMP in that no formal grid survey is normally required.

LAND SMOOTHING (LSM)

Purpose:

- To prevent erosion by improving surface drainage and providing for more effective use of precipitation.

Conditions Where Practice Applies:

- This practice applies on resource extraction areas where surface depressions, mounds, and other surface irregularities interfere with proper drainage and the installation of soil conservation best management practices.



- This practice is limited to areas having adequate soil depth or where topsoil can be salvaged and replaced.

Planning Considerations:

- The effects of the smoothing operation on the overall drainage scheme must be considered.
- This practice should be used in conjunction with a topsoiling BMP (see Topsoiling (T) (p. 4-28), under the Construction BMP section).
- The extent of rough grading required and tolerances of the finished smoothing job will vary from site to site and in accordance with local regulations or goals.

Definition: *The planting of a design mix of grasses and legumes on resource extraction areas (i.e., sand and gravel pits) as a part of an overall vegetative stabilization plan.*

CRITICAL AREA PLANTING (CAP)

Purpose:

- To stabilize the soil, reduce erosion, runoff, and sediment damages to downstream areas, improve water quality, wildlife habitat, and visual quality;
- To establish a permanent vegetative cover on resource extraction areas to prevent the erosion of soil and subsequent deposition of sediments in adjacent waterways; and/or
- To slow the course of the overland flow of storm water runoff and to allow for the infiltration of storm water to the underlying groundwater.



Conditions Where Practice Applies:

- On resource extraction sites, or severely eroding areas, that have reached planned limits, in whole or in part, and are presently experiencing erosion or have the potential to erode during local storm events.

Planning Considerations:

- Surface runoff water should be diverted from the area to be seeded to the extent feasible. Provision should be made for safe disposal of this water.
- Seepage water that would continue to have adverse effects on the protecting vegetation or on soil stability should be diverted by underground drains.
- Species of plants should be selected with careful consideration for their use and site conditions. The most frequent controlling site factor is soil moisture.
- Consult with representatives from your local office of the U.S.D.A., Soil Conservation Service and your local Soil Conservation District Office.
- See also Trees, Shrubs, Vines, and Ground Covers (TSV) (p. 4-34) in the Construction BMP section.

Definition: An earthen embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and a water detention basin.

WATER AND SEDIMENT CONTROL BASIN (W-SCB)

Purpose:

- To reduce watercourse and gully erosion in resource extraction areas.
- To trap sediment.
- To reduce and allow for on-site management of storm water runoff.
- To improve downstream water quality.

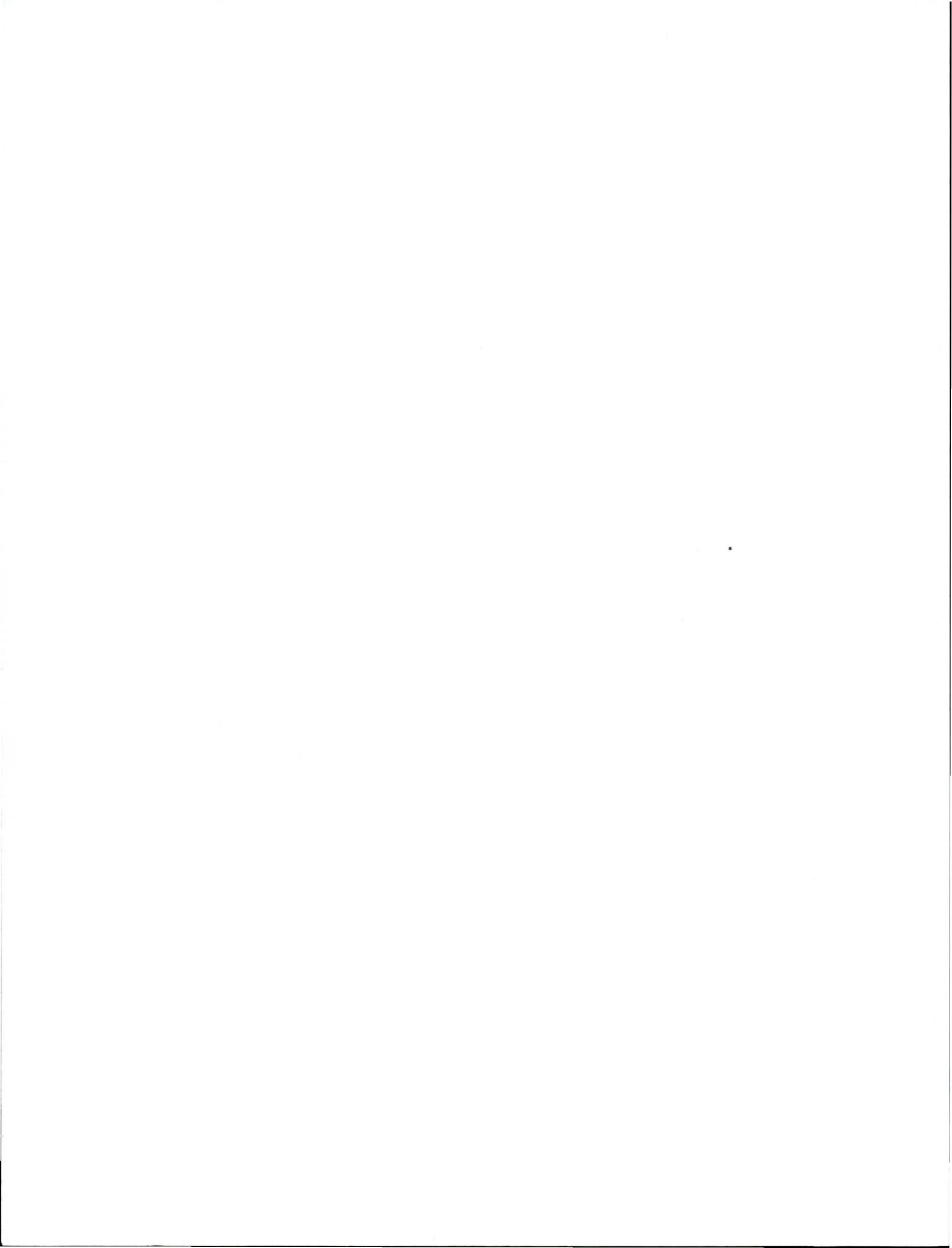


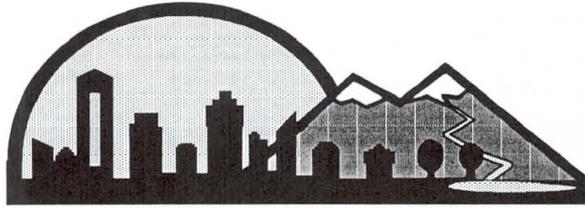
Conditions Where Practice Applies:

- This practice applies to sites where:
 1. the topography is generally irregular,
 2. watercourses and gully erosion are a problem,
 3. sheet and rill erosion are controlled by other conservation best management practices,
 4. runoff and sediment damage land and improvements,
 5. soil and site conditions are suitable, and
 6. adequate outlets for the collected runoff are available or can be provided.

Planning Considerations:

- Any plan to use a water and sediment control basin should include its effect on the water budget, especially on volumes and rates of runoff, infiltration, and evaporation.
- The quality of stored storm water runoff needs to be evaluated to prevent possible contamination of the underlying groundwater.





LAND DISPOSAL BMPs

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Sources

Massachusetts Executive Office of Communities and Development and Town of Blackstone, MA. 1988. "Water Resources and Growth - Tools For Management". Boston, MA.

Massachusetts Executive Office of Communities and Development and Pioneer Valley Planning Commission. 1988. "The Growth Management Workbook". Boston, MA.

Massachusetts Department of Environmental Protection, Division of Water Supply. January, 1992. "Wellhead Protection and Floor Drains". Boston, MA.



Definition: A system for the proper subsurface disposal of sanitary waste consisting conventionally of a septic tank, distribution box, and subsurface absorption and disposal area.

ON-SITE SEWAGE DISPOSAL SYSTEMS (O-SDS)

Purpose:

■ To provide for the disposal of sanitary sewage in unsewered areas in a manner that will not endanger public health or the environment.

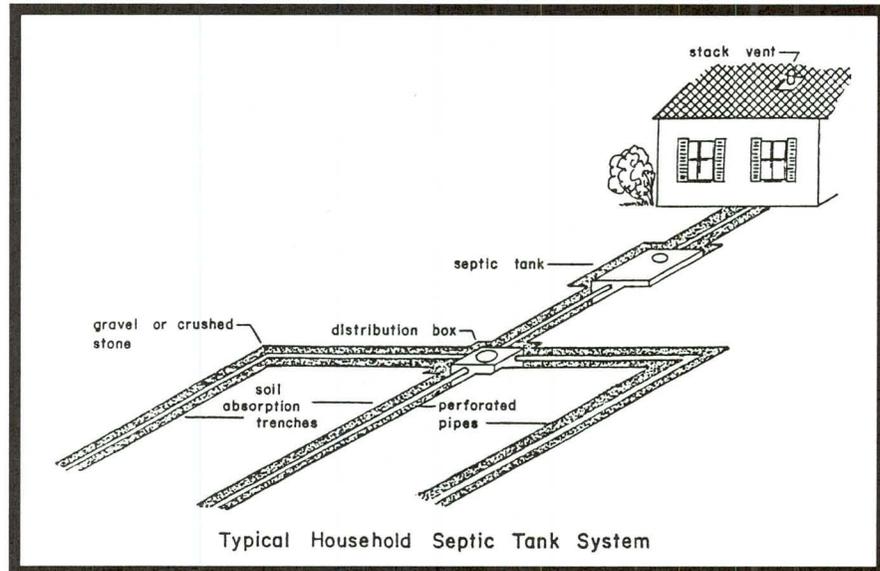
Conditions Where Practice Applies:

■ On any site in unsewered areas where the soils are suitable for the biological treatment of wastewater and the site meets the requirements of the State Environmental Code - Title 5 (310 CMR 15.00)

and local Board of Health regulations, if applicable. There may be alternative systems available to replace existing failed substandard systems or where a higher level of pollutant removal is needed. Contact DEP-Division of Water Pollution Control for discussion of these options.

Planning Considerations:

- Have the septic tank inspected regularly, pump when necessary. Ideally, septic systems should be inspected annually.
- Practice water conservation to increase system life-span.
- Keep roof drains and stormwater runoff away from the drain field area.
- Keep leaching area free of vehicles, buildings, trees, and shrubs.
- Natural wetlands should not be filled to achieve the required "set back" distances.
- Never use septic system additives - they may cause more problems than they solve.
- Prevent strong chemicals from entering the system.
- Keep accurate records of your on-site maintenance activities.
- Keep an accurate map of the location of all system components.



DEP/DWPC

Definition: Towns may ensure that adequate sewage treatment capacity exists before granting Special permits for major developments. Review of privately owned treatment plants may require design changes to minimize pollution. Towns may give sensitive areas priority for planned sewer extensions.

PUBLIC SEWERAGE (SEW)

Purpose:

- To ensure that servicing new developments will result in no limitation upon a town's ability to adequately provide sewage services to other areas of town.
- To ensure that sewage systems are designed to minimize the potential of pollution and to minimize groundwater infiltration.
- To ensure that environmentally sensitive lands are protected from possible pollution from septic systems and package treatment plants. (Sewer pipes are not allowed within the Zone I of a public water supply well.)

Conditions Where Practice Applies:

- Special permits for major developments must include a determination that adequate capacity exists.
- Design review of private systems can result in requirements that developers minimize environmental impacts and groundwater infiltration.
- Water and Sewer Commissions can agree to give water resource areas and environmentally sensitive lands priority for future sewer extensions.

Planning Considerations:

- Public sewerage controls may be adopted as an amendment to the municipal zoning bylaws/ordinances via a two-thirds majority vote of town meeting.
- The Special Permit Granting Authority must, before approving any new major development, make a determination that existing or proposed facilities will be able to serve the new development without any substantial limitation upon the town's ability to adequately provide sewage services to other areas of the town.
- The Water and Sewer Commission may require developers to redesign private systems to minimize pollution and groundwater infiltration.

Definition: Under the authority of MGL c. 111, § 31, local Boards of Health may adopt sewage discharge permit regulations to provide increased control over septic system discharges.

SEWAGE DISCHARGE PERMITTING REGULATIONS (SDPR)

Purpose:

- To allow adoption of local regulations due to site specific conditions which are necessary to protect the public health and the environment.

Condition Where Practice Applies:

- **Title 5** of the State Environmental Code (**310 CMR 15.00**) regulates the installation and impacts of septic systems that serve a single lot. These regulations are occasionally inadequate to regulate septic systems with higher flow rates than what is considered normal for a single family to generate. By adopting local Board of Health regulations, a town can regulate medium-sized flows differently than smaller flows. A flow of 15,000 gallons/day or greater requires DWPC approval and a groundwater discharge permit (**314 CMR 5.00**) and is not subject to Title 5.

Planning Considerations:

- Board of Health regulations can require applicants for septic systems discharging a certain amount (over 2000 or 5000 gallons/day, for example) to:
 1. Submit hydro-geological data on groundwater flow, elevation of the groundwater, soil conditions, the impact of the disposal system on public or private water resources, and nitrogen loading calculations.
 2. Submit a written evaluation of the potential for the generation or use of toxic or hazardous waste on the site.
 3. Submit a written evaluation of the quality, quantity, and method of disposal of stormwater discharge on the site.
 4. Monitor groundwater regularly to test for contamination.
- The Board may require a proposed system to be redesigned to reduce or eliminate pollution, and may require large dischargers to construct on-site sewage treatment plants. The regulations may include actions that must be taken by the permittee if water quality standards are violated.
- A septic system that does not comply with Title 5 requirements must obtain written approval (variance) from DWPC before the local Board of Health can issue the Disposal Works Construction Permit.

Definition: *Septic system regulations can be drafted and adopted by the Board of Health that provide local controls stronger than Title 5 to ensure that the systems are upgraded and/or maintained and do not damage water resources.*

SEPTIC SYSTEM UPGRADING/ MAINTENANCE (SSU)

Purpose:

- To protect public health from potential and present sources of pollution to water sources.

Conditions Where Practice Applies:

- Many homes across the state have substandard septic systems/cesspools to dispose of their sewage. Existing systems that do not comply with the technical requirements of Title 5 are not "grandfathered", even when such systems have not failed hydraulically. It is important that these substandard systems be upgraded to protect surface and groundwater as well as public health. Also, without regular maintenance of septic systems (even ones that meet Title 5 standards), solids will clog the system and it will eventually fail.

- If an owner wishes to enlarge, renovate, or replace existing buildings to the extent where a building permit is required, under Title 5, the Board of Health must determine that the existing system is adequate for the proposed alterations. If the system is not in full compliance with Title 5 the owner must obtain either a Disposal Works Construction Permit to upgrade the system to full Title 5 compliance, or seek a variance under **310 CMR 15.20**.

Planning Considerations:

- Home septic system maintenance/upgrade regulations can be enacted through two approaches:
 1. Through a Board of Health regulation requiring inspection and regular pumping of septic systems by a sanitary engineering firm on a one, two, or three year basis.
 2. Through a real estate transfer regulation where the owner of the property must have the system inspected and, if necessary, upgraded to meet Title 5 standards before the transfer of the property to the new owner.
- The Board of Health can inspect on-site septic systems and classify them into one of three categories:
 1. Good - conforms to sanitary code.
 2. Marginal- systems requiring frequent pumping or are determined to be inadequate for the size of the house.
 3. Failed - system must be upgraded or replaced.

Definition: In addition to following the Underground Injection Control (UIC) Regulations (310 CMR 27.00), which prohibit discharge to the ground via an injection well (for example, via a floor drain discharging process water to a septic system), facilities should employ best management practices to lower the risk of ground and surface water contamination. Facilities of concern include automotive service stations, dry cleaners, printed circuit board shops, furniture refinishers, and other industrial or commercial operations managing hazardous materials and wastes

UNDERGROUND INJECTION CONTROL (UIC)

Purpose:

- To protect groundwater and surface water from contamination from underground discharges (such as from floor drains).
- To eliminate the threat of contamination of drinking water supplies from floor drain discharges to the ground.

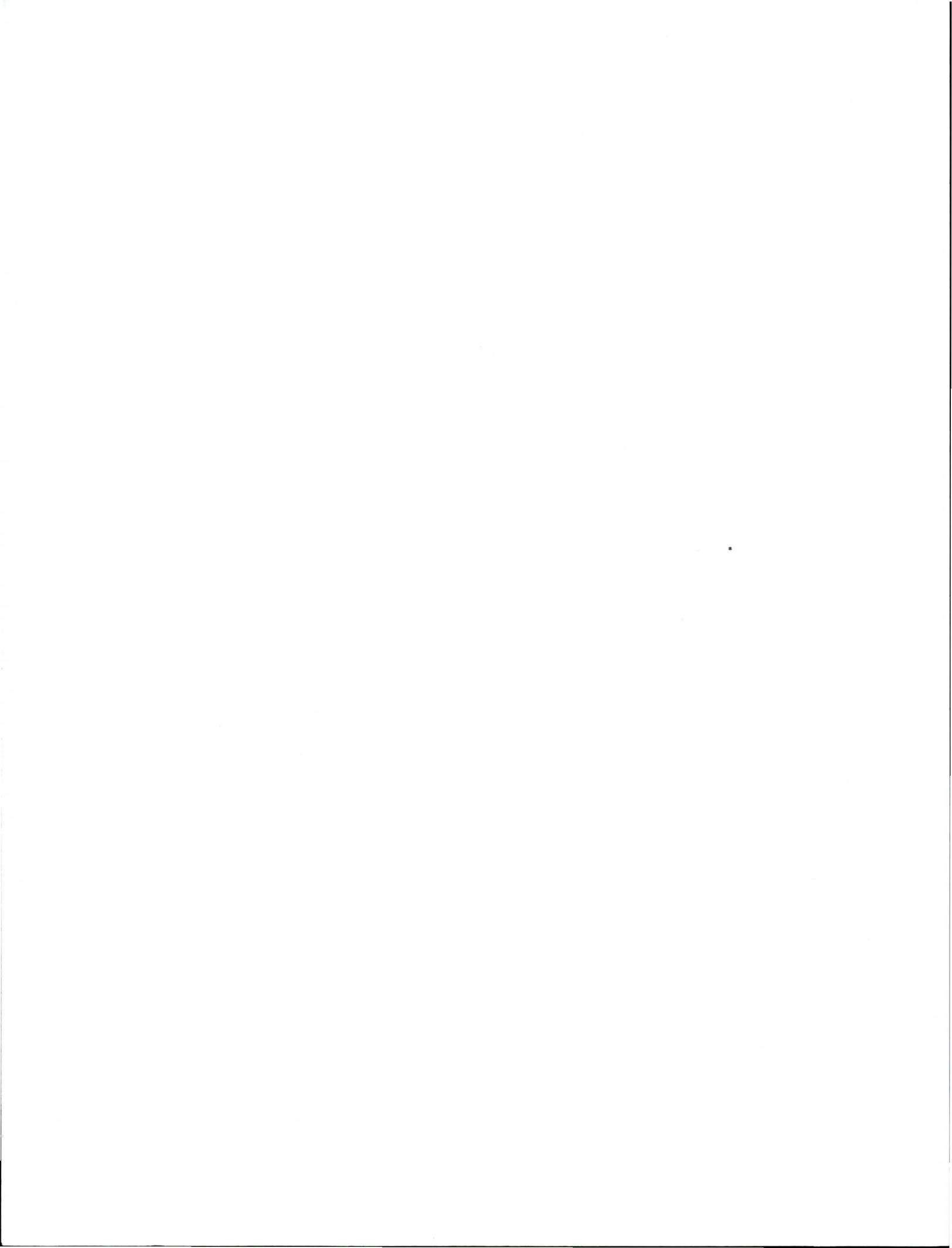
Conditions Where Practice Applies:

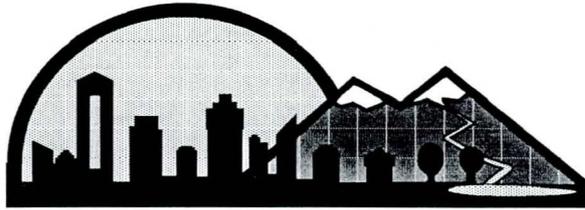
- The potential for contamination due to floor drains is high. Floor drains leading to any point in the ground such as a dry well, septic system, or oil/water separator that discharges to a leach field, constitute a primary pathway of materials to the groundwater. Under the UIC program, floor drains in facilities that use, store, or maintain hazardous materials must either be sealed (with approval of the local plumbing inspector), be connected to a holding tank, or connected to a municipal sewer line leading to a wastewater treatment plant. A waste minimization plan should also be implemented.

Planning Considerations:

- A waste minimization program should be implemented that includes the following best management practices:
 1. use absorbents to clean up spills and minor fluid leaks,
 2. train employees in proper spill management and housecleaning operations,
 3. label and store all hazardous materials in a delineated area, as far from any drain as is practical,
 4. handle of all hazardous materials away from the floor drains,
 5. collect and recycle of solvents, petroleum based fluids, and coolants,
 6. substitute non-hazardous materials for hazardous ones where ever possible,
 7. use dry clean-up methods to clean the floor, rather than flooding,
 8. collect hazardous wastewater in a holding tank to be disposed of by a licensed hazardous waste transporter,
 9. collect non-hazardous industrial wastewater in an approved tight tank and take to a wastewater treatment facility,
 10. isolate (cover) the floor drain when it is not in use.
- A Board of Health regulation (such as in force in Sandwich, MA) may be employed to eliminate floor drain discharges to the ground in existing industrial and commercial facilities located in wellhead protection areas. Establishing and enforcing local control options in combination with BMPs will provide the best wellhead protection strategy.







HYDROLOGIC/HABITAT MODIFICATION BMPs

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Soil Bioengineering (SBE)	4-116a

Sources

U.S.D.A. Soil Conservation Service. 1989. "Field Office Technical Guide - For the Design and Description of BMP's". Amherst, MA.

U.S.D.A. Soil Conservation Service. 1992. "National Engineering Field Handbook, Part 650, Chapter 18 - Soil Bioengineering For Upland Slope Protection and Erosion Reduction". Washington, D.C.



Definition: *This best management practice pertains to the clearing of trees and brush and the removal of sediment bars, drifts, logs, snags, boulders, pilings, piers, headwalls, debris, and other obstructions from the flow area of a natural or excavated channel.*

CLEARING AND SNAGGING (C-S)

Purpose:

- To increase the flow capacity of a channel by improving its flow characteristics;
- To prevent bank erosion by eddies;
- To reduce the forming of bars; and/or
- To minimize blockages by debris and ice.

Conditions Where Practice Applies:

- In any channel or floodway where the removal of trees, brush, and other obstructions is needed to accomplish one or more of the listed purposes.

Planning Considerations:

- If clearing and snagging are likely to result in channel erosion, impairment to the landscape resource quality, or impairment to habitat for fish and wildlife, either the clearing and snagging should not be done or practices to minimize such damages should be applied concurrently with the clearing and snagging.
- Selective clearing (in only specific areas of the channel), should be encouraged whenever possible by using hand-operated equipment, water-based equipment, or small equipment used in a manner that will minimize soil, water, and other resource disturbances.
- Measures and construction methods that enhance fish and wildlife values should be incorporated as a general rule into all clearing and snagging operations.
- Changes in stream water temperature may result from the clearing of vegetation.
- The Wetlands Protection Act (**MGL c. 131, § 40**) requires that, for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent file a "Determination of Applicability" or "Notice of Intent" with their local Conservation Commission.



Definition: Using vegetation or structures to stabilize and protect banks of streams, lakes, or excavated channels against scour and erosion.

STREAMBANK PROTECTION (STRP)

Purpose:

■ To stabilize or protect banks of streams, lakes, or excavated channels for one or more of the following purposes:

1. to prevent the loss of land or damage to utilities, roads, buildings, or other facilities adjacent to the banks,
2. to maintain the capacity of the channel,
3. to control channel meander that would adversely affect downstream facilities.
4. to reduce sediment loads causing downstream damages and pollution,
5. to improve the stream for recreation or as a habitat for fish and wildlife.



Conditions Where Practice Applies:

- This practice applies to natural or excavated channels where the streambanks are susceptible to erosion from the action of water, ice, or debris or to damage from vehicular traffic.
- This practice also applies to controlling erosion on shorelines where the problem can be solved with relatively simple structural measures, vegetation, or upland erosion control practices.

Planning Considerations:

- Obstructions in the stream channel should be removed to prevent water from being deflected laterally and causing erosion of the bank. (See Clearing and Snagging (C-S) (p. 4-112).)
- Consideration should be given to flattening the side slope of the channel in some reaches to better facilitate the establishment of vegetation.
- The following is a partial list of protection measures that may be used: bulkheads, revetments, groin systems, gabion baskets, vegetation (including bio-engineering practices). (See Soil Bioengineering (SBE) p. 4-116a.)
- The Wetlands Protection Act (**MGL c. 131, § 40**) requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent file a "Determination of Applicability" or "Notice of Intent" with the local Conservation Commission.

Definition: Stabilizing the channel of a stream with suitable materials.

STREAM CHANNEL STABILIZATION (SCS)

Purpose:

- To accomplish structural measures to control aggradation or degradation in a stream channel. It does not include work done to prevent bank cut or meander.

Conditions Where Practice Applies:

- This practice applies to stream channels undergoing damaging aggradation or degradation that cannot be feasibly controlled by clearing and snagging, by the establishment of vegetative protection, or by the installation of upstream water control facilities.



Planning Considerations:

- Changes in stream water temperature may result from the clearing of vegetation or alteration of the stream channel.
- A channel is considered stable if, over long periods of time, the channel bottom remains essentially at the same elevation.
- The Wetlands Protection Act (**MGL c. 131, § 40**) requires that, for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent file a "Determination of Applicability" or a "Notice of Intent" with the local Conservation Commission.

Definition: A dam constructed across a stream or a natural watercourse that has a designed reservoir storage capacity for two or more purposes, such as floodwater retardation, irrigation water supply, municipal water supply, and recreation.

MULTIPLE PURPOSE DAM (MPD)

Purpose:

■ A multiple purpose dam must provide distinct and specific storage allocations for two or more of the following purposes:

1. floodwater retardation,
2. irrigation,
3. fishing, hunting, boating, swimming, or other recreational uses,
4. improve environment or habitat for fish or wildlife,
5. municipal, industrial, or other uses.



Conditions Where Practice applies:

- This practice applies only to sites meeting all of the following criteria:
1. topographic, geologic, hydrologic, and soil conditions at the proposed site are satisfactory for constructing a dam,
 2. the watershed is protected from erosion to the extent that the sediment yield will not shorten the planned effective life of the reservoir,
 3. water is available from a single or combined source of surface runoff base flow in sufficient quantity and adequate quality to satisfy the intended purpose.

Planning Considerations:

- Consider the effects on the water budget, especially of longer downstream flow durations, evaporation from the water surface, and infiltration in the bottom and sides of the pool.
- Consider the effects on the movement of sediments, pathogens, and soluble and sediment-attached substances carried by runoff.
- Consider the changes in groundwater quality caused by increased infiltration of soluble substances.
- The Wetlands Protection Act (**MGL c. 131, § 40**) requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent file a "Determination of Applicability" or a "Notice of Intent" with the local Conservation Commission.

Definition: A waterway having an erosion-resistant lining of concrete, stone, or other permanent material. The lined section extends up the side slopes to a designed depth. The earth above the permanent lining may be vegetated or otherwise protected.

LINED WATERWAY (LW)

Purpose:

- To provide for safe disposal of runoff from other BMPs or from natural concentrations of flow, without damage by erosion or flooding, where unlined or grassed waterways would be inadequate.
- To control seepage, piping, and sloughing or slides.

Conditions Where Practice Applies:

- This practice applies if the following or similar conditions exist:

1. concentrated runoff is such that a lining is needed to control erosion;
2. steep grades, wetness, prolonged base flow, seepage, or piping would cause erosion;
3. the location is such that use by people precludes use of vegetated waterways;
4. soils are highly erosive or other soil or climatic conditions preclude using vegetation.

Planning Considerations:

- Linings can consist of: non-reinforced, cast-in-place concrete; flagstone mortared in place; rock riprap; or similar permanent linings.
- Consider adopting a standard limiting the maximum velocity for the design of grassed waterways, after which a lined waterway must be used.
- The Wetlands Protection Act (**MGL c. 131, § 40**) requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent file a "Determination of Applicability" or a "Notice of Intent" with the local Conservation Commission.

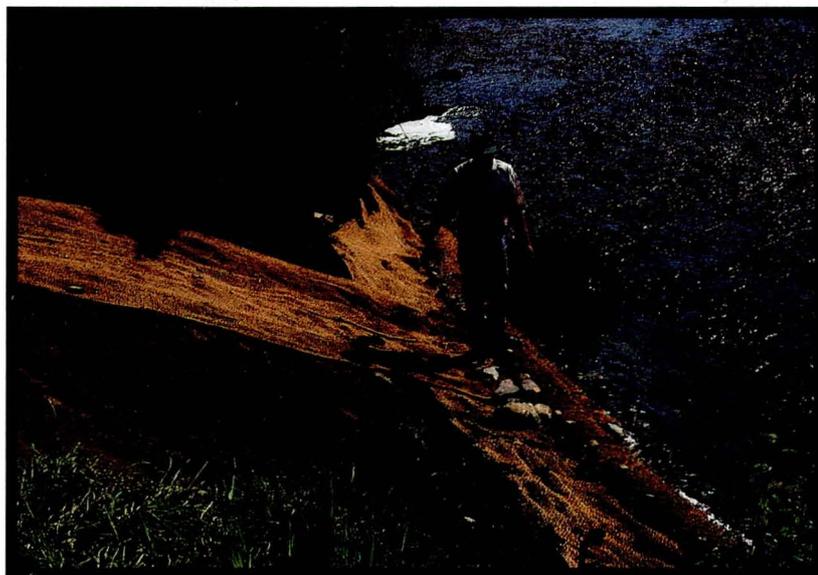


Definition: *Methods of upland slope protection, streambank, and/or shoreline stabilization that combine biological and ecological concepts with engineering design principals to arrest and prevent shallow slope failures, erosion, and sedimentation.*

SOIL BIOENGINEERING (SBE)

Purpose:

- To stabilize and protect upland slopes, dunes, streambanks, and/or shoreline areas from erosion;
- To reduce sediment loads from slope and bank erosion that may cause downstream damages such as habitat loss and reduced flood storage;
- To filter soil, intercept raindrops, maintain infiltration, control weeds, and moderate soil temperature;
- To improve the stream, lake, or coastal areas for recreation or create improved habitat for fish and wildlife; and/or
- To generally improve the appearance of engineering structures that may be used in conjunction with vegetative plantings.



Conditions Where Practice Applies:

- This practice applies to natural or excavated stream and channel banks, lakeshores, coastal areas, wetlands, and upland slopes where banks and shorelines are susceptible to erosion from the action of water, ice, wind, and debris.

Planning Considerations:

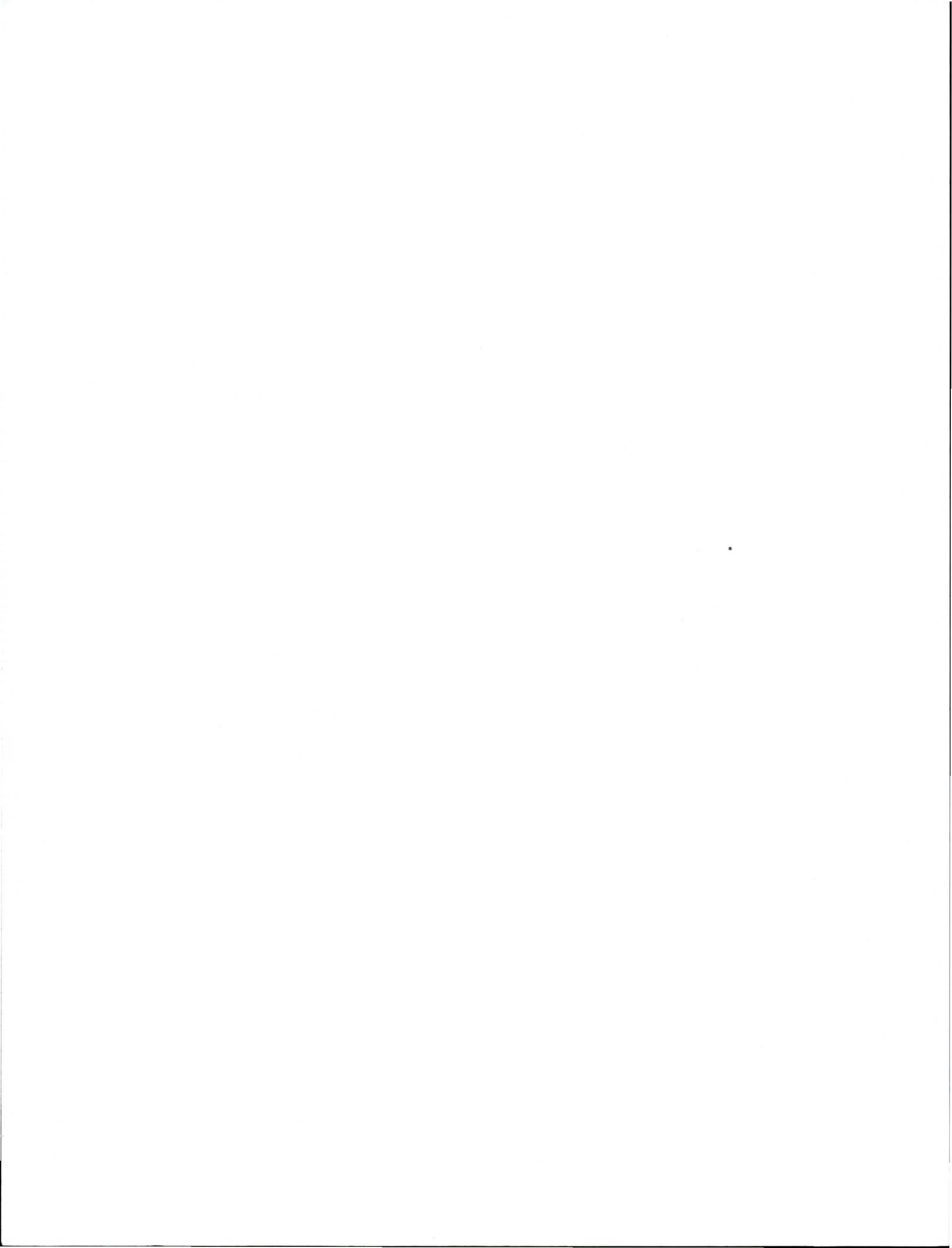
- Types of soil bioengineering techniques include: plantings of conventional grasses, forbs, and/or shrubs; live staking, live fascines (branch bundles), brushlayers, and/or branchpacking using stems or branch parts of living plants; construction of live cribwalls, vegetated rock gabions or vegetated rock walls; installation of geotextiles such as coconut fiber or synthetic fabric rolls, mats or carpets planted with selected plants.
- The success of a bioengineering project depends on: understanding the environmental conditions of the site (such as topography, water depth and chemistry, soil characteristics, exposure and

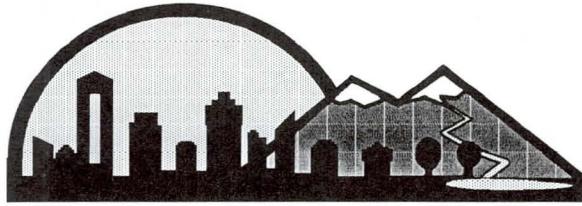


hydrology); appropriate design of technique(s); appropriate timing of the project; and suitable use of live plant material.

- Some grading or refinement of the slope or bank may be necessary before vegetation is planted or other bioengineering techniques are applied.
- Working within the regulatory boundaries of water resources requires adherence to all local, state and federal permit requirements. Necessary permits may include, but are not limited to: Wetlands Protection Act (**MGL c. 131, § 40**), Federal Clean Water Act (**Section 401 and Section 404**), Massachusetts Surface Water Quality Certificate (**314 CMR 4.00**).







ZONING AND LAND MANAGEMENT BMPs

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Massachusetts Executive Office of Communities and Development and Pioneer Valley Planning Commission. 1988. "The Growth Management Workbook". Boston, MA.

Massachusetts Department of Environmental Protection. 1985. "Road Salts and Water Supplies - Best Management Practices". Boston, MA.



Definition: A residential zoning bylaw which uses a special permit and site plan review process to allow clustering of single family homes in return for protection of significant adjacent areas of open space.

OPEN SPACE COMMUNITY (CLUSTER) ZONING (OS CZ)

Purpose:

- To identify open space, farmlands, and natural landscape features for special management consideration;
- To promote more efficient use of land and allow for greater flexibility and creativity in the design of residential subdivisions;
- To maintain the traditional New England rural character and land use pattern in which small villages contrast with open space and farmlands; and
- To facilitate the construction and maintenance of streets, utilities, and public services in a more economical and efficient manner.

Conditions Where Practice Applies:

- Many communities are experiencing a loss of open space and rural character as a result of extensive development of single family homes along available frontage lots.
- More efficient use of land in a cluster development results in lower costs of development, roads, and lower municipal costs for providing maintenance and services. Clustering allows the preservation of natural features by minimizing the impact of development on open spaces, scenic waterways, slopes, trees, and wildlife areas.

Planning Considerations:

- Most open space community or cluster zoning bylaws in Massachusetts allow development of single family houses on lots significantly smaller than those normally allowed in the zoning district (i.e., 30% to 50% of the existing lot size requirement).
- In most bylaws the developer is not allowed to construct a greater total number of houses than would normally be allowed for a given tract of land. The developer is simply given a "density bonus" on a portion of his land parcel in return for preserving the remainder of the tract as permanent open space.
- In an open space community, all land within the parcel boundaries that is not designated for homes, roads, or other development is conveyed to the community or a non-profit organization to be permanently preserved as open space.
- It is important to adopt regulations which ensure the proper, long-term maintenance of common



space areas, utilities and other shared facilities. Zoning standards should address the following issues:

1. Minimizing the size and environmental impact of communal septic systems (if no public sewer system exists);
 2. Criteria for determining the allowable number of dwelling units and required amount of open space;
 3. Lands which qualify to meet open space requirements;
 4. Ownership and use of common open space;
 5. Establishment of a homeowner's association to be responsible for the long-term maintenance of common open space and communal septic systems.
- Adoption requires a two-thirds majority vote of Town Meeting to amend the zoning bylaw. The bylaw must specify the zoning districts in which open space communities are allowed by Special Permit.



Definition: Agricultural Preservation Districts are established as overlay zones to preserve prime farmlands and minimize adverse development impacts and conflicts.

AGRICULTURAL PRESERVATION ZONING (APZ)

Purpose:

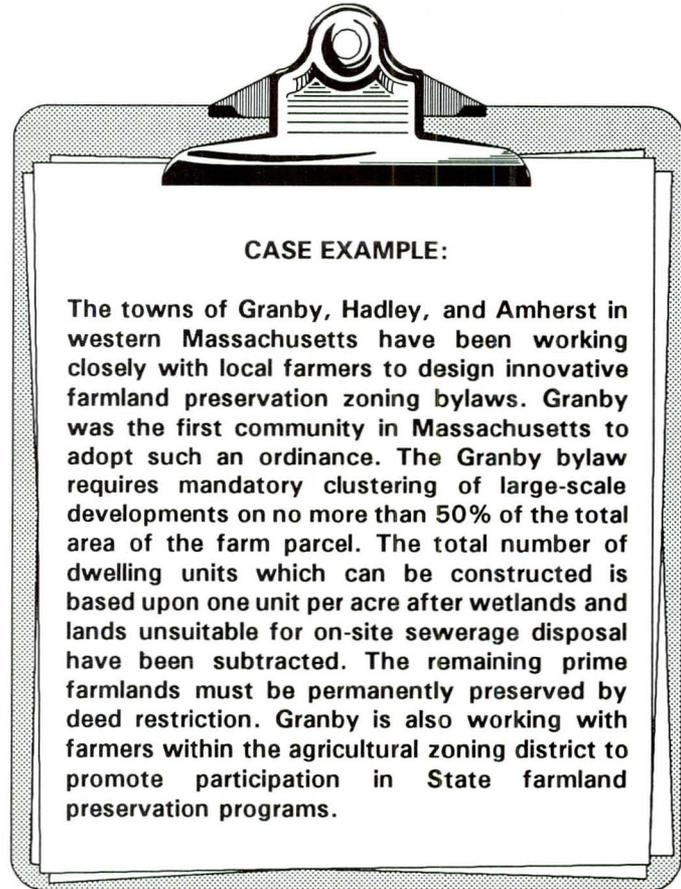
- To protect prime agricultural lands for future food production;
- To promote the practice of farming, and minimize conflicts with other land uses;
- To preserve historic, scenic, open space, and other farm-related values which help to define the community's character; and/or
- To allow landowners a reasonable return on the value of their holdings while preserving the most important farmlands for future agricultural use.

Conditions Where Practice Applies:

- Prime farmland is also prime land for development. Throughout Massachusetts, important farmlands have been permanently lost to subdivisions and industrial parks. To successfully preserve farmlands, State programs such as the Agricultural Preservation Restriction Program (APR) must be complemented by effective local land use controls.

Planning Considerations:

- Agricultural zoning can be designed to require mandatory clustering of all large-scale residential developments on the portions of the parcel with soils least suitable for agriculture.
- The permitted uses in the district should be limited to farming, farm-related activities, and residential development on lots with frontage on an existing public way.
- All residential subdivisions that require approval under **MGL c. 41** (subdivision control law) must



obtain a Special Permit/Site Plan Approval and follow special guidelines:

1. Structures must be clustered in order to preserve the majority of the site's most productive farmlands as open space.
2. Remaining open farmlands must be permanently preserved by deed restriction.
3. Landscaped and fenced buffer areas must be created to separate residential and agricultural areas.

■ As an amendment to the zoning bylaw, adoption requires a two-thirds majority vote of Town Meeting. Zoning district boundaries should be delineated on an overlay map.



Definition: Flexible Zoning permits variation in lot size and frontage within a development, while maintaining the overall density of the development according to established standards.

FLEXIBLE ZONING (FZ)

Purpose:

- To promote greater harmony between development and natural landscape qualities.
- To allow visual and aesthetic variety in residential land use patterns.
- To protect important natural resources, such as wildlife habitat, watercourses or unique landscape features without public expense.

Conditions Where Practice Applies:

- Flexible Zoning is a technique to allow variation in single-family residential lots without a required dedication of open space or mix of uses in new or existing developments.

Planning Considerations:

- The total number of lots should not exceed the number which could be developed on that parcel under a conventional plan in full conformance with zoning, subdivision regulations, and health codes.
- As an amendment to the zoning bylaw, adoption requires a two-thirds majority vote of Town Meeting.

Definition: An open space conservation program involving a combination of methods merging long-range planning with an opportunistic action approach. Those methods include: outright purchase of land at full or "bargain-sale" prices; establishment of permanent Conservation Restrictions through gift or purchase; exercise of the local first refusal right under Chapter 61A; limited development purchases; and others.

STRATEGIES FOR PRESERVING OPEN SPACE AND CONSERVATION AREAS (SPOSCA)

Purpose:

- To permanently preserve a greenbelt of open lands for aesthetic enjoyment, recreation, wildlife habitat, landscape, and farmland preservation.

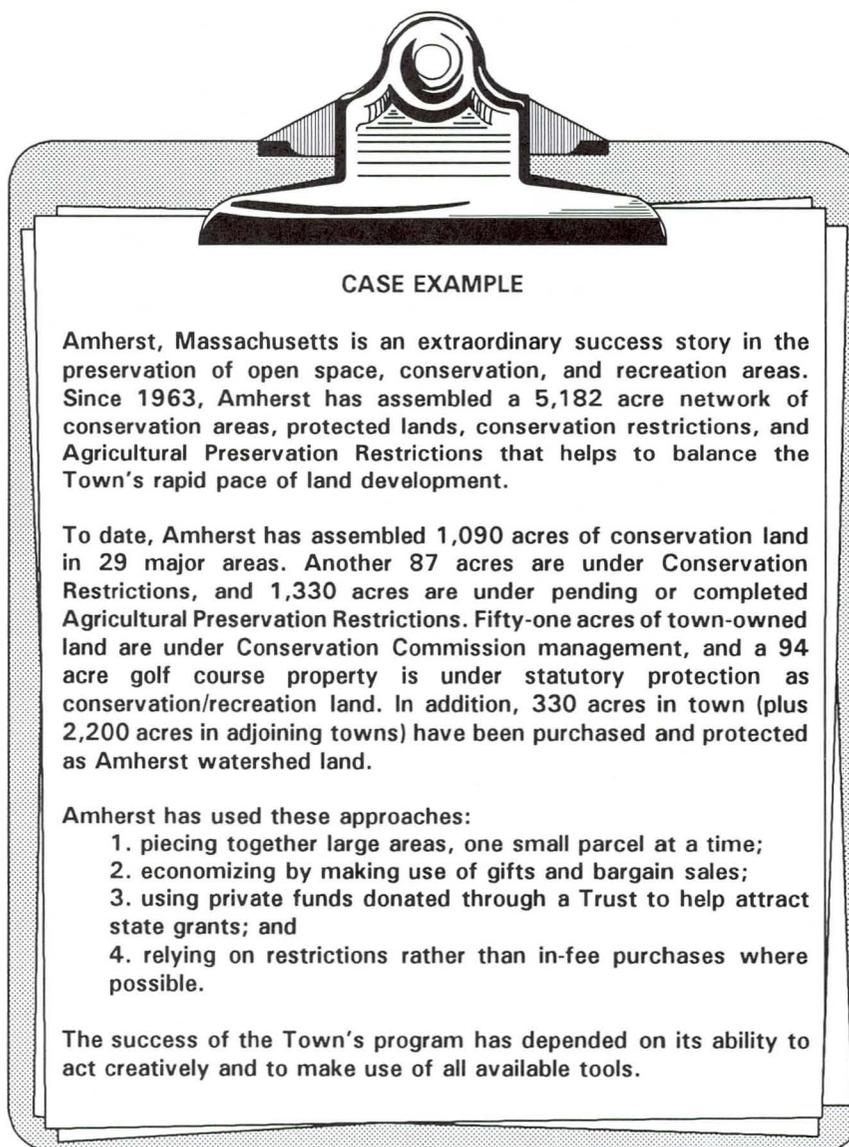
Conditions Where Practice Applies:

- When prime open space in a community becomes available the opportunity to create blocks or greenbelts of local conservation land should be taken advantage of by the community.

Planning Considerations:

- Land preserved through acquisition, deed restriction, or other methods should be representative of each major land or habitat type within the town, and should be joined to form connecting corridors wherever possible.

- A multi-faceted local approach to the preservation of open space requires the support of Town Meeting, a willingness to work with local or regional land trusts, the existence of a working open space plan, and the maintenance of a healthy conservation fund.



CASE EXAMPLE

Amherst, Massachusetts is an extraordinary success story in the preservation of open space, conservation, and recreation areas. Since 1963, Amherst has assembled a 5,182 acre network of conservation areas, protected lands, conservation restrictions, and Agricultural Preservation Restrictions that helps to balance the Town's rapid pace of land development.

To date, Amherst has assembled 1,090 acres of conservation land in 29 major areas. Another 87 acres are under Conservation Restrictions, and 1,330 acres are under pending or completed Agricultural Preservation Restrictions. Fifty-one acres of town-owned land are under Conservation Commission management, and a 94 acre golf course property is under statutory protection as conservation/recreation land. In addition, 330 acres in town (plus 2,200 acres in adjoining towns) have been purchased and protected as Amherst watershed land.

Amherst has used these approaches:

1. piecing together large areas, one small parcel at a time;
2. economizing by making use of gifts and bargain sales;
3. using private funds donated through a Trust to help attract state grants; and
4. relying on restrictions rather than in-fee purchases where possible.

The success of the Town's program has depended on its ability to act creatively and to make use of all available tools.

Definition: A zoning bylaw requiring the submission of a site plan for commercial, industrial, and in some cases, large-scale residential developments.

SITE PLAN REVIEW (SPR)

Purpose:

- To ensure that new development is designed in a manner which protects the visual and environmental qualities and property values of the town.
- To assure adequate review of plans for developments which may have significant impacts on traffic, drainage, municipal, and public services, environmental quality, and community character.

Conditions Where Practice Applies:

- The Site Plan Review process provides a mechanism for a municipality to ensure that proposed developments provide adequately for access, circulation, parking, utilities, landscaping, and protection of important natural resources, before a special permit or a building permit is issued.
- The following are examples of issues that can be addressed through Site Plan Review:
 1. nonpoint source pollution issues concerning both surface water and groundwater,
 2. integration of development into the existing terrain,
 3. adequacy of water supply and sewage disposal systems,
 4. screening or buffering of unsightly uses,
 5. minimizing odors, noise, and other environmental impacts,
 6. traffic circulation and pedestrian safety.

Planning Considerations:

- Like subdivision control, any project that meets site plan review standards must be approved.
- A project that does not meet review standards can be approved subject to conditions or modifications imposed by the Board to bring it into compliance.
- The Planning Board may require a developer to post a bond or security to assure imposed conditions are met.
- Adoption requires a two-thirds majority vote of Town Meeting to amend the zoning bylaw.
- Site plan regulations can be adopted as a Special Permit process (Site Plan Approval), or as a review process (Site Plan Review).

Definition: A well location bylaw, adopted by the local Board of Health, establishes procedures for siting private wells in relation to on-site and off-site septic systems.

WELL LOCATION BYLAW (WLB)

Purpose:

- To protect private wells from possible contamination from on-site and/or off-site septic systems.
- To establish procedures (that are more effective than those required under **Title 5** of the State Sanitary Code) for estimating the zone of contribution for a well which take into account the particular geological and hydrological characteristics of the specific site and require landowners to use the protocols to more carefully position their wells with respect to septic systems.

Conditions Where Practice Applies:

- **Title 5** of the State Sanitary Code established procedures for siting septic systems in relation to private wells. However, no state regulations govern the placement of private wells in relation to septic systems. The State Code does require that a septic system leach field be at least 100 feet (horizontally) away from any private drinking water well. While this zone may be sufficient to encompass the zone of contribution for many wells, it has proven to be insufficient in several instances, particularly where the geology and the hydrology are such that the zone of contribution forms an ellipse, rather than a circle.

Planning Considerations:

- Local Boards of Health have the authority to adopt "reasonable health regulations" under **MGL c. 111, § 31** by majority vote of the board.
- The local Board of Health should develop a simple procedure for delineating a protective zone, based on recharge rate, and groundwater direction, flow and velocity, for a residential private well.
- Once a procedure has been established, the local Board of Health can require landowners to obtain a permit for well construction or replacement, and make the procedures for well location a condition for the permit.



- Once these recharge areas have been mapped, communities should evaluate existing and potential surface and groundwater contamination sources.
- Restrict future land uses that are likely to contaminate groundwater and also require best management practices for present activities.
- As an amendment to the zoning bylaw, adoption requires a two-thirds majority vote of Town Meeting.

Definition: Floodplain Zoning overlay districts can be established to preserve natural flood storage areas and reduce the severity of floods.

FLOODPLAIN MANAGEMENT (FM)

Purpose:

- To provide adequate and safe floodwater storage capacity;
- To prevent filling or building within floodplains and floodways which would increase the severity of floods.
- To ensure that lands subject to flooding will not be used for residences or other land uses which will endanger the health, safety, or economic well-being of residents.

Conditions Where Practice Applies:

- Floodplains provide a temporary storage area for floodwaters which have overtopped the main channel of a river or stream. Floodwaters can then be slowly released through surface discharge, evaporation, or percolation to groundwater.
- The building of a structure in a floodplain area not only places that structure in danger of flood damage, but also increases the overall severity of flooding and the potential for those floodwaters to carry potential pollutants to downstream areas.

Planning Considerations:

- Floodplain Zoning bylaws can be designed to prevent development within the floodplain that might increase flood levels and velocities, or cause flood damages due to unanchored materials.
- Any new floodplain development can be required to comply with stringent Special Permit standards requiring the applicant to demonstrate that the development will not increase flood levels or severity.
- Floodplain overlay zones must be based upon detailed maps illustrating 100-year floodplains developed under the National Flood Insurance Program.
- As an amendment to the zoning bylaw, adoption requires a two-thirds majority vote of Town Meeting.

Definition: River Protection Districts can be established as overlay zones to protect the riverbank and the scenic qualities of important rivers, and to minimize adverse development impacts and conflicts.

RIVER PROTECTION ZONING (RPZ)

Purpose:

- Enhance and preserve existing scenic or environmentally sensitive areas along the shoreline.
- Prevent any disruption of the natural flow of the river.
- Control erosion and siltation.
- Protect fisheries within the river.
- Conserve shore cover and encourage well-designed developments.

Conditions Where Practice Applies:

- Rivers in Massachusetts are under pressure for a variety of uses including recreational activities, energy projects, and residential development. Zoning regulations can be useful in ensuring lands will be compatible with river conservation objectives, and prohibiting uses which diminish scenic amenities or endanger natural resources through nonpoint source pollution.

Planning Considerations:

- A River Protection overlay district can be designated for a portion of the riverbank from the shoreline landward up to an established distance from each bank.
- Residential subdivisions in the district can be required to include mandatory clustering, and be located away from the shoreline to the maximum practical extent. River protection design standards can be established for all new residential uses, such as the following:
 1. All structures must be located at an established setback (i.e., 150 feet) from the shoreline and be visually screened from the shoreline by a vegetated buffer;
 2. Each structure should be integrated into the existing landscape so as to minimize its scenic and environmental impact;
 3. Runoff should be directed toward areas covered with vegetation.
- Certain uses should be prohibited outright, such as altering, dumping, filling, removal of riverine materials, or dredging. In addition, no clear cutting of existing vegetation and no more than minimal disruption of wildlife habitat should be permitted.
- As an amendment to the zoning bylaw, adoption requires a two-thirds majority vote of Town Meeting. Zoning district boundaries should be delineated on an overlay zoning map.

Definition: Overlay zoning districts can be established to protect mountain or upland areas of unique visual appeal and scenic quality from aesthetic or environmental degradation.

SCENIC UPLAND ZONING (SUZ)

Purpose:

- To protect community character, property values and public welfare by preventing erosion, sedimentation, flooding, water pollution, and visual or environmental degradation due to damage to scenic areas or unique natural resource areas.
- To regulate vegetation removal, new construction, filling or excavation of land which could adversely affect scenic qualities or natural resources.

Conditions Where Practice Applies:

- Controls must be imposed to protect scenic areas, such as prominent ridge lines, wooded canyons, or exceptional vistas as important resources which contribute to the character and quality of life of a community.
- These areas are commonly the most fragile areas with the least carrying capacity for development due to steep slopes, unstable or poor soils, and inadequate public infrastructure.

Planning Considerations:

■ Scenic district regulations function in a similar manner to site plan review. All proposed development is scrutinized for potential negative effects on the environment and on the scenic amenities of the district.

■ The following issues could be addressed in scenic area regulations:

1. Alterations to the environment:

- control removal, excavation, or dredging of soil, sand, gravel, or aggregate material of any kind;
- regulate changing of pre-existing drainage characteristics, sedimentation patterns, and flow patterns;
- control removal or destruction of plant life, including cutting of trees;
- regulate drainage or disturbance of existing water courses or water table;
- prevent substantial change in topographic features;
- control water pollution.

2. New Residential or Commercial Development:

- establish screening or buffer areas for new development;
- establish standards for landscaping or site treatment;
- regulate the amount of paved or impermeable surfaces;
- prevent building on very steep slopes, wetlands, or other sensitive lands.

3. Incentives for land uses which maintain scenic qualities:

- promote and protect farming, forestry practices;
 - encourage passive and active recreation uses;
 - direct growth to less critical and sensitive areas.
- Scenic and natural resource areas must be mapped, based upon objective criteria.
- As an amendment to the zoning bylaw, adoption requires a two-thirds majority vote of Town Meeting. Similar regulations have also been adopted as state legislation (Berkshire Scenic Mountains Act, **MGL c. 131, § 39a**).



Definition: A local Wetlands Protection Bylaw can be established to provide increased control over development activities affecting wetland areas (as defined in the Wetlands Protection Act, MGL, c. 131, § 40).

WETLANDS PROTECTION BYLAW (WPB)

Purpose:

- To promote enforcement of the Massachusetts Wetlands Protection Act and provide greater local control of wetland protection.
- To protect the wetlands, related water resources and adjoining land areas in the community by controlling activities likely to have significant or cumulative effect upon wetland values.

Conditions Where Practice Applies:

- By adopting a local wetlands protection bylaw a municipality can increase control over activities not regulated in the Massachusetts Wetlands Protection Act.
- A local wetlands protection bylaw could provide local regulation and greater protection of wetlands in the following areas:
 1. provide Conservation Commission jurisdiction over all isolated wetlands (ie. vernal or seasonal ponds), some of which are currently unregulated by the Massachusetts Wetlands Protection Act;
 2. establish a 100 foot buffer zone for land subject to flooding;
 3. provide greater protection for wetland values such as recreation, aesthetics, and erosion control which are not regulated by the Act;
 4. increase coordination between town boards on wetlands protection;
 5. define the required contents of a Notice of Intent.

Planning Considerations:

- The Conservation Commission is the bylaw administrator and as such can not only regulate development as permitted in the Wetlands Protection Act, but can deny a permit.
- If a negative decision is made by the Conservation Commission, the applicant/developer must appeal in Superior Court, rather than appealing to the Department of Environmental Protection as required in the Massachusetts Wetlands Protection Act.
- A wetlands protection bylaw can be adopted as a town or municipal bylaw/ordinance. Adoption of such a bylaw/ordinance requires a majority vote of Town Meeting.

Definition: A program designed for a town/city to control the amount (application rates), locations, method, and disposal of road salting operations.

ROAD SALTING MANAGEMENT PROGRAM (RSMP)

Purpose:

- To prevent the contamination of surface water, groundwater, or adjacent wetlands from road salting operations.

Conditions Where Practice Applies:

- In any town or city where road salting operations have caused, or have potential to cause, environmental damage to surface water, groundwater or wetlands.

Planning Considerations:

- Sensitive areas should be identified and made known to all salt users. Areas around public water supplies should be designated as sensitive areas where control over salt storage and application should be practiced.
- Ground speed controllers should be used for all spreaders.
- Spreaders should be calibrated before the winter season, using the materials to be used (salt, mixtures of sand and salt, etc.)
- Levels of service depending on road type, weather conditions, and traffic volume should be determined prior to the winter season. These levels of service can range from no salt use to mainly plowing and using sand to straight salt application on heavily traveled road sections and dangerous intersections.
- Reduced salt application should be considered for sensitive areas.
- Appropriate accounting should be conducted after the storm to determine the amount of materials used, the area covered, and the results.
- Explore alternatives. A new chemical which shows promise as a replacement for sodium chloride (NaCl) and calcium chloride (CaCl) is calcium magnesium acetate (CMA) and an asphalt additive called Verglimit which is added to the top-course mix.
- Snow Dumps:
 1. Carefully choose snow disposal sites in areas that will not threaten water supplies.
 2. Avoid direct dumping into rivers or water courses. Consider downstream uses of the river or water course and the impacts due to direct disposal.
 3. Try to choose a site near a large river with suitable soils where the melted snow can filter through the soil.
 4. Snow should not be deposited at a sanitary landfill since the added moisture from the melting snow will contribute to leachate generation.

Definition: A municipal bylaw to regulate underground storage tanks (USTs) including those that are exempt from certain provisions of the State regulations (527 CMR 9.00).

UNDERGROUND STORAGE TANK REGULATIONS (USTR)

Purpose:

- To provide for the proper construction, installation, operation, and maintenance of all USTs.

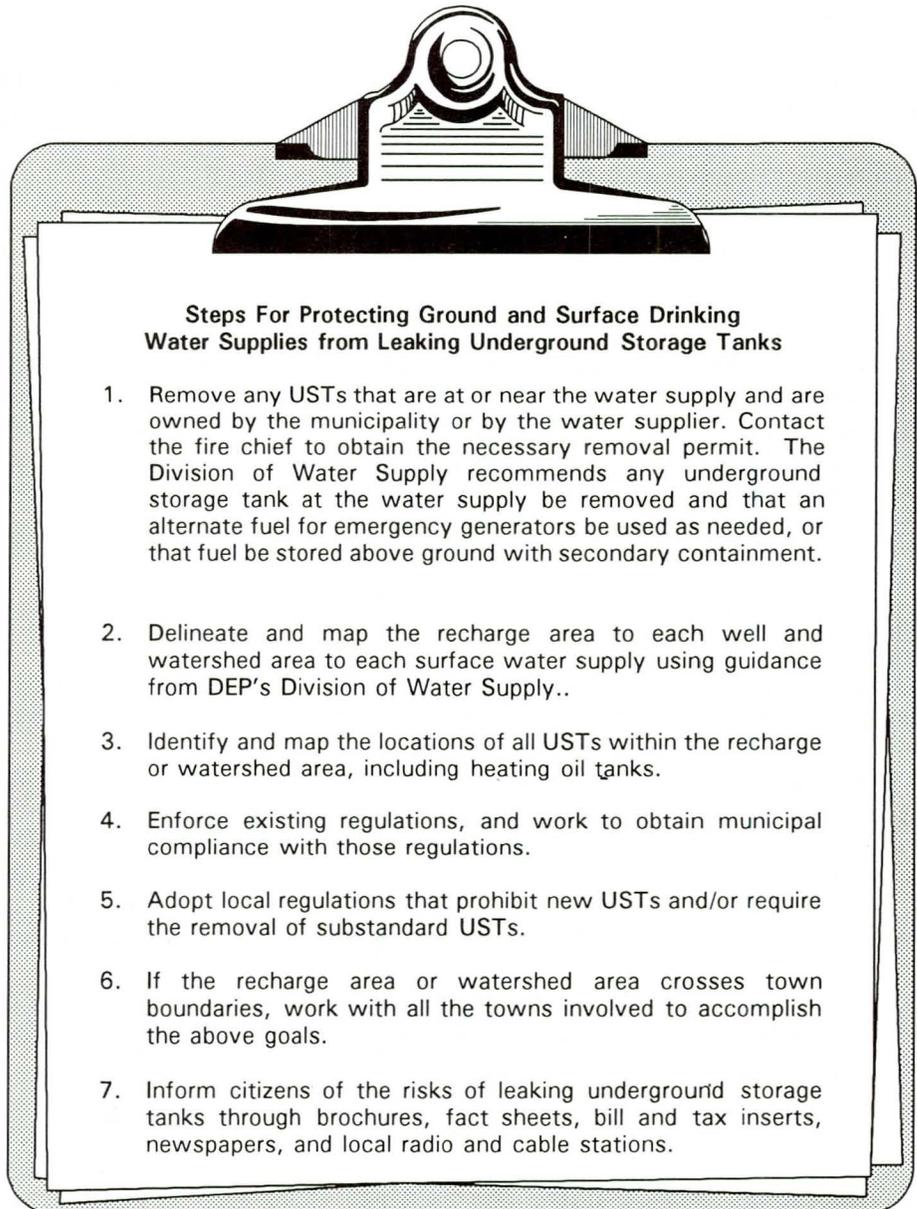
- To prevent UST leaks which could pollute ground and surface water and threaten public health and safety.

Conditions Where Practice Applies:

- The regulations could prohibit or set special conditions on all new underground storage tanks within the community's water supply area, whether an aquifer recharge area or reservoir watershed area.

- Any new heating fuel tanks in the water supply area could be required to be placed in above ground tanks.

- All new underground storage tanks outside the water supply area would be subject to municipal regulations (as well as State regulations) on construction, installation, and regular testing.



Planning Considerations:

- These local regulations ensure that all UST systems are regulated according to standards comparable to Massachusetts Board of Fire Prevention regulations. The State UST regulations do contain exemptions from some provisions of the regulations for certain tanks (for example: USTs storing oil used 100 per cent for heating, and USTs under 1100 gallon capacity). Thus, most residential and some commercial tanks are exempted from many of the provisions of **527 CMR 9.00**.
- Adoption requires a majority vote of Town Meeting. Regulations may be adopted under **MGL c. 40, § 21, or MGL c. 40A**.
- Under the provisions of **MGL c. 148** communities may also make and enforce related bylaws provided they are not inconsistent with the Commonwealth's rules and regulations. To ensure consistency, a municipal bylaw of this type must be submitted to the Massachusetts Board of Fire Prevention within ten days of passage for review and approval by the Board.



Definition: Performance standards to control the impact of erosion and sedimentation from development. Standards are set in advance to limit erosion and siltation resulting from development both during the construction period and once the development is completed, to ensure protection of water quality and prevent overloading or clogging of municipal infrastructure such as storm drains.

EROSION AND SEDIMENT CONTROL STANDARDS (E-SCS)

Purpose:

- To protect surface and groundwater quality from degradation;
- To protect quality of aquatic habitats for fish and other wildlife;
- To protect downstream wetlands from increased amounts of sediment, decreasing their productivity;
- To protect the land's capability for rapid infiltration of water, which allows for aquifer recharge, decreases rapid runoff and accompanying flooding, and decreases overburdening of infrastructure (deep soils have greater capacity for receiving and retaining water);
- To protect agricultural land by preserving topsoil.

Conditions Where Practice Applies:

- Requirements for erosion control set standards and safeguards for the developer which must be incorporated into the design as well as employed during construction to ensure that erosion and siltation are effectively held in check.

Planning Considerations:

- Techniques, standards, and guidelines for analysis which are consistent with some established set of rules, such as the Soil Conservation Service Guidelines, should be set out in the regulations for all applicants to adhere to.
- Applicants should provide evidence of probable compliance with the established standards either by example of similar facilities or by engineering analysis when applying for permits.
- The reviewer (anyone from the Building Inspector to the Planning Board to the Special Permit Granting Authority) should check to see that the standards have been met.
- As an amendment to the zoning bylaw, adoption requires a two thirds majority vote of Town Meeting.
- As an addition to subdivision rules and regulations, adoption requires approval by the Planning Board, but standards then are only applicable to subdivision proposals.
- As a special permit provision adopted as an amendment to the zoning bylaw, adoption requires a two thirds majority vote of Town Meeting and standards are then only applicable to uses which fall under the special permit process.

Definition: Performance standards to control the impact of nutrient loading from development by directly regulating the amount of nutrients entering surface and groundwater through zoning, special permit and subdivision controls.

NUTRIENT LOADING STANDARDS (NLS)

Purpose:

- To maintain the quality of public and private water supplies.
- To protect water bodies from eutrophication by sewage-derived nitrogen and phosphorus from residential on-site septic systems and other human induced runoff.

Conditions Where Practice Applies:

- Federal and state laws and usual zoning requirements do not always protect water supplies and other water resources from nonpoint sources such as septic system leachate and the eutrophication associated with dense residential and commercial development.
- Criteria are set for allowable levels of nutrients before development occurs. All developments must provide proof that they will not exceed the specified levels in order to gain permit approval.

Planning Considerations:

- Bylaws should delineate specific requirements (standards) for developers to follow and should be equitably applied to all developers within specifically delineated recharge areas.
- Special Permit procedures and Subdivision Regulations can be amended to trigger a more in-depth analysis for projects which, because of their special nature or larger size, may tend to have a greater impact.
- There are two ways to enact nutrient loading controls:
 1. The town should condition subdivision approval or grant a special permit on the requirement that the developer do a water quality impact analysis of the specific development proposal. The nutrient loading effects of the proposed development on the groundwater must be determined and compared to the carrying capacity of the receiving waters. If the existing nutrient concentration of the water is in excess of the carrying capacity, or if the development would push the water quality past the threshold level, the developer must propose mitigations to reduce the nutrient output generation. For example, measures may include reducing the number of lots and the extent of lawn areas.
 2. The town should establish baseline data of water quality, establish critical threshold limits and then calculate the permissible loading standards. From this, permissible housing densities and standards that ensure a level of development below the critical threshold level can be established. These density limits along with performance criteria can then be directly inserted

into the zoning bylaw or subdivision regulation. Developers are then required to provide proof of compliance when applying for needed permits. This approach is more quickly and easily administered than true performance rules in that review consists only of ensuring that the standards are being met.

- Nutrient loading requirements have been adopted into the subdivision regulations as well as into the zoning bylaws as a part of the special permit process within water recharge areas in Falmouth and Mashpee, Massachusetts.
- As an amendment to the zoning bylaw, adoption requires a two thirds majority vote of Town Meeting.
- As an addition to subdivision rules and regulations, adoption requires approval by the Planning Board.
- As a special permit provision adopted as an amendment to the zoning bylaw, adoption requires a two thirds majority vote of Town Meeting.



Definition: To protect water resources, especially aquifers, from excessive runoff and recharge reduction by limiting the amount of impervious surface that can be placed on aquifer recharge areas or on steep slopes near water bodies.

IMPERVIOUS SURFACE LIMITATIONS (ISL)

Purpose:

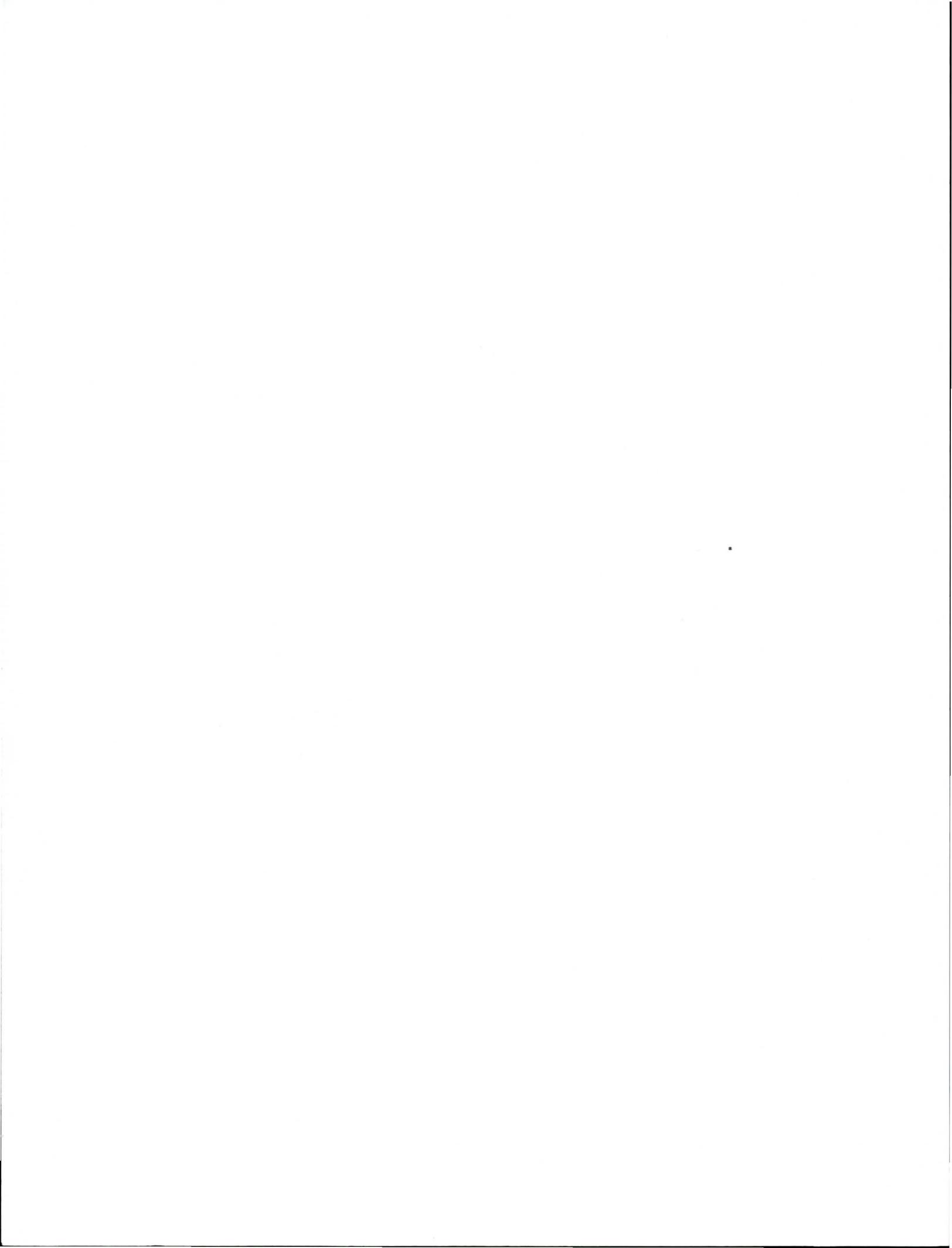
- To protect water supplies by keeping aquifer recharge areas permeable.
- To reduce runoff into water bodies.

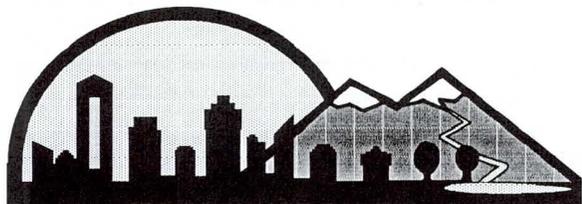
Conditions Where Practice Applies:

- Precipitation must be able to permeate the ground to recharge aquifers. Impervious surfaces cause rain water to runoff into nearby water bodies, carrying with it pollutants and eroded silt that can contaminate water supplies.
- Communities can regulate the amount of impervious surface in new developments by limiting the percentage of a lot that can be surfaced.

Planning Considerations:

- Formulas, based on aquifer recharge rates, can be calculated to determine the amount of impervious surface allowable on any lot in areas near sensitive water resources.
- The amount of impervious surface allowed can be decreased:
 1. as the slope becomes steeper and/or;
 2. in more environmentally sensitive areas.
- Impervious surface regulations may be adopted as an amendment to the municipal zoning bylaw/ordinance via a two thirds vote of Town Meeting.





LAKE RESTORATION AND MANAGEMENT BMPs

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Sources

U.S. Environmental Protection Agency. 1990. "The Lake and Reservoir Restoration Guidance Manual, 2nd Edition". Washington, D.C.



LAKE MANAGEMENT

Massachusetts has approximately 3200 lakes and ponds, most of which have been affected to varying degrees by nonpoint source pollution. Problems such as sedimentation and the loss of depth, fish kills, obnoxious odors and taste in drinking water, algal blooms, nuisance growths of aquatic plants and toxic and bacterial contamination have been reported. Lakes are highly responsive to human activities, not only along their shorelines, but throughout their entire watersheds. The quality and quantity of the water entering a lake from its watershed will determine the condition of the lake. Thus the management of the watershed is the key to preventing and controlling nonpoint source pollution.

A lake is more than just a body of water. It is a complex "**ecosystem**" made up of plants, animals, and microorganisms interacting with each other and their physical and chemical environment. The lake watershed is also an integral part of this ecosystem. The lake is a receiver and what comes into it depends on existing conditions in the surrounding watershed.

Lake watershed management is the key in most cases to preventing the pollution and cultural eutrophication of lakes. Most lake watersheds have a diversity of land use activities such as residential, urban, agricultural, industrial, and forestry which can affect the water quality of lakes. In most cases, nonpoint source pollution is affecting these water bodies because the natural vegetation which acted as a buffer strip to trap and absorb pollutants has been destroyed. **The most environmentally sensitive areas are within approximately 1000 feet of a lake and its tributaries.** Although it is within this area that sound watershed management should be rigorously applied, it is the watershed as a whole which must be considered in any effort to reduce nonpoint source pollution.

In cases where lakes are already showing the effects of cultural eutrophication, the development of BMPs within the watershed may not be enough to restore the lakes to their optimum recreational potential. In such cases, in-lake technologies must be used to restore these lakes. Some eutrophic lakes and reservoirs may be very difficult to restore and the user's expectations are not achievable under present conditions. For example, if the primary source tributary is of poor quality and it is not feasible or practical to improve it, protection and restoration will be impossible.

The term "**pond**" has been used in common practice for small, shallow, weedy bodies of water although the designation of lake is actually correct. Historically, there has been no consistency in the application of these two terms. A pond may be a natural body of water such as Walden Pond in Concord, Massachusetts with a depth of about 100 feet, and a lake can be as shallow as Fawn Lake in Bedford, Massachusetts, an artificial impoundment with a maximum depth of about 4 feet. Reservoirs are artificial lakes with the same biological and physical processes found in natural lakes. Both can have identical fauna and flora, both may stratify thermally, and both can have the same types of ecological habitats. There are, however, significant differences between lakes and reservoirs which may eventually limit the choice of which lake restoration or management, best management practice (BMP) to use. One of the primary differences is that reservoirs generally have larger watershed areas which make control of nutrient and sediment runoff very difficult. Another problem is who has political jurisdiction over the watershed since these large watersheds often cover more than one political municipality or state.

WHAT HAPPENS WHEN A LAKE IS DISTURBED?

Because of the complex interdependence that has evolved among the organisms in a lake community, disrupting one part of the lake ecosystem affects the other parts. Road runoff, failing septic systems, housing developments, or other changes in the watershed can alter the delicate balance of the lake ecosystem. Moreover, human disturbance in the lake can also have unforeseen consequences. For example, removal of aquatic weeds by mechanical harvesting or herbicide



applications may destroy valuable fish habitat. The removal of weeds may cause nutrients formerly used by the weeds to be available for algae growth. If the algal blooms are then treated with chemicals to clean up the water, increased penetration of sunlight through the water may encourage new weed growth. Lake preservation and restoration must therefore be studied and well planned to avoid creating ecological disasters.

■ NUTRIENTS

Although both phosphorus and nitrogen are essential nutrients or fertilizers for aquatic plant growth, phosphorus is the nutrient most often associated with cultural eutrophication and the focus of most lake restoration efforts. There are two reasons for this:

1. it is usually the primary limiting factor determining the rate of plant growth in freshwater lakes; and
2. it is much easier to control than nitrogen.

Nutrients come from many sources in the watershed. Soil erosion, septic systems, road runoff, fertilizers, animal wastes and even the atmosphere can contribute to the nutrient load of a lake. Lakes can also internally recycle nutrients from their own sediments which may fuel algal blooms and support luxuriant aquatic plant growth.

■ SEDIMENTATION

Wind and water move soils from the surrounding watershed down into a lake. These soils settle on the bottom of the lake, and the lake becomes increasingly shallow. This process is a natural part of lake aging, governed by gravity and the forces of rain and wind. Sedimentation is greatly accelerated, however, by human activities such as construction activities, that leave the soil exposed without vegetation for extended periods and by a reduction in wetland acreage in a wetland.

■ TOXIC CONTAMINATION

Several types of toxic substances may contaminate the water and sediments of lakes such as PCBs (polychlorinated biphenyls), metals, and solvents from urban runoff.

Toxic contamination may be dramatic, such as fish kills that eliminate part or all of a lake's fish population. (Fish kills can also be caused by low dissolved oxygen resulting from decaying organic matter or increased water temperature.) Less obvious impacts may include decreased reproduction or slower growth rates in fish. One particularly dangerous impact is the build-up of toxic substances in fish flesh. The toxic effects may be passed on to humans eating the fish.

EVALUATING A LAKE OR RESERVOIR

Before any lake or reservoir restoration plan can be implemented, the uses of the lake and the causes of its problems must be evaluated. This evaluation should be done as a part of your municipality's Nonpoint Source Management Plan explained in Chapter 2. Four questions should be asked of the lake owners, the home owner association, or persons knowledgeable about the lake or reservoir:

1. What are the primary uses or desired uses of the lake? The approach to understanding and



solving the lake's problems may vary with the answers to this question. For example, a single-purpose lake (i.e., fishing) may need an entirely different solution to its problems than a comparable multi-purpose lake.

2. What are the problems associated with this lake (i.e., algal blooms, turbidity, excessive aquatic plants, etc.) and what condition of the lake do the users desire? Is the desired condition realistic and compatible with the desired use?
 3. What is the history of the lake? When was the dam constructed, homes built, fish stocked, etc., and have the symptoms of eutrophication been treated in the past? Are there previous reports or other data available?
 4. Is restoration or lake improvement feasible? For example, a small lake community may receive excessive nitrates to their lake from septic system failures located upstream of the lake. The lake users may be economically or politically powerless to have this source diverted or treated. If restoration is not possible, can any improvements be made to alleviate the symptoms? Long-term improvement of an impaired lake/pond or reservoir can be accomplished through the use of ecologically sound principles.
- The answers to these questions will provide a better understanding of the future of surface waters and provide valuable information for use in your municipality's Nonpoint Source Management Plan and guide you in selecting the most effective Best Management Practice(s).



Definition: *The cutting and raking of nuisance rooted aquatic plants and associated filamentous algae with mechanical devices mounted on barges.*

AQUATIC WEED HARVESTING AND HYDRORAKING (AWH-H)

Purpose:

- To provide short-term success in controlling nuisance levels of rooted plants.

Harvesting provides an average 3-4 weeks of control.

Hydroraking provides longer term control.

Conditions Where Practice Applies:

- In any pond or lake where high densities of aquatic plants exist.

Planning Considerations:

- Mechanical harvesting, unlike herbicide application, does not generate the controversy of chemical use and there are no use-restrictions on the water after implementation.
- Gives immediate benefits and removes the cut plants which are a potential nutrient source for regrowth of weeds and/or algae.
- Composted weeds can be sold to farmers and gardeners.
- Methods are slow and only small areas can be covered by individual machines.
- May kill large numbers of small fish.
- High capital outlay. May require extensive operation and maintenance.
- Harvesting and hydroraking depths are limited.
- Causes sediment re-suspension.
- Fragmenting plants may cause some species to spread.
- Hydroraking is not effective on all types of aquatic plants; it is best suited for pond lilies, cattails, and other well-rooted plants.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice is implemented.



Definition: This practice consists of bringing the deep stagnant (low dissolved oxygen) water layer of a thermally stratified lake to the surface where it is aerated and then returned to the deep layer with the thermal stratification intact.

DEEP STAGNANT WATER LAYER AERATION (DSWLA)

Purpose:

- To prevent the origin of algae blooms and to restore impaired fish populations.
- To eliminate taste and color problems from drinking water withdrawn from the deep stagnant layer.

Conditions Where Practice Applies:

- In deep stratified lakes and ponds with a large volume of deep stagnant water.



Planning Considerations:

- Restores cold water fisheries.
- Less successful in reducing phosphorus.
- High capital costs.
- Expensive operation and maintenance cost.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice is implemented.

Definition: *Disrupting the stratification process in a lake or pond by pumping compressed air to the lake bottom. The rising bubbles mix the thermally stratified top and bottom layers of the lake, eliminating temperature differences.*

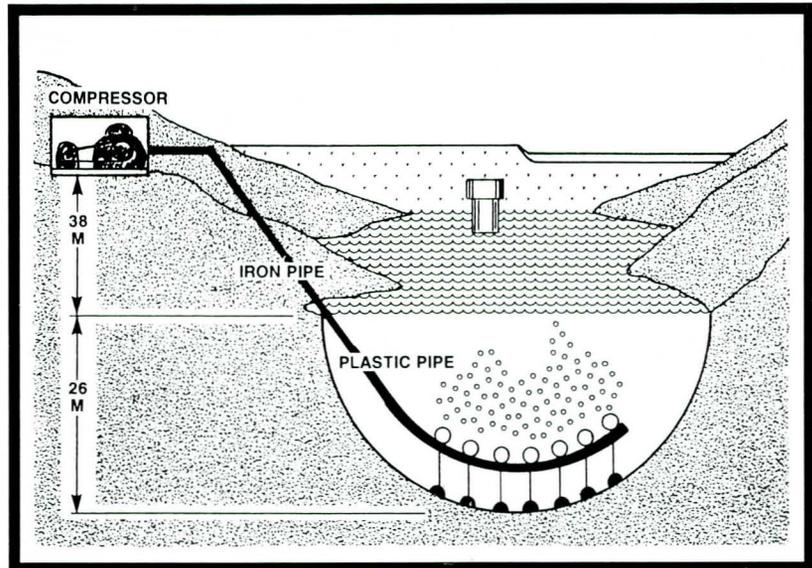
ARTIFICIAL CIRCULATION (AC)

Purpose:

- To reduce phosphorus levels and algal biomass.
- To reduce or eliminate the thermal stratification of a pond or lake.
- To oxygenate the bottom waters eliminating sediment phosphorus release and reduce algal blooms.

Conditions Where Practice Applies:

- In any pond or lake that is subject to thermal stratification and is impaired due to the presence of algal blooms.



U.S. EPA, 1988

Planning Considerations:

- May reduce phosphorus release from sediments.
- May shift algal species composition from blue-green to less offensive green algae.
- Generally a low cost practice.
- This practice is still relatively unproven and may adversely impact cold water fisheries.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice is implemented.

Definition: *The application of chemicals to aquatic vegetation to produce a rapid reduction in vegetation for periods of weeks to months.*

HERBICIDE APPLICATION (HA)

Purpose:

- To provide a short-term solution for the reduction or elimination of the presence or formation of aquatic plants.

Conditions Where Practice Applies:

- In any pond or lake that is experiencing problems with a high density of aquatic plants.

Planning Considerations:

- In Massachusetts, only EPA approved chemicals can be applied by state licensed applicators. Chemicals must also be currently approved for use in the state by the Pesticide Bureau.
- The chemicals are fast acting.
- Dead plants release nutrients into the water which could lead to a reduction in dissolved oxygen in the pond or lake.
- Reduction of one species of aquatic plants might simply be replaced by another.
- The chemicals may be hazardous to humans and aquatic organisms.
- This practice treats only the symptoms and does not address the underlying causes for nuisance growth.
- Some recreation uses such as swimming and fishing may be restricted for a period of 24 hours to several days or more depending on the specific chemical added.
- New algal blooms frequently occur 3-4 weeks after application.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice can be implemented.
- Under the authority of **MGL c. 111 § 5E**, the Massachusetts DEP requires that anyone wishing to apply chemicals to control nuisance aquatic vegetation in lakes and ponds apply for a license to apply chemicals through the Lakes Section of the Office of Watershed Management in Boston.



Definition : This practice consists of the application of copper sulfate (or other chemicals) to ponds, lakes, and drinking water reservoirs to inhibit algal growth.

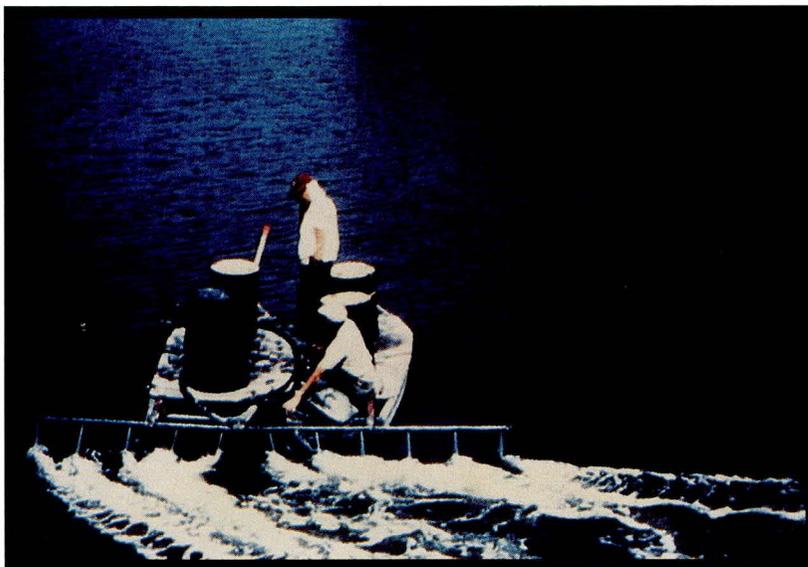
ALGICIDE APPLICATION (AA)

Purpose:

- To provide a short-term solution for the reduction of algal densities in ponds, lakes, and drinking water reservoirs.

Conditions Where Practice Applies:

- Where high algal densities are a problem with ponds, lakes or drinking water reservoirs.



Planning Considerations:

- The effect of the application is immediate and relatively inexpensive.
- Can be toxic to fish or other aquatic organisms.
- Dissolved oxygen depletions may occur after use.
- Copper can accumulate in bottom sediments.
- Banded approach to lake restoration; does not treat the underlying causes.
- "Rebound effect" is frequently observed. Algal species not as susceptible to algicide increase their growth rates due to decreased competition and increased nutrient availability from dead algae.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice can be implemented.
- Under the authority of **MGL c. 111 § 5E**, the Massachusetts DEP requires that anyone wishing to apply chemicals to control nuisance aquatic vegetation in lakes and ponds apply for a license to apply chemicals through the Lakes Section of the Office of Watershed Management in Boston.

Definition: This practice consists of the removal of sediment from ponds, lakes, and drinking water reservoirs.

SEDIMENT REMOVAL (SEDR)

Purpose:

- To increase depth.
- To reduce nutrient recycling which fuels algal blooms.
- To control aquatic weeds.
- To remove toxic substances.

Conditions Where Practice Applies:

- This practice can be used in any pond, lake or water supply reservoir that is experiencing problems due to sediment deposition.



Planning Considerations:

- Effectiveness depends on the depth of sediment to be removed; the chemical composition of the remaining sediments; and the depth of light penetration into the water.
- Can provide a long-term reversal of eutrophication and loss of depth.
- Sediment disposal may be a problem.
- The removal process may cause a short-term turbidity problem.
- Fish habitat may be adversely affected.
- Costs are variable but are generally high.
- Many permits and approvals are required.

Definition: The practice of transferring nutrient-poor water from one source which is then used to dilute nutrient-rich water in a eutrophic pond or lake. By increasing the volume of in-flowing water, algae can be flushed out faster than it can grow.

DILUTION AND FLUSHING (D-F)

Purpose:

- To reduce the amount of algal blooms in a pond or lake.

Conditions Where Practice Applies:

- In nutrient-rich ponds or lakes where an adjacent source of nutrient-poor water can be found.

Planning Considerations:

- Relatively low cost.
- Depends on water quality and the volume of the added source.
- Immediate decrease in nutrient levels.
- This practice is not well documented because of a scarcity of nutrient-poor sources.
- Can have negative downstream impacts.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice can be implemented.

Definition: This practice consists of:

1. light limiting dyes used to reduce aquatic weed densities; and/or
2. synthetic materials such as polyethylene, polypropylene, fiber glass, and nylon to cover bottom sediments to suppress weed growth.

SHADING AND SEDIMENT COVERS (S-SC)

Purpose:

- To suppress weed growth in small ponds with limited outflow.
- To suppress weed growth within small areas of a larger pond or lake (such as swimming beaches and dock spaces).

Conditions Where Practice Applies:

- In any small pond or small area within a large pond or lake that has problems with dense growths of aquatic plants.



Planning Considerations:

- Synthetic cover materials are highly effective for the short- term.
- Sediment covering materials are easy to install over small areas.
- Synthetic cover materials are expensive.
- The effectiveness for light limiting dyes is unknown since its use has not been generally accepted.
- Both light limiting dyes and synthetic cover materials treat the symptoms and do not treat the basic cause of the problem.
- The Wetlands Protection Act requires that the proponent file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice is implemented.

Definition: *The practice of lowering the water level of a lake for 2-4 weeks or longer during the winter. Water bodies are usually lowered from October to March.*

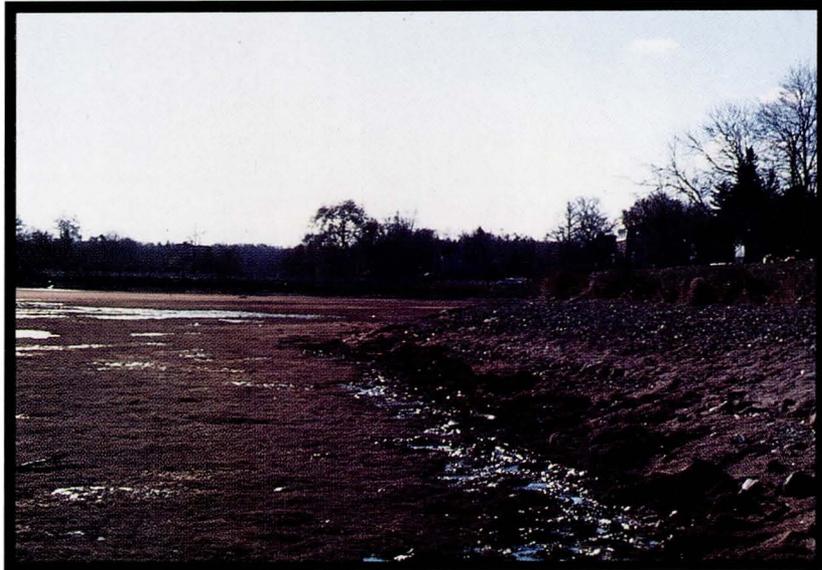
WATER LEVEL DRAWDOWN (WLD)

Purpose:

- To allow the exposed sediments in a lake, after drawdown, to freeze and dry to control nuisance levels of aquatic plants.

Conditions Where Practice Applies:

- To any pond or lake having a dam with drawdown capability and experiencing high densities of certain aquatic plants.



Planning Considerations:

- Factors critical to the effectiveness of this practice are:
 1. severity of winter;
 2. ability of sediments to dry out. Wet cold lake sediments or wet sediments covered with snow may have little negative effect on plants;
 3. the technique is species-specific (some plant species may not be negatively affected and may even thrive); and
 4. successful drawdown-freezing operations should be altered every two years with no drawdown so that resistant species do not become firmly established.
- The practice is low cost and generally very effective.
- Fish kills may occur.
- Refilling to normal levels depends upon spring rains.
- The practice may adversely affect adjacent wells.
- Bordering wetlands may be severely affected.
- Many permits and approvals are required, including filing a "Determination of Applicability" or a "Notice of Intent" with the local Conservation Commission before this practice is implemented.

Definition: The practice of siphoning water from the deep stagnant thermal layer of a lake and discharging it to the downstream channel.

DEEP STAGNANT WATER LAYER WITHDRAWAL (DSWLW)

Purpose:

- To draw down oxygenated water from the overlying layer into the deep stagnant layer leaving the stratification intact.
- To reduce the amount of phosphorus available for weed and algae growth.

Conditions Where Practice Applies:

- In any deep water pond or lake where there exists a deep stagnant thermal layer.
- In any deep pond or lake currently experiencing problems from algal blooms and an impaired cold-water fishery.

Planning Considerations:

- A deep stagnant water layer replacement rate of 2-3 times/month is considered necessary for a tangible improvement in most lakes.
- The siphon procedure is dependable.
- The practice has low initial costs and low operation costs.
- Good success can be obtained in the restoration of cold-water fisheries and in the reduction of algae blooms.
- The discharge of nutrient-rich oxygen-poor water can have an adverse effect on the downstream water quality.
- The downstream discharge may require state or federal permits.
- Not enough data is available to fully evaluate all aspects of this practice.
- The Wetlands Protection Act requires the proponent to file a "Determination of Applicability" or a "Notice of Intent" with their local Conservation Commission before this practice is implemented.

Table 4.4*

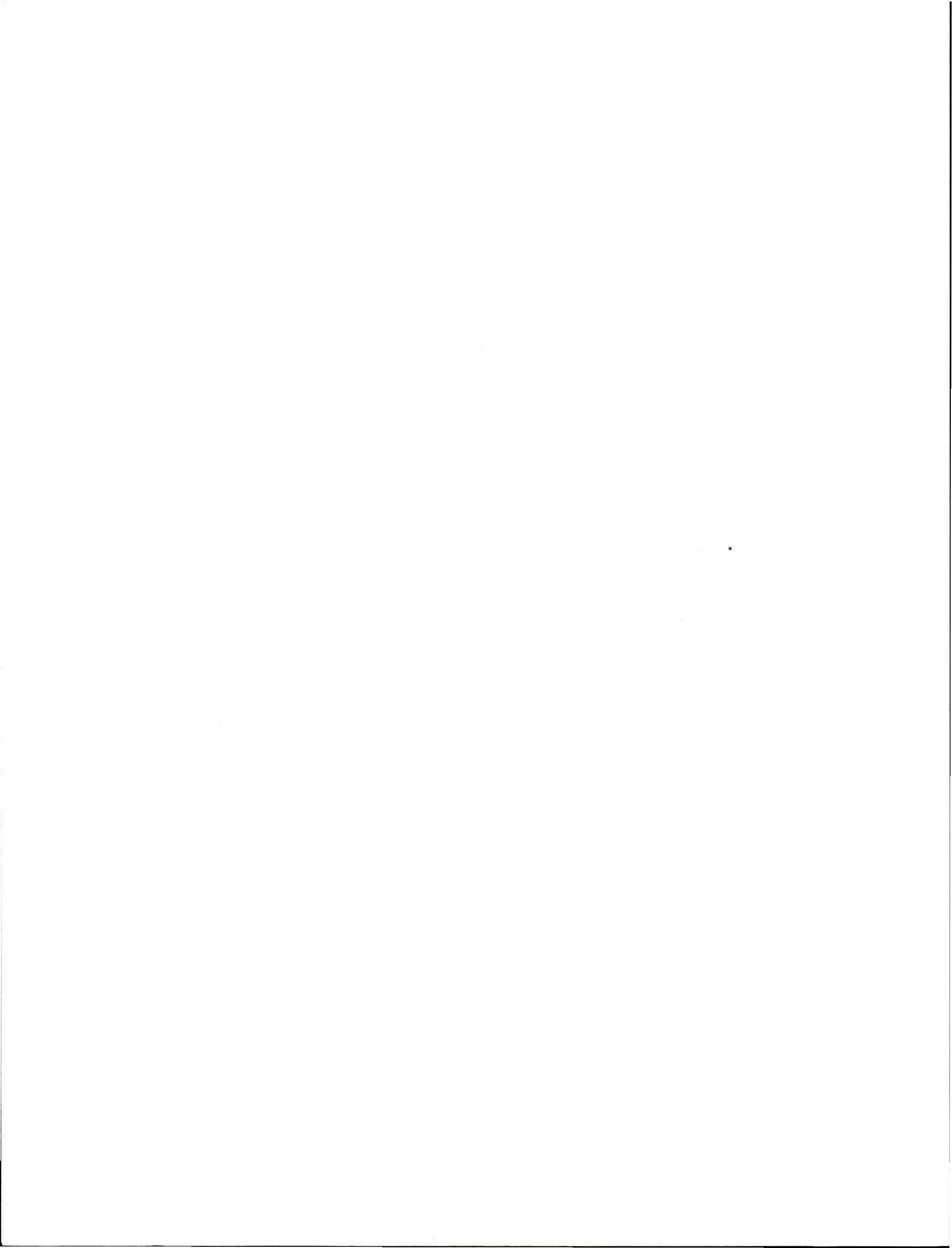
Comparison of Lake Restoration and Management Practices for Control of Nuisance Aquatic Weeds				
Treatment (one application)	Short Term Effect	Long Term Effect	Cost	Chance of Negative Effect
Sediment Removal	E	E	P	F
Drawdown	G	F	E	F
Sediment Covers	E	F	P	P
Harvesting	E	F	F	F
Herbicides	E	P	F	E

Table 4.5*

Comparison of Lake Restoration and Management Practices for Control of Nuisance Algae				
Treatment (one application)	Short Term Effect	Long Term Effect	Cost	Chance of Negative Effect
Phosphorus Inactivation	E	E	G	P
Dredging	F	E	P	F
Dilution	G	G	F	P
Flushing	F	F	F	P
Artificial Circulation	G	?	G	F
Deep Stagnant Water Aeration	F	?	G	Fair
Deep Stagnant Water Withdrawal	G	G	G	Fair
Algicide	E	P	G	High

Key: E = Excellent, F = Fair, G = Good, P = Poor

*From EPA "Lake and Reservoir Restoration Guidance Manual", 2nd ed.



Definition: *A variety of techniques employed to educate the public about nonpoint source pollution issues. The format of this effort should be appropriate to the specific issue, such as mailing water quality tips to homeowners, or a town meeting for discussion of zoning changes. Since nonpoint source pollution stems largely from human activity, most nonpoint source pollution management strategies should require ongoing education efforts to change people's understanding and behavior.*

PUBLIC EDUCATION (PE)

Purpose:

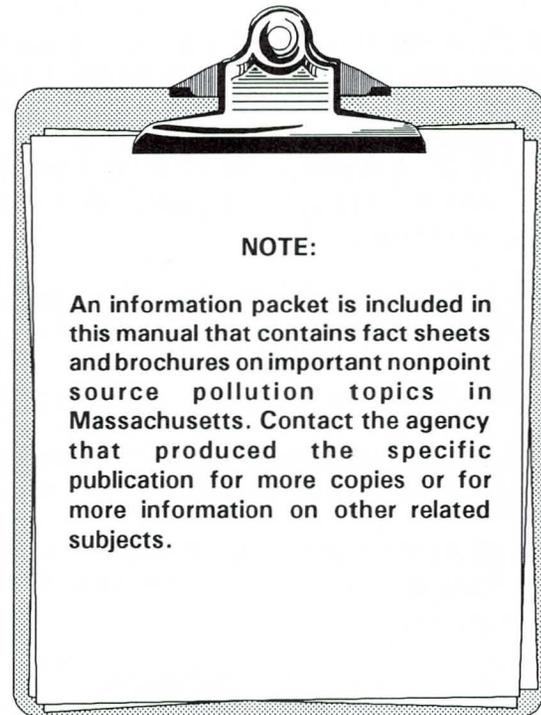
- To encourage "common sense" land-use practices that do not impair water quality. Educate consumers about the limitations and vulnerable status of our supply of clean water for drinking, recreation, and wildlife.
- To educate town members when making decisions related to changes planned for water resource protection, such as the various zoning or regulation techniques noted in this manual.

Conditions Where Practice Applies:

- Many water resource protection methods rely on proper actions being taken by individuals or groups in unregulated activities. Public education and subsequent awareness can bring these groups together and foster cooperation.
- As an alternative to more stringent controls, a public education campaign can show people how responsible actions on a small scale can preserve water resources for the whole town or region.
- Many BMPs require a town meeting vote for approval. For these methods, public education efforts should coordinate with and precede the town meeting where the vote will be taken. If the issues are discussed beforehand, then the town meeting vote will be an informed one.

Planning Considerations:

- Town/watershed committees formed to work on water resource protection planning and implementation projects should be representative and include members of the Board of Selectmen, Planning Board, Board of Health, Conservation Commission, interested citizens, developers, and other business interests such as the local Chamber of Commerce.
- Fact sheets, brochures, guidebooks, pamphlets, and other educational literature about every aspect of nonpoint source pollution exists today. This type of material is good for distributing to large, loosely targeted groups and for general broad-based public education.



■ A number of groups in Massachusetts produce educational materials or offer technical assistance to the public on a variety of nonpoint source pollution issues and should be contacted for assistance early in the planning process. The groups share many similar program goals, mainly resource protection and wise land use planning. The following is a list of the kinds of information/assistance available:

- slide shows
- maps/photos
- workshops
- newsletters
- model bylaws
- videos
- data/reports
- speakers
- displays
- school curricula
- topical literature/libraries
- technical information/advice
- bylaw review
- guidance manuals/handbooks
- telephone "hot lines"

■ Consult Appendix A for a listing of Federal, State, and Special Purpose groups/agencies that offer assistance in solving nonpoint source pollution problems.

■ The public should participate during any nonpoint source pollution discussions that impact public water resources. They should be involved in any review process and in the initial phases of any bylaw or regulation meetings. Public involvement can take the following forms:

1. **Consultations.** These include informal meetings with representatives or small groups of interested or affected parties for the purpose of discussing problems or solutions or sharing information.

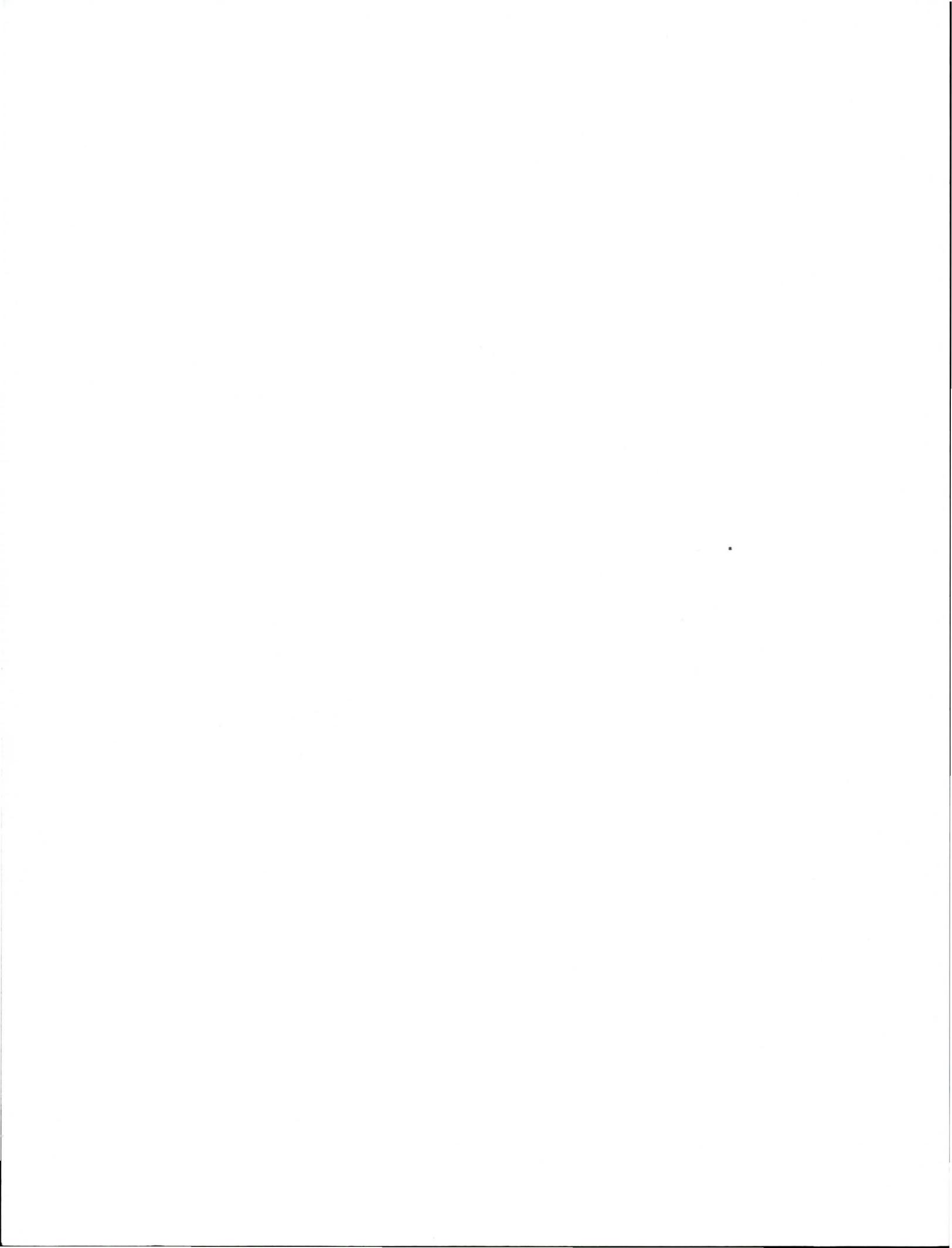
2. **Document Review.** Solicitation of comment from interested and affected parties on reports, proposals, or plans during various stages of action plan development.

3. **Public Hearing.** A formal public meeting to take testimony on a pending action.

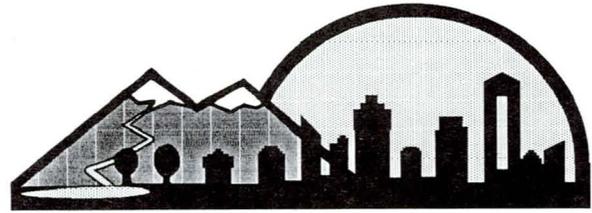
4. **Public Meeting.** An informal public proceeding (including a workshop) that informs the public and provides an opportunity for people to ask questions and voice opinions.

5. **Public Notification.** Public information techniques such as newspapers, radio, local cable television, the mailing of information sheets or brochures with water or tax bills, etc. that ensure:

- information on decisions to be made or action to be taken is complete and understandable;
- a full explanation is provided on the effects of decisions or actions on the public; and
- the ways in which the public may influence the decision-maker and appeal the decision are explained.



CHAPTER 5



NONPOINT SOURCE POLLUTION CHECKLISTS

The checklists in this chapter are designed to help you ask the right questions during a review of a proposed land-use activity so that all aspects of potential water quality effects are considered. Find the category of concern and address each consideration or requirement relevant to the specific activity you are reviewing.

You may not be able to request all of the information in the checklists for review purposes if your town or city's bylaws/ordinances or regulations do not require it. If this is the case, you should consider changing existing laws or adopting new ones to enable boards/commissions and/or committees to obtain material necessary for a complete review. (See chapter 3 for more information on bylaws/ordinances and regulations.)

The development review process as a best management practice ensures that each local official has the opportunity and information needed to evaluate all environmental effects of proposed developments. While the Massachusetts General Laws (MGL) outline the legal procedure for reviewing subdivisions and variance requests, in practice many communities find that inefficient communication causes confusion, lack of needed information, or wasted time and effort in keeping up with what is happening. A development review manual can be adopted from these checklists to clarify "who does what and when" and to instruct applicants about the data and materials that they must submit to officials as part of their application.

The following sources were used to develop the checklists:

- MA Cooperative Extension Service, 1987
- McGregor, 1986
- VA Soil and Water Conservation Commission, 1980
- MA Audubon, 1990a
- MA Audubon, 1990b
- MA Audubon, 1987

Fill in the blanks with the following:

Information has been supplied/requested: (X)

Information is not applicable: (N/A)

■ COMMERCIAL/INDUSTRIAL DEVELOPMENT

- Require the location of the proposed development to be shown on all overlay maps of the community's nonpoint source pollution management plan along with a statement as to impact.
- Require the calculation of the area of land (percentage) within the development rendered impervious, especially over aquifers and recharge areas.
- Require a statement and description of proposed facilities to be constructed and plan of action to contain a fuel spill or spillage of any other hazardous material.
- Require special environmental precautions if the proposed development is within an aquifer or recharge area.
- Consider requiring an environmental impact analysis.
- Require the submittal of a list of all hazardous materials to be used in the business or industry along with a plan of by-product disposal.
- Provide for special environmental precautions for all businesses and industries to be located over or within an aquifer recharge area.
- Require the submittal of an emergency response plan in the event of a hazardous material spill for review and approval by community officials.

■ EROSION AND SEDIMENT CONTROL

- Require a description of the nature and purpose of the land-disturbing activity.
- Require a description of the existing topography, vegetation, and drainage of the site.
- Require a description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance.
- Require a description of the soils on the site giving such information as soil name (U.S.D.A. Soil Conservation Service Classification), erosion potential, suitability for on-site septic systems (detailed percolation rate data), depth to groundwater, depth to bedrock, etc.
- Require a description of areas on the site that have the potential to cause serious erosion problems.
- Require a description of measures that will be taken to control erosion and sedimentation on the site. (See chapter 4, "Construction BMPs" (page 4-23) for erosion control alternatives during construction.)



- Require a description of how the site will be permanently stabilized after construction.
- Require the submittal of a plan or schedule of regular maintenance inspections and repair procedures of erosion and sedimentation control structures during the construction phase of the project for review and approval.
- Consider requiring the developer to provide an environmental bond, for the duration of the construction phase of the project, to assure proper attention to operation and maintenance of pollution control devices.
- Require calculations for the design of such items as sediment basins, diversions, waterways, detention/retention ponds, etc.

■ **IMPLEMENTATION BY LOCAL BOARDS/COMMISSIONS**

- Has your Planning Board adopted comprehensive subdivision control regulations incorporating performance standards and design specifications?
- Has the local Board of Health adopted local septic system regulations supplementing **Title 5** of the State Environmental Code?
- Has your Conservation Commission issued guidelines under the Wetlands Protection Act or regulations under its local wetlands bylaw?
- Are your wetlands and floodplain mapped?
- Have you mapped the zones of contribution of your wells?
- Does your community have an underground fuel tank testing and inspection program?
- Has your town/city adopted a local air pollution code as is allowed by state law?

■ **LANDFILLS**

- Consider the installation of monitoring wells around your landfill to check for the possible contamination of adjacent groundwater. Provide for a regular schedule of water quality tests of these wells.
- Assure that all closed landfills are capped as soon as possible according to state regulations.
- Consider any active, uncapped landfills, located near aquifers or recharge areas, to be high priority nonpoint source pollution problem areas that need immediate attention.

■ **LOCAL ENVIRONMENTAL LAWS**

- Has your Town Meeting adopted floodplain zoning?
- Do you have zoning that protects wetlands?



- _____ Do you have aquifer, watershed, and well or reservoir protection districts in your zoning?
- _____ Do you have Site Plan Review governing large projects like shopping malls and office parks?
- _____ Do your Bylaws require a local "environmental impact analysis" for each major development?
- _____ Do you have Bylaws regulating underground storage tanks and hazardous materials?
- _____ Do you have a non-zoning Wetlands Protection Bylaw that is administered by the Conservation Commission?
- _____ Do your Bylaws cover sand and gravel removal and erosion control at construction sites?

■ **LONG RANGE PLANNING**

- _____ Is there a Comprehensive Master Plan for your community?
- _____ Does your town/city actively use the services of a Regional Planning Agency? The Soil Conservation Service? The Conservation Districts? Other state or county agencies?
- _____ Have your Boards/Commissions joined the Massachusetts Municipal Association? The Massachusetts Federation of Planning Boards and Boards of Appeals? The Massachusetts Association of Conservation Commissions? The Massachusetts Association of Health Boards?
- _____ Does each Board or Commission schedule monthly, quarterly, or annual meetings devoted only to long range items, such as nonpoint source pollution?
- _____ Is somebody in charge of seeing that the Comprehensive Master Plan and growth policy are being implemented? Does the Planning Board plan? Does the town/city simply exist by putting out "brush fires"?

■ **PESTICIDE - FERTILIZER APPLICATION**

- _____ Assure that commercial lawn care companies are fully aware of "sensitive areas" in your community, such as aquifers, recharge areas, wetlands, and flood prone areas.
- _____ Assure that lawn care companies commonly inquire of their clients the location of private wells or other sensitive areas which may be located on their property.
- _____ Assure that those responsible for the operation and maintenance of utility and/or railroad rights-of-way located in your community have been informed as to the location of "sensitive areas" along their routes.
- _____ Assure that your community has a legal or oral agreement with the owners of rights-of-way regarding modified herbicide spraying near "sensitive areas".



■ RESIDENTIAL DEVELOPMENT

- _____ Require the location of proposed development on all overlay maps of the community's nonpoint source management plan along with statement as to impact.
- _____ Require a statement of impact upon groundwater and surface water quality and recharge, including estimated phosphate and nitrate loading from septic systems, lawn fertilizers, etc.
- _____ Require the proposed action to mitigate the impacts of the development on groundwater.
- _____ Require an analysis of open and closed drainage system alternatives, including an analysis of the concentration and velocity of the transport of contaminants.
- _____ Require a statement of the capability of the soils, vegetative cover, and proposed erosion control measures to support the proposed development.
- _____ Require the location of the project to be shown on a map (nonpoint source pollution management plan map) in relation to local aquifers and recharge areas.
- _____ Require the calculation of the area of land (percentage) within the development rendered impervious, especially over aquifers and recharge areas.
- _____ Require all proposed pollution control devices (detention basins with subsurface drains, oil and grease separator catchbasins, etc.) to be shown on an overlay map (especially those within aquifers or aquifer recharge areas).
- _____ Consider requiring an environmental impact analysis for larger subdivisions (more than a certain number of units).
- _____ The Planning Board should review subdivision regulations to better protect aquifer/recharge areas.

■ ROAD SALT STORAGE/APPLICATION/DISPOSAL

Salt Storage Areas:

- _____ Locate salt storage areas far away from water supplies, wells, aquifers, lakes, ponds, wetlands, bogs, and other sensitive areas.
- _____ Store all salt piles in specially designed sheds or cover piles on impervious pads.
- _____ Provide for proper drainage of clean surface water runoff away from the salt storage pile. Allow for spilled chemicals to drain back to the salt pile.
- _____ Shield truck loading and unloading operations from the weather.
- _____ Plan the delivery of all salt shipments so that no extra handling or temporary outside storage is needed.

Chemical Application:

- _____ Identify all sensitive areas (water supplies, aquifer recharge areas, etc.) within the community and make sure equipment operators are aware of them.
- _____ Adopt the policy of reducing salt rates or other special measures to protect environmentally sensitive areas.
- _____ Adopt a policy of providing for different levels of service used for different road types and weather conditions.
- _____ Consider assigning individual maintenance crew members the same section of road and the same equipment for each storm.
- _____ Actively seek new information and technology on new de-icing techniques currently under development (CMA, Verglimit, etc).

Snow Dumping:

- _____ Assure that the disposal of snow that is removed from such areas as highways, parking lots, and other salt-treated areas does not pose a threat to water supplies.
- _____ Consider prohibiting the direct dumping into rivers, wetlands, ponds, and bogs.
- _____ Consider prohibiting the dumping of snow in sanitary landfills, to avoid leaching of wastes.

■ SEPTIC SYSTEMS

- _____ Require deep hole test to determine soil type, proximity to bedrock, and level of ground water at the wettest time of the year.
- _____ Assure that the location of leach fields or trenches are at least four feet above the level of groundwater at the wettest time of the year (**Title 5** of the State Environmental Code).
- _____ Assure that leach fields or trenches are sited at least 100 feet from private wells.
- _____ Assure that percolation tests are performed to determine the capacity of the soil to absorb wastewater from the septic tanks. Disallow septic systems in soils that percolate slower than 30 min./inch.
- _____ Ensure full enforcement of **Title 5** by the Board of Health.
- _____ Is there a requirement for regular pumping and inspection of septic systems?
- _____ Review existing septic system regulations and make more stringent modifications based on local, site specific conditions if necessary.

■ STAFFING OF LOCAL BOARDS AND COMMISSIONS

- _____ Does your town/city have a full time planner?
- _____ Are there engineering and water resource or wetlands consultants on staff or on retainer?
- _____ Is there an agent for the Board of Health, Planning Board, and Zoning Board of Appeals?
- _____ Has a hazardous waste coordinator been appointed?
- _____ Is there a municipal coordinator for the Hazardous Materials Right-to-Know Law?
- _____ Does the town/city engineer help Boards/Commissions to review technical plans?
- _____ Does the Fire Chief understand his/her role and authority concerning the installation of underground storage tanks?

■ STORMWATER MANAGEMENT

- _____ Require calculations of anticipated nitrogen and/or phosphorus contributions from roads, lawns, and septic systems.
- _____ Require an assessment/description of the **existing** environmental and hydrological conditions (pre-development conditions) of the site and of receiving waters and wetlands, including the following:
 - _____ The direction, flow rate, and volume of surface water runoff for various design frequency storms;
 - _____ The location of areas of the site where stormwater collects or percolates into the ground;
 - _____ A description of all surface water courses, waterbodies, and wetlands on or entering or adjacent to a site, into which stormwater flows;
 - _____ Depth to seasonal groundwater levels; approximate direction and rate of flow; seasonal fluctuations;
 - _____ Location of the 100-Year Flood Zones;
 - _____ Principal vegetation types;
 - _____ Topography described in full contour detail; with 2 foot contour intervals; with areas of steep slopes (over 10%) highlighted; and
 - _____ Soils with an accompanying analysis of the best use potential of the soils and the hydrologic group classification (U.S.D.A. Soil Conservation Service analysis).



_____ Require the **proposed** alterations of the site (post-development condition) as they affect the environmental and hydrological conditions of the site and of receiving waters/wetlands in detail, including the following:

_____ Changes in topography, described in full contour details at 2 foot intervals.

_____ Areas where vegetation will be cleared or otherwise altered.

_____ Areas that will be covered with an impervious surface (driveways, parking lots, etc.).

_____ The proposed development layout, including:

_____ The site arrangement, including the location of structures, roadways, parking areas, sewage disposal facilities, undisturbed lands.

_____ All drainage systems, including the location of roadway and individual lot sub-drains; full drainage calculations; prediction of impacts of proposed development on water quality, changes in groundwater level, adverse impacts on wetlands, and increased incidents of flooding.

_____ Require all components of the drainage system and any measures for the detention, retention, or infiltration of stormwater or for the protection of water quality, including the following:

_____ The channel, direction, volume; rate of flow, and quality of stormwater that will be conveyed from the site, with a comparison to existing and proposed conditions.

_____ Detention and Retention areas and devices, including:

_____ Plans for discharge of contained water; time to drawdown; description of outlet structures.

_____ Maintenance plan: maintenance schedule; responsible party/owner; signed agreements.

_____ Pollutant removal considerations: efficiency of removal.

_____ Infiltration trenches, basins, and devices, including:

_____ Depth to seasonal groundwater table.

_____ Prediction of the impact on groundwater quality.

_____ Areas to be utilized in overland flow, including:

_____ Hydrologic soils group (Soil Conservation Service).

_____ Existing and proposed vegetation.

_____ Soil susceptibility to erosion.

■ **UNDERGROUND FUEL/CHEMICAL STORAGE TANKS**

_____ Are underground fuel/chemical storage tanks part of the proposal? If so:

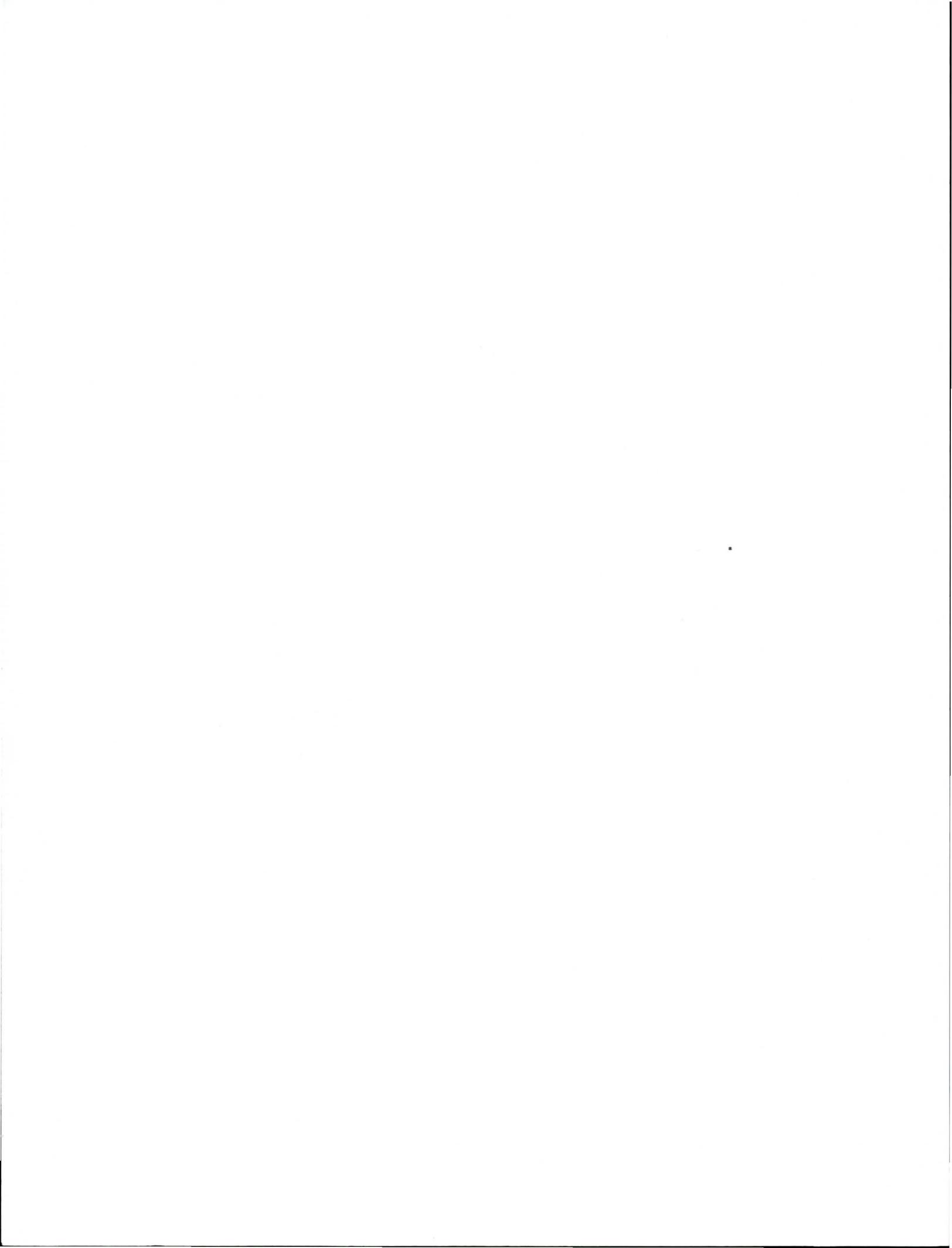
_____ Consider not approving new underground heating oil tanks.

_____ Consider not approving all new underground storage tanks within aquifer/recharge areas.

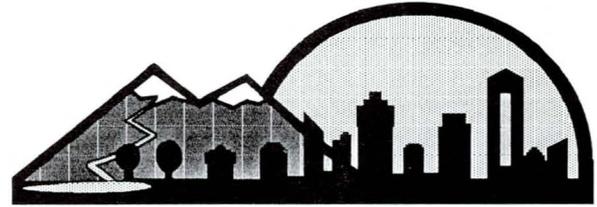
_____ Adopt local standards for construction and installation of underground storage tanks.

_____ Assure that all requirements of state and local underground storage tank regulations are adhered to.

_____ Consider the required installation of monitoring wells so located as to keep track of groundwater direction and quality.



APPENDIX A



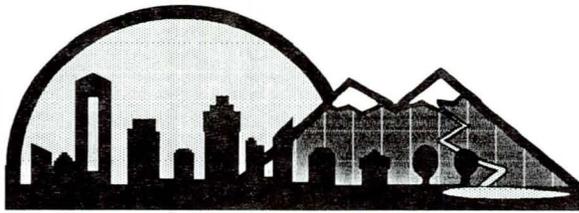
RESOURCE AGENCIES/ ORGANIZATIONS

Appendix A provides a listing of natural resource and associated planning agencies that may assist the town/city board or commission members in solving a wide range of nonpoint source pollution problems. Agencies/organizations are listed under their appropriate affiliation: either **Federal**, **State**, or **Special Purpose**. Names, addresses, phone numbers, and a brief statement of the services offered are provided for each agency/organization. Only services that pertain to the area of nonpoint source pollution have been included, although all of the groups are involved in other issues.

For more detailed information about the nature of programs listed in the directory, the reader is advised to contact the agency directly. At the time of printing this information was current. With time, however, some of these entities may change.

<u>Affiliation</u>	<u>Page</u>
Federal	A - 2
State	A - 7
Special Purpose	A - 23





FEDERAL AGENCIES

1. Name: **U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE (ASCS)**
- Address: ASCS State Office
445 West Street
Amherst, MA 01002
- Phone: (413) 256-0232

Service: The Agricultural Stabilization and Conservation Service (ASCS) assists agricultural producers through cost-sharing programs to conserve agricultural soil, water, woodland, and wildlife resources. The location of the various ASCS county offices are as follows:

Berkshire County ASCS Office
78 Center St.
Pittsfield, MA 01201
Tel: (413) 443-9227

Middlesex County ASC Office
319 Littleton Rd.
Westford, MA 01886
Tel: (508) 692-5163

Essex County ASCS Office
Essex Ag. & Tech. Institute
33 Walker Rd
N. Andover, MA 01845
Tel: (508) 794-9607

Norfolk County ASCS Office
Norfolk County Ag. High School
460 Main St.
Walpole, MA 02081
Tel: (508) 668-0245

Franklin County ASCS Office
Hayburne Building
55 Federal St., Rm. 200
Greenfield, MA 01301
Tel: (413) 772-6810

S.E. MA County ASCS Office
(covering Barnstable, Dukes,
Nantucket and Plymouth Counties)
2510 Cranberry Highway
Wareham, MA 02571
Tel: (508) 295-6860

Hampden County ASCS Office
171 Park Ave., Suite 104
W. Springfield, MA 01089
Tel: (413) 732-5215

Bristol County ASCS Office
84 Center St.
Dighton, MA 02715
Tel: (508) 669-6621

Worcester County ASCS Office
52 Boyden Road, Suite 103
Holden, MA 01520
Tel: (508) 829-5721

Hampshire County ASCS Office
243 King St., Rm. 26
Northampton, MA 01060
Tel: (413) 586-6570

2. Name: **U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE (SCS)**
Address: 451 West St.
Amherst, MA 01002-2927
Phone: (413) 253-4375

Service: The Soil Conservation Service (SCS) serves as the Nation's technical agency dedicated to the wise use of our soil, water, and related resources. Since 1935, the SCS has offered technical assistance to individuals, groups, organizations, and units of government in conserving and managing their land resources.

Through Massachusetts' 16 locally organized and operated Conservation Districts (CD), SCS provides the expertise of soil conservationists, soil scientists, agronomists, biologists, foresters, geologists, and engineers to work together on programs aimed at: Reducing soil erosion; preventing flood damages; conserving water used in agriculture; improving water quality, cropland, pasture, and forest land; conserving and developing natural resources; and promoting sound land use. The location of the various SCS offices throughout Massachusetts are:

Soil Conservation Service
Federal Building
78 Center St. (Arterial)
Pittsfield, MA 01201
Tel: (413) 443-6867
(Berkshire CD)

Soil Conservation Service
21 Spring St.
Taunton, MA 02780
Tel: (508) 824-6668
(Bristol-Plymouth-Norfolk CD)

Soil Conservation Service
243 King St., Rm 39
Northampton, MA 01060
Tel: (413) 586-5440
(Hampshire-Hampden CD)

Soil Conservation Service
Flint Rock Road, P.O. Box 709
Barnstable, MA 02630
Tel: (508) 362-9332
(Cape Cod-Nantucket-Dukes CD)

Soil Conservation Service
319 Littleton Rd.
Westford, MA 01886
Tel: (508) 692-1904
(Essex-Middlesex-Suffolk CD)

Soil Conservation Service
Hayburne Building-R.M. 270
55 Federal St.
Greenfield, MA 01301
Tel: (413) 772-0384
(Franklin CD)

Soil Conservation Service
Medical Arts Center
52 Boyden Street
Holden, MA 01520-2587
Tel: (508) 829-6628
(N.E., N.W., And S.Worcester CD)



3. Name: **U.S. ARMY CORPS OF ENGINEERS (COE)**
Address: New England Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149
Phone: (617) 647-8220 or (617) 647-8238

Service: This agency carries out studies and planning related to water resource development in the areas of flood control, water supply, hydroelectric power, navigation, beach erosion control, recreation and related land uses. It is responsible for the design and construction of major water control structures such as dams, channels, harbors, and beach erosion improvements. Other responsibilities include issuing permits for construction or other work in navigable waterways (404 Permits), operating and maintaining recreation flood control projects, and major navigation projects such as the Cape Cod Canal.

4. Name: **U.S. DEPARTMENT OF COMMERCE
NATIONAL MARINE FISHERIES SERVICE**
Address: National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930
Phone: (508) 281-9300

Service: The National Marine Fisheries Service helps assure that supplies of nutritious fish and shellfish are available to sport and commercial fishermen by assisting the fishing industry and assuring the safe maintenance of fish stocks. Through its Habitat Protection Branch the Service helps to manage, preserve, and protect marine habitats and the living resources of the sea within 200 miles of our shoreline. It also cooperates with state fisheries and other non-federal interests for the conservation, development, and enhancement of anadromous fish resources. Additionally it operates the National Marine Fisheries Service Aquarium in Woods Hole, MA.

5. Name: **U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE**
Address: U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035
Phone: (413) 253-8200

Service: The U.S. Fish and Wildlife Service is the principal agency through which the U.S. Government carries out its responsibilities to conserve, protect, and enhance the nation's fish and wildlife and their habitats. Specifically, the Service manages national wildlife refuges and fish hatcheries and provides Federal leadership in habitat protection, fish and wildlife research, and the conservation and protection of migratory birds, endangered species, certain marine animals, and anadromous fish such as Atlantic salmon.



6. Name: **U.S. DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY**
Address: U.S. Geological Survey
Water Resources Division
28 Lord Rd., Suite 280
Marlborough, MA 01752
Phone: (508) 485-6360

Service: The Water Resources Division of the U.S. Geological Survey is responsible for appraising and describing the quantity and quality of the nation's water resources, and for scientific investigations of water problems. The Survey's program is financed cooperatively by agreements with agencies of states, regions, counties, and municipalities.

7. Name: **U.S. DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE**
Address: North Atlantic Regional Office
National Park Service
15 State Street
Boston, MA 02109
Phone: (617) 223-5200

Service: The principal responsibility of the National Park Service is administration of the National Park System. The system in Massachusetts now comprises more than 330 acres of great diversity, including parks, monuments, historic sites, battlefields, seashores and lakeshores, and recreation areas. The Service also directs programs to assist states, other federal agencies, local governments, and individuals in the protection of historical, natural, architectural, engineering and archaeological resources that lie outside of the National Park System. For these purposes, the Service administers the state portion of the Land and Water Conservation Fund.

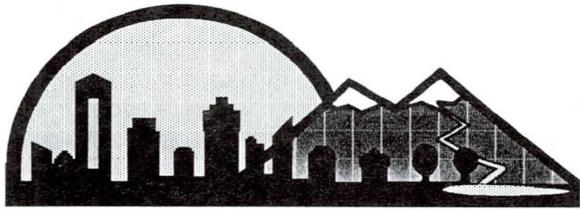
8. Name: **U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)**
Address: Regional Administrator
Environmental Protection Agency
JFK Federal Building
Boston, MA 02203
Phone: (617) 565-3420

Service: The Environmental Protection Agency is charged with mounting a coordinated attack on the environmental problems of air and water pollution, hazardous and solid waste, pesticides, toxic substances, and radiation. Activities of the EPA are directed through the following offices: Water Management Division (water quality, municipal facilities, and drinking water supplies); Waste Management Division (solid waste, hazardous waste); Air Programs Division (air, pesticides, toxic substances and radiation programs); and the Environmental Services Division (monitoring and surveillance).

9. Name: **FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)**
Address: McCormack Building, Room 442
Post Office Courthouse
Boston, MA 02109
Phone: (617) 223-9522

Service: The Federal Emergency Management Agency (FEMA) coordinates the planning activities and provides financial and technical support for national emergencies in both peace and war. FEMA supports state and local governments in a wide range of disaster planning preparedness, mitigation, response and recovery efforts.





STATE AGENCIES

1. Name: **EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS (EOEA)**
Address: Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-9800

Service: This agency deals with a broad range of environmental concerns including planning and management of water supplies, regulation of solid and hazardous wastes, promotion of agricultural production, protection of fisheries and wildlife, and development and operation of recreational facilities. It is comprised of five departments: Department of Environmental Protection, Department of Environmental Management, Department of Food and Agriculture, Department of Fisheries-Wildlife-Environmental Law Enforcement, and the Metropolitan District Commission. It also includes the offices of Coastal Zone Management, Water Resources Commission, MA Environmental Policy Act Unit (MEPA), Division of Conservation Services and Hazardous Waste Siting Council.

2. Name: **COASTAL ZONE MANAGEMENT (CZM)**
Address: Massachusetts Coastal Zone Management Office
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-9530

Service: The Coastal Zone Management Office develops and implements programs to protect coastal resources and manage development along Massachusetts' 1500 miles of shoreline. CZM administers the Coastal Nonpoint Source Control Program (Section 6217).

3. Name: **DIVISION OF CONSERVATION SERVICES (DCS)**
Address: Division of Conservation Services
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-1552

Service: The Division of Conservation Services is designed to assist communities, agencies, groups, organizations, and individuals in initiating and maintaining a sound program for conservation and development of open space and recreational areas. Grants can be offered to communities which have an approved Open Space and Recreation Plan. The Urban Self-Help Program provides up to 90% reimbursement for the acquisition and

development of park and recreation lands to Massachusetts cities and towns with a population of 35,000 or more which have established park or recreation commissions. The Self-Help Program provides up to 90% reimbursement for the acquisition of conservation lands to communities with Conservation Commissions. The Land and Water Conservation Fund provides up to 50% reimbursement for development and/or acquisition of recreation/conservation land.

4. Name: **MASSACHUSETTS ENVIRONMENTAL POLICY ACT UNIT (MEPA)**
Address: Environmental Impact Review
MEPA Unit
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-5830

Service: The Massachusetts Environmental Policy Act Unit gathers environmental and planning information for state agencies to use in permitting and licensing proposed development. The MEPA statute directs state agencies to "review, evaluate, and determine the impact on the natural environment of these works, projects, or activities and "to use all practicable measures to mitigate their impacts and minimize damage to the environment". Regulations define which projects are subject to MEPA review.

5. Name: **WATER RESOURCES COMMISSION (WRC)**
Address: Water Resources Commission
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-9800

Service: The Massachusetts Water Resources Commission develops and coordinates the water resource policies and planning functions of the Executive Office of Environmental Affairs. It also establishes criteria and priorities for all water related cooperative programs with the Federal Government and other divisions of the state.

6. Name: **DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)**
Address: Department of Environmental Management
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3160

Service: The Department of Environmental Management's responsibilities are to "exercise general care and oversight of the environmental management of the Commonwealth and of its adjacent waters... and to propose and carry out measures for the protection, conservation, control, use, increase and development thereof". In addition to this broad grant of management authority, the Department is also charged with: "developing statewide policies regarding the protection and use of areas of critical environmental concern (ACEC) to the Commonwealth" and with "managing all lands and properties acquired and assigned to it to preserve their natural beauty, wilderness, or open character or hydrological, geological, historical, scientific, wildlife management, recreational or other significance or value."



7. Name: **DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)
DIV. OF RESOURCE CONSERVATION-BUREAU OF ENGINEERING**
Address: Division of Resource Conservation-Bureau of Engineering
Department of Environmental Management
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3160

Service: The Bureau is responsible for repair, rehabilitation and new construction in State parks and forests; administering the state's dam safety program; carrying out improvements and repairs to municipal dams; providing engineering and landscape architectural design and construction management service.

8. Name: **DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)
DIVISION OF FOREST AND PARKS (DFP)**
Address: Division of Forest and Parks
Department of Environmental Management
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3180

Service: The Division of Forest and Parks' purpose is to maintain the State Forest and Park system for conservation, recreation, and forestry purposes; promote and protect the Commonwealth's public and private forestry resources through **Chapter 61-61A** tax classification program; and administer the Forest Cutting Practices Act (**Chapter 132**). Regional offices of the states' Division of Forest and Parks are located in:

Region 1
Myles Standish State Forest
P.O. Box 66
S. Carver, MA 02566
Tel: (508) 866-2580

Region 2
P.O.Box 829
817 Lowell Road
Carlisle, MA 01741
Tel: (508) 369-1965

Region 3
Division of Forest and Parks
P.O. Box 155, Route 110
West Boylston Street
Clinton, MA 01510
Tel: (508) 368-0126

Region 4
Division of Forest and Parks
P.O. Box 484
Amherst, MA 01004
Tel: (413) 545-5993

Region 5
S. Mountain Regional Headquarters
P.O. Box 1433
740 South Street
Pittsfield, MA 01201
Tel: (413) 442-8928



9. Name: **DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)**
Address: Office of Waterways, Hingham Facility
349 Lincoln St., Bldg. 45
Hingham, MA 02043
Phone: (617) 740-1600 or (617) 727-9477

Service: This office provides technical information on existing publically-financed civil coastal and waterways engineering structures throughout the Commonwealth, including harbor dredging, and publically owned seawalls, piers, marinas, revetments, bulkheads, jetties, spillways, flood control structures, and related facilities.

10. Name: **DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)**
Address: Office of Waterways
100 Cambridge St.
Boston, MA 02202
Phone: (617) 727-3160

Service: The Office of Waterways' responsibilities include: research, analysis, and plans for the protection of all natural and cultural resources of Massachusetts; carrying out planning and project management for all DEM land acquisition and disposition; provides technical and financial assistance for resource protection to municipalities, non-profit groups, individuals, and other state and federal agencies; evaluates, classifies, designates and protects significant cultural and natural resources throughout Massachusetts; licenses and monitors well drilling activities.

11. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)**
Address: Department of Environmental Protection
One Winter Street
Boston, MA 02108
Phone: (617) 292-5500

Service: The Department of Environmental Protection is the state's environmental regulatory agency responsible for developing, administering and enforcing programs which regulate air, surface water and groundwater, water supplies, wetlands, and solid and hazardous waste. The following are regional offices of the DEP:

Central Regional Office
75 Grove Street
Worcester, MA 01605
Tel: (508) 792-7650

Northeast Regional Office
10 Commerce Way
Woburn, MA 01801
Tel: (617) 935-2160

Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347
Tel: (508) 946-2700

Western Regional Office
4th Floor, State House West
436 Dwight Street
Springfield, MA 01101
Tel: (413) 784-1100



12. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF HAZARDOUS WASTE**
Address: Division of Hazardous Waste
Department of Environmental Protection
One Winter Street
Boston, MA 02108
Phone: (617) 292-5853

Service: This Division implements and enforces a hazardous waste regulatory program that encourages sound management and safe treatment of hazardous waste, and carries out or oversees responses to release of oil or hazardous materials to the environment.

13. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY**
Address: Division of Air Quality
Department of Environmental Protection
One Winter Street
Boston, MA 02108
Phone: (617) 292-5630

Service: The Air Quality Program regulates and prevents air pollution. The Regional offices review plans and specifications for any new or modified facility that might be a source of air pollution to determine whether it conforms with state and federal regulations and emission standards. The air quality program monitors air quality across the state and develops strategies and regulations to achieve acceptable air quality.

14. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL ANALYSIS**
Address: The Wall Experiment Station
37 Shattuck Street
Lawrence, MA 01843
Phone: (508) 682-5237

Service: The Division of Environmental Analysis maintains the Lawrence Experiment Station, the support facility for all environmental programs in the Commonwealth. The laboratory analyzes samples of water, shellfish, and unidentified chemicals to determine the composition, contamination or presence of toxic materials. It also operates a program which certifies other laboratories for the bacteriological and chemical analysis of drinking water.

15. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WETLANDS AND WATERWAYS**
Address: Division of Wetlands and Waterways
Department of Environmental Protection
One Winter street
Boston, MA 02108
Phone: (617) 292-5695

Service: Wetland areas include fresh water and coastal wetlands, beaches, swamps,



marshes, flood plains, dunes, and land subject to flooding. To protect these resources the Legislature passed the Wetlands Protection Act (**MGL c. 131, § 40**) which is administered by DEP in conjunction with local conservation commissions. The Wetlands Division develops regulations and policies for use by local Conservation Commissions and, if necessary, serves as the appellate agency in wetlands cases. In addition the Division administers the Wetland Conservancy Program (**MGL c. 13, § 40A; c. 130, § 105**), the 401 Certification Program, and the Waterways and Licensing Permits sections of **MGL c. 91**.

16. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF SOLID WASTE**
Address: Division of Solid Waste
Department of Environmental Protection
One Winter Street
Boston, Mass 02108
Phone: (617) 292-5960

Service: The Division of Solid Waste regulates and enforces proper disposal of solid waste through municipal and commercial landfills and transfer station permits. It is also concerned with developing and implementing new alternative waste management programs that emphasize recycling, composting, and source reduction.

17. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER POLLUTION CONTROL**
Address: Division of Water Pollution Control
Department of Environmental Protection
One Winter Street, 8th Floor
Boston, MA 02108
Phone: (617) 292-5673

Service: The Division of Water Pollution Control is charged with the abatement of pollution and the preservation of water quality in the waters of the Commonwealth. The Division's major programs encompass wastewater treatment plant construction and operator training/assistance; collection systems construction; Title 5 regulations; and groundwater discharge permit issuance, compliance and enforcement.

18. Name: **DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER SUPPLY**
Address: Division of Water Supply
Department of Environmental Protection
One Winter Street, 9th Floor
Boston, MA 02108
Phone: (617) 292-5770

Service: The Division of Water Supply monitors all proposed surface or groundwater sources to ensure the availability of a safe and adequate source of water supply for public use; protects public water supply facilities from possible pollution; administers the Wellhead Protection Program; regulates cross-connections between water supply sources

to prevent bacterial or dangerous chemical contamination of public water supplies; and administers a construction grants program for water purification plants.

19. Name: **DEPARTMENT OF FOOD AND AGRICULTURE**
Address: Department of Food and Agriculture
100 Cambridge Street, Suite 2103
Boston, MA 02202
Phone: (617) 727-3000

Service: The Department of Food and Agriculture's goal is to maintain and strengthen the state's agricultural economy. It is responsible for monitoring the quality of agricultural products, the inspection of poultry and livestock for diseases, and the regulation of agricultural industries to reduce and prevent diseases in plants and animals. Regional offices are as follows:

Central Regional Office
Dept. of Food and Agriculture
142 Old Common Road
Lancaster, MA 01523
Tel: (508) 792-7711

Western Regional Office
Dept. of Food and Agriculture
University of Massachusetts
Draper Hall
Amherst, MA 01003
(413) 545-5731

20. Name: **DEPARTMENT OF FOOD AND AGRICULTURE**
BUREAU OF AGRICULTURAL LAND USE
Address: Bureau of Agricultural Land Use
Department of Food and Agriculture
142 Old Common Road
Lancaster, MA 01523
Phone: (508) 792-7711

Service: The Bureau administers the Agricultural Preservation Restriction (APR) Program, the State-owned Farmland Project, and the Municipal Farmland Identification Program. The APR program purchases the development rights from privately-owned farmland throughout the Commonwealth so that it will remain available for agriculture in perpetuity. The Municipal Farmland Identification Program maps agricultural land on a town-by-town basis and gives advice to municipalities on farmland preservation.

21. Name: **DEPARTMENT OF FOOD AND AGRICULTURE**
DIVISION OF REGULATORY SERVICES
Address: Director of Regulatory Services
Department of Food and Agriculture
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3000

Service: This Division consists of five Bureaus, each of which administers and enforces statutes related to the regulation of the Massachusetts agricultural community.



22. Name: **DEPARTMENT OF FOOD AND AGRICULTURE
PESTICIDE BUREAU**

Address: Pesticide Bureau
Department of Food and Agriculture
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3020

Service: This Bureau controls the use and application of pesticides and investigates their alleged misuse. It licenses those who sell restricted pesticides, certifies those who use or supervise the use of restricted pesticides, and licenses those who apply pesticides to another's land. In addition, the Bureau provides technical and administrative support to the Pesticide Board which sets policy regarding control and registration of the use of pesticides.

23. Name: **DEPARTMENT OF FOOD AND AGRICULTURE
STATE RECLAMATION AND MOSQUITO CONTROL BOARD**

Address: State Reclamation Board
Department of Food and Agriculture
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3000

Service: The State Reclamation and Mosquito Control Board maintains previously reclaimed wetland areas and operates as a central administrative and technical unit for regional mosquito control projects.

24. Name: **DEPT. OF FISHERIES, WILDLIFE, & ENVIRONMENTAL LAW ENFORCEMENT**

Address: Dept. of Fisheries, Wildlife, & Environmental Law Enforcement
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3151

Service: The Department of Fisheries, Wildlife, and Environmental Law Enforcement maintains and improves the quality and quantity of the state's resources of fish, shellfish, game, and non-game wildlife species. It also maintains and improves the state's lakes, ponds, streams, and coastal waters through programs of research and restoration development. It also enforces all environmental laws, rules, and regulations relating to hunting, fishing, hazardous waste, pollution, boating, and recreational vehicles.

25. Name: **DEPT. OF FISHERIES, WILDLIFE, & ENVIRONMENTAL LAW ENFORCEMENT
DIVISION OF FISHERIES AND WILDLIFE**

Address: Division of Fisheries and Wildlife
Dept. of Fisheries, Wildlife, & Environmental Law Enforcement
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3151

Service: The Division of Fisheries and Wildlife is responsible for the protection and



management of the fish and wildlife resources of the Commonwealth. Wildlife lands and waters are preserved through an acquisition program. The Division administers the Riverways/Adopt-a-Stream Programs. The Division also informs the public about fish and wildlife resources and their wise use through the publication of magazines and special reports, school curricula news releases, and regulations. Films, slide presentations, speakers, and exhibits are provided by the Division.

Additional information can also be obtained by contacting:

Division of Fisheries and Wildlife
Field Headquarters
Westborough, MA 01581
Tel: (508) 366-4470

26. Name: **DEPT. OF FISHERIES, WILDLIFE, & ENVIRONMENTAL LAW ENFORCEMENT
NATURAL HERITAGE PROGRAM**
Address: Natural Heritage Program
Division of Fisheries and Wildlife
Department of Fisheries, Wildlife and Environmental Law Enforcement
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-9194

Service: The Natural Heritage Program maintains a comprehensive, statewide database on the location and status of the State's rarest and most vulnerable natural features. Currently, the program collects and manages information on 130 rare animal species, 250 rare plant species, and 20 ecologically significant natural community types. The Natural Heritage Program uses its information to encourage the conservation of sites which harbor rare species by participating in environmental review processes and land protection planning, and by responding to data requests from private consultants.

27. Name: **DEPT. OF FISHERIES, WILDLIFE, & ENVIRONMENTAL LAW ENFORCEMENT
DIVISION OF LAW ENFORCEMENT**
Address: Division of Law enforcement
Dept. of Fisheries, Wildlife, & Environmental Law Enforcement
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3190

Service: The Division of Law Enforcement, through its inland officers, coastal officers, and marine patrol vessels, enforces all environmental laws, rules, and regulations relating to hunting, fishing, shellfishing, hazardous waste pollution, and maintains law and order in state facilities.

28. Name: **DEPT. OF FISHERIES, WILDLIFE, & ENVIRONMENTAL LAW ENFORCEMENT
DIVISION OF MARINE FISHERIES**
Address: Division of Marine Fisheries
Dept. of Fisheries, Wildlife, & Environmental Law Enforcement
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-3193

Service: The Division of Marine Fisheries is responsible for the protection and maintenance of the Commonwealth's marine fishery resources (fish, shellfish, and crustacea) and for the promotion and regulation of commercial and sport fisheries which utilize those resources. The Division is also concerned with the protection of the marine environment; it cooperates with other state and federal agencies on pollution abatement, coastal wetlands protection, and other programs concerning coastal waters and marine life.

29. Name: **DEPT. OF FISHERIES, WILDLIFE, & ENVIRONMENTAL LAW ENFORCEMENT
PUBLIC ACCESS BOARD**
Address: Public Access Board
Dept. of Fisheries, Wildlife, & Environmental Law Enforcement
100 Nashua Street, Rm. 915
Boston, MA 02114
Phone: (617) 727-1843

Service: The Public Access Board designates locations of public access to great ponds and other waters in the Commonwealth. After public hearing in a city or town, the Board acquires property easements for the purpose of such access. It designates roads and facilities to be built, improved, operated and maintained, and adopts rules and regulations governing the use of such land and waters.

30. Name: **METROPOLITAN DISTRICT COMMISSION (MDC)**
Address: Metropolitan District Commission
20 Somerset Street
Boston, MA 02108
Phone: (617) 727-5114

Service: The Metropolitan District Commission is a regional environmental management agency which provides services relative to water, parks, and recreation as well as police protection to approximately 2.5 million residents of Massachusetts in the Metropolitan Boston area. In all, the MDC serves the city of Boston and 54 cities and towns in the Metropolitan Region.

31. Name: **METROPOLITAN DISTRICT COMMISSION
WATERSHED MANAGEMENT DIVISION**
Address: Watershed Management Division
Metropolitan District Commission
20 Somerset Street or 180 Deaman Street
Boston, MA 02108 West Boylston, MA 01583
Phone: (617) 727-5274 (508) 835-4816



Service: The Watershed Management Division operates and manages the reservoirs and watershed lands located on 87,000 acres of property at the Quabbin, Wachusett, and Sudbury reservoirs and the Ware River. The Division is responsible for the environmental protection of these water supplies in order to provide high quality drinking water to the Massachusetts Water Resources Authority for distribution to 2.5 million residents throughout 46 Massachusetts communities.

32. Name: **CENTER FOR RURAL MASSACHUSETTS**
Address: Center for Rural Massachusetts
Hills North
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2255

Service: The Center for Rural Massachusetts was created by the legislature in 1984 to conduct applied research into all aspects of rural life in the Commonwealth, including agriculture, natural resource management, land use planning, and economic development, in order to promote the welfare of rural residents. The Center also acts as an informational clearinghouse serving town officials dealing with these issues. Priority is given to towns experiencing unique difficulties which offer unusual research opportunities for which "model" plans or bylaws could be drafted and would have broad applicability to other communities.

33. Name: **MASSACHUSETTS CONSERVATION DISTRICTS**

Service: The Massachusetts Conservation Districts are among 3,000 soil and water conservation districts across the nation whose primary reason for existence is to bring conservation of our natural resources to the grassroots level. Conservation Districts are organized along county lines. There are 16 Districts in Massachusetts, serving all counties. Some of the services that Conservation Districts provide are:

- acting as liaison between landowners and various action agencies to alleviate soil and water problems;
- identifying and evaluating present and future needs and opportunities for conservation and development of the state's natural resources;
- preparing Soil Surveys; providing grants for Open Space Plans; and the Massachusetts Natural Resource Planning Programs for towns and cities;
- providing a seedling program for reforestation, wildlife habitat, and beautification; inventory forest lands;
- educate the public in solving conservation resource problems.

The following are locations of Conservation District offices:

Berkshire Conservation District
78 Center Street (Arterial)
Pittsfield, MA 01201
Tel: (413) 443-1776

Middlesex Conservation District
319 Littleton Road, Suite 205
Westford, MA 01886
Tel: (508) 692-9395

Bristol Conservation District
P.O.Box 475
Dighton, MA 02715
Tel: (508) 669-6558

Nantucket Conservation District
10 South Beach
Nantucket, MA 02554
Tel: (508) 228-7230

Cape Cod Conservation District
P.O. Box 296
West Barnstable, MA 02668
Tel: (508) 362-6327

Norfolk Conservation District
460 Main Street
Walpole, MA 02081
Tel: (508) 668-0995

Dukes Conservation District
P.O. Box 1010
Edgartown, MA 02539
Tel: (508) 693-7775

N.E. Worc. Conservation District
N.W. Worc. Conservation District
S. Worc. Conservation District
91 McCormick Road
Spencer, MA 01562
Tel: (508) 885-2595

Essex Conservation District
5 Preston Street
Hathorne, MA 01937
Tel: (508) 777-0391

Plymouth Conservation District
15 Cranberry Highway
West Wareham, MA 02576
Tel: (508) 295-5495

Franklin Conservation District
Hampden Conservation District
Hampshire Conservation District
243 King Street, Rm. 39
Northampton, MA 01060
Tel: (413) 584-1464

Suffolk Conservation District
95 Berkeley Street, Suite 632B
Boston, MA 02116
Tel: (617) 451-9141

34. Name: **THE ENVIRONMENTAL INSTITUTE**
Address: The Environmental Institute
Blaisdell House
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2842

Service: The Environmental Institute is a research unit of the Graduate School of the University of Massachusetts at Amherst. The purpose of the Institute is to provide "public service through research" on matters of broad environmental concern. The Institute accomplishes its purpose by supporting teams of faculty, staff, and graduate students who conduct research or provide professional training on environmental problems that are significant to public health, safety and the public trust. The primary role of the Institute is to provide public and nonprofit agencies access to University expertise concerning environmental issues.

35. Name: **WATER RESOURCES RESEARCH CENTER**
Address: Water Resources Research Center
Blaisdell House
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2842



Service: The objectives of the Center are to promote interdisciplinary research on water resources, to provide opportunities for graduate education in water resources related fields, and to provide consultation to public agencies and citizen groups on water resources problems. The Center's program covers research in the biological and physical sciences, engineering and social sciences. This research is directed to problems of water quality, hydrology, wetlands, recreation, groundwater, and coastal waters. It includes research on water law and water resources planning and management.

36. Name: **CRANBERRY EXPERIMENT STATION**
Address: Cranberry Experiment Station
P.O. Box 569
East Wareham, MA 02538
Phone: (508) 295-2212

Service: The Cranberry Experiment Station conducts Cooperative Extension programs and specialized research in specific problems of the cranberry industry. Pesticides research relative to this industry, and problems of estuarine pollution receive major attention. A water quality research laboratory operates at this facility.

37. Name: **MASSACHUSETTS COOPERATIVE EXTENSION**
Address: Cooperative Extension
Stockbridge Hall
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-4800

Service: Cooperative Extension was created to serve as the outreach arm of the Land-Grant colleges and universities and the U.S. Department of Agriculture. This is accomplished through university staff and county and regional Extension specialists who provide educational assistance, information and guidance in terms of collection, analysis, interpretation, and dissemination of agricultural information for management and application. Programs related to agricultural production and marketing control, natural resources development, community planning and development, home economics and consumer services, and youth (4-H) are developed for urban and rural interests.

38. Name: **OFFICE OF MARINE RESOURCES**
Address: Office of Marine Resources
Holdsworth Natural Resource Center
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2757

Service: The Office of Marine Resources has been established to address the marine resource needs of the Commonwealth. It functions to 1) bring university expertise together with agencies, industries, and organizations to identify information needs, 2) promote interdisciplinary activity to produce needed information, and 3) aid in disseminating this information to state and local agencies, industries and the general public through activities of Massachusetts Cooperative Extension.

39. Name: **UNIVERSITY OF MASSACHUSETTS MARINE STATION**
Address: University of Massachusetts Marine Station
P.O. Box 7128, Lanesville Station
Gloucester, MA 01930
Phone: (508) 291-1930

Service: The University of Massachusetts Marine Station is an interdisciplinary research facility located on the coast in Gloucester, MA. The Station is equipped for a wide range of marine biochemical, biological, and chemical studies in laboratories with modern research equipment, cultural facilities, seawater systems, and small library. Basic and applied research are conducted by faculty and graduate students from the Amherst campus.

40. Name: **EXECUTIVE OFFICE OF COMMUNITIES AND DEVELOPMENT (EOCD)**
Address: Executive Office of Communities and Development
Office of Planning and Management
100 Cambridge Street
Boston, MA 02202
Phone: (617) 727-9800

Service: Provides assistance to communities and regional agencies regarding land use planning and development issues and municipal management practices. Assistance includes advice on planning, zoning, subdivision control, and a variety of municipal management approaches and practices such as budgeting, charter reform, and personnel practices.

41. Name: **MASSACHUSETTS HIGHWAY DEPARTMENT**
Address: Massachusetts Highway Department
10 Park Plaza
Boston, MA
Phone: (617) 973-7500

Service: The Massachusetts Highway Department provides and/or administers all services relative to keeping the state highway system safe and operational including design and engineering of repairs, improvements and additions, maintenance, bridges, and traffic and transportation planning.

42. Name: **MASSACHUSETTS DATA CENTER (MassGIS)**
Address: Massachusetts Data Center
Executive Office of Environmental Affairs
20 Somerset Street
Boston, MA 02108
Phone: (617) 727-3888

Service: MassGIS is a geographic information system developed by EOEА. This system is a computer system that assembles, stores, manipulates, and displays geographically referenced information. MassGIS is located within the Environmental Data Center at EOEА. Through MassGIS the Commonwealth has created a coordinated, statewide database of spatial information for environmental planning and management. MassGIS distributes data from this database to the public and supports the GIS users in EOEА's constituent departments.

43. Name: **MASSACHUSETTS STATE COMMISSION FOR THE CONSERVATION OF SOIL, WATER, AND RELATED RESOURCES**
Address: Commission for the Conservation of Soil, Water, and Related Resources
EOEA/Division of Conservation Services
100 Cambridge St., Room 2000
Boston, MA 02202
Phone: (617) 727-1552

Service: One of the goals of the State Commission is to provide through the Massachusetts Conservation Districts the best available and newest technology to rural and urban decision makers so that they can respond to water quality concerns and state environmental requirements. The goal is to do this by focusing on providing:

- technology transfer through workshops;
- public information and education to municipal boards; and
- assessment and technical assistance to communities.

44. Name: **MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY
DIVISION OF FIRE PREVENTION**
Address: Division of Fire Prevention
Department of Public Safety
P.O.Box 490
Tewksbury, MA 01876
Phone: (508) 851-9813

Service: Provides assistance to local fire department officials concerning removal and/or installation of underground storage tanks.

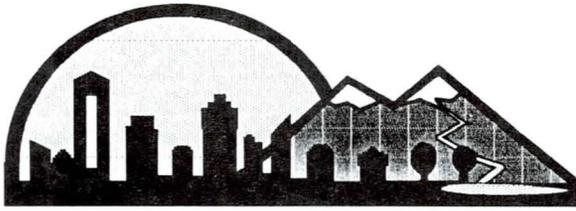
45. Name: **MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTE SITE CLEANUP**
Address: Bureau of Waste Site Cleanup
Department of Environmental Protection
One Winter Street, 5th Floor
Boston, MA 02108
Phone: (617) 292-5851

Service: The Bureau of Waste Site Cleanup is responsible for ensuring immediate and effective response to releases of oil and hazardous materials such as oil spills, chemical fires and leaking underground storage tanks. This Bureau also oversees the assessment and cleanup of hazardous waste sites by responsible parties, including leaking underground storage tanks. The Bureau recognizes that leaking underground storage tanks are a big problem, and strive, whenever possible, to assist the homeowner in efforts to remediate the problems created by a leaking residential underground storage tank. They also offer advice and information to homeowners and municipal officials with underground storage tank questions.

46. Name: **MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF WATERSHED MANAGEMENT**
Address: Office of Watershed Management
Department of Environmental Protection
One Winter Street, 9th Floor or P.O.Box 116
Boston, MA 02108 North Grafton, MA 01536
Phone: (617) 292-5653 (508) 792-7470

Service: The Office of Watershed Management (OWM) formed in Spring, 1993, integrates several programs originally administered by the Division of Water Pollution Control and the Division of Water Supply within the Department of Environmental Protection. This office administers the NPDES Permit Program for municipal facilities and stormwater discharges, the Nonpoint Source Pollution Program, the Massachusetts Water Management Act, the Massachusetts Research and Demonstration (R&D) Program, the Marine Program, and the Lakes Program. The OWM also performs resource assessment studies which may involve water and sediment quality sampling, biological assessment, fish tissue sampling for toxics, data analysis and reporting and establishes water quality standards for Massachusetts' surface waters.





SPECIAL PURPOSE

1. Name: **ASSOCIATION FOR THE PRESERVATION OF CAPE COD**
Address: Association for the Preservation of Cape Cod
P.O. Box 636
Orleans, MA 02653
Phone: (508) 255-4142

Service: The Association for the Preservation of Cape Cod was founded in 1968 and is dedicated to preserving the environment of Cape Cod through research and public education. Publications include a series of Informational Bulletins and Impact Studies and most recently, a growth report, Options for Cape Cod's Future. Special programs include: slide shows, films, and lectures on a variety of environmental subjects.

2. Name: **ATLANTIC CENTER FOR THE ENVIRONMENT**
Address: QLF/Atlantic Center for the Environment
39 South Maine Street
Ipswich, MA 01938
Phone: (508) 356-0038

Service: The Atlantic Center for the Environment, a division of the Quebec-Labrador Foundation, promotes environmental understanding and encourages public involvement in resolving resource issues in the Atlantic Region - New England and Eastern Canada. The Atlantic Center provides conservation education and environmental information to present and future policy-makers and resource managers, and promotes cooperation at the local, regional and international levels.

3. Name: **BERKSHIRE NATURAL RESOURCES COUNCIL, INC.**
Address: Berkshire Natural Resources Council
20 Bank Row
Pittsfield, MA 01201
Phone: (413) 499-0596

Service: The Berkshire Natural Resources Council, Inc. is a non-profit advocacy organization which represents the environmental concerns of the Berkshires. It also maintains the Berkshire County Land Trust and Conservation Fund, a tax exempt charitable land conservation trust which owns 27 parcels of land totaling 4,400 acres.

4. Name: **CENTER FOR COASTAL STUDIES**
Address: Center for Coastal Studies
58 Commercial Street, P.O.Box 1036
Provincetown, MA 02657
Phone: (508) 487-3622

Service: The Center for Coastal Studies is a non-profit advisory, education and research organization specializing in an interdisciplinary approach to the coastal environment. Founded in 1967, The Center was established in response to the urgent need to understand the processes and phenomena of the coastal environment and to communicate these findings to managers and users of the coastal zone.

5. Name: **TUFTS UNIVERSITY CENTER FOR ENVIRONMENTAL MANAGEMENT**
Address: Tufts University
Center for Environmental Management
Curtis Hall, 474 Boston Ave.
Medford, MA 02155
Phone: (617) 627-3486; (617) 627-3531

Service: The Center for Environmental Management at Tufts University is a broad-based research, policy and education institute working on issues related to hazardous and solid wastes. The Center supports activities related to four main areas of concentration: waste reduction and treatment, health effects, risk assessment and management, and site assessment and management.

6. Name: **COMPACT OF CAPE COD TRUSTS, INC.**
Address: The Compact of Cape Cod Conservation Trusts, Inc.
P.O. Box 327
North Truro, MA 02652
Phone:

Service: The Compact of Cape Cod Conservation Trusts, Inc. was formed in 1986 as a federation of the non-profit land trusts on Cape Cod to which it provides administrative support and services. Member trusts include Barnstable Conservation Foundation, Brewster Conservation Trust, Orleans Conservation Trust, Provincetown Conservation Trust, Truro Conservation Trust and Wellfleet Conservation Trust. Associate Members include Eastham Conservation Foundation, Sandwich Conservation Trust, and Yarmouth Conservation Trust.

7. Name: **CONSERVATION LAW FOUNDATION OF NEW ENGLAND, INC.**
Address: Conservation Law Foundation of New England, Inc.
62 Summer Street
Boston, MA 02110
Phone: (617) 350-0990

Service: The Conservation Law Foundation of New England, Inc. founded in 1966, is a non-profit, public interest environmental law organization dedicated to the preservation of New England's natural resources. The Foundation advocates environmental quality before courts, agencies, and resource management. The Foundation draws upon an extended network of groups, and government officials. The Foundation's work is focused in seven

major project areas:

- Protection of air quality
- Protection of groundwater and surface water
- Energy conservation and the transition to renewable fuels
- Reduction or elimination of environmental threats to public health
- Management of public and critical private lands
- Assistance to individuals and communities in matters of environmental law
- Protection of marine wildlife and habitats

8. Name: **ENVIRONMENTAL LOBBY OF MASSACHUSETTS**
Address: Environmental Lobby of Massachusetts
3 Joy Street
Boston, MA 02108
Phone: (617) 742-2553

Service: The Environmental Lobby of Massachusetts works for the protection of natural resources in Massachusetts through legislative action. The Environmental Lobby serves as the legislative arm for conservation in Massachusetts by providing representation at the state house; publishes the Environmental Legislative Bulletin to keep its members informed of the existence and progress of legislation affecting natural resources; publishes a newsletter containing up-to-date information on general conservation issues.

9. Name: **MASSACHUSETTS WATER WATCH PARTNERSHIP**
Address: Massachusetts Water Watch Partnership
Blaisdell House
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2842

Service: The Massachusetts Water Watch Partnership (Mass WPP) is a statewide collaboration of scientists, educators, industry and volunteer groups working to involve citizens in the collection of water quality information. Mass WPP provides technical assistance, laboratory analysis and data management for citizen groups that are conducting their own water monitoring efforts on rivers and lakes in Massachusetts.

10. Name: **MASSACHUSETTS FEDERATION OF PLANNING BOARDS**
Address: Massachusetts Federation of Planning Boards, Inc.
187 Mill Street
Haverhill, MA 01830
Phone: (508) 372-2159

Service: The Massachusetts Federation of Planning Boards is a non-profit, voluntary association of the Planning Boards and Zoning Boards of Appeals of Massachusetts. Its purpose is to promote effective municipal planning boards and, thereby, the orderly development of all the municipalities of the Commonwealth; to encourage planning boards and zoning boards of appeals in carrying out their responsibilities; to collect and publish relevant facts and data; to offer education materials and programs; and to pursue activities directed toward sound growth policies and wise use of the land, water, and air resources of the Commonwealth.



11. Name: **MASSACHUSETTS ASSOCIATION OF CONSERVATION DISTRICTS**
Address: Massachusetts Association of Conservation Districts
319 Littleton Road, Suite 205
Westford, MA 01880
Phone: (508) 692-9395

Service: The Massachusetts Association of Conservation Districts is the voluntary state association for the sixteen conservation districts in Massachusetts. Its purpose is to monitor and propose legislation, work with other state and federal resource agencies, especially dealing with the areas of farming, soil, water, and related land resources. MACD keeps the Massachusetts districts informed of events, meetings, and important activities and works with other state associations and with the National Association of Conservation Districts.

12. Name: **MASSACHUSETTS ASSOCIATION OF CONSERVATION COMMISSIONS, INC.**
Address: Massachusetts Association of Conservation Commissions, Inc.
10 Juniper Road
Belmont, MA 02178
Phone: (617) 489-3930

Service: The Massachusetts Association of Conservation Commissions, Inc. is a private non-profit, service organization formed in 1961 to support and assist the municipal Conservation Commissions of Massachusetts. MACC offers a broad range of programs to local Conservation Commissions and their constituents with a heavy focus on wetlands and water protection. MACC communicates through publication of the "MACC Newsletter" and maintains a resource library and data information center.

13. Name: **MASSACHUSETTS AUDUBON SOCIETY**
Address: Massachusetts Audubon Society
South Great Pond Road and 346 Grapevine Road
Lincoln, MA 01773 Wenham, MA 01984
Phone: (617) 259-9500 508) 927-1122

Service: The Massachusetts Audubon Society is a non-governmental, membership-supported conservation, environmental education, and research agency concerned with the preservation of a healthy environment for both people and wildlife.

14. Name: **MASSACHUSETTS FORESTRY ASSOCIATION**
Address: Massachusetts Forestry Association
Box 7, West Road
Petersham, MA 01366

Service: Begun in 1970 as the Massachusetts Land League, the name was changed in 1986 to the Massachusetts Forestry Association, to more accurately reflect the organization's interest in forest conservation. A non-profit, volunteer, educational organization, the Association seeks to promote the conservation and thoughtful management of forest land.



15. Name: **MASSACHUSETTS REGIONAL PLANNING AGENCIES**
Address: Massachusetts Association of Regional Planning Agencies
c/o Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
Phone: (617) 451-2770

Service: The purpose of the thirteen regional planning agencies in Massachusetts is to plan and promote the orderly growth of their respective regions. The regional planning agencies serve in advisory capacity to area communities; make studies of the area's resources and needs of the area including: solid waste disposal, sewerage, water resources, open space, and pollution. Regional offices are located as follows:

Berkshire County Regional
Planning Commission
10 Fenn Street
Pittsfield, MA 01201
Tel: (413) 442-1521

Cape Cod Commission
3225 Main St., P.O. Box 226
Barnstable, MA 02630
Tel: (508) 362-3828

Central MA Regional
Planning Commission
340 Main Street, Suite 747
Worcester, MA 01608
Tel: (508) 756-7717

Martha's Vineyard Commission
P.O. Box 1447
Oak Bluffs, MA 02557
Tel: (508) 693-3453

Pioneer Valley Planning Commission
26 Central Street
West Springfield, MA 01089
Tel: (413) 781-6045

Merrimack Valley
Planning Commission
350 Main Street
Haverhill, MA 01830
Tel: (508) 374-0519

Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
Tel: (617) 451-2770

Montachusett Regional Planning Commission
R1427 Water Street
Fitchburg, MA 01420
Tel: (508) 345-7376

Nantucket Planning & Economic
Development Commissions
1 East Chestnut Street
Nantucket, MA 02554
Tel: (508) 228-7237

Northern Middlesex Council
of Governments
115 Thorndike Street
Lowell, MA 01852
Tel: (508) 454-8021

Old Colony Planning Council
70 School Street
Brockton, MA 02401-4097
Tel: (508) 583-1833

S.E. MA Regional Planning Commission
88 Broadway
Taunton, MA 02780
Tel: (508) 824-1367



16. Name: **MASSACHUSETTS WATERSHED ASSOCIATIONS**

Blackstone R. Watershed Assoc.
Memorial Town Hall
Memorial Square
Whitinsville, MA 01588
Tel: (508) 234-8797

Ipswich R. Watershed Assoc., Inc.
Essex Ag. & Tech. Institute
562 Maple Street, Box 112
Hawthorne, MA 01937
Tel: (508) 774-8927

Charles R. Watershed Assoc.
2391 Commonwealth Ave.
Auburndale, MA 02166
Tel: (508) 527-2799

Conn. R. Watershed Council, Inc.
1 Ferry Street
Easthampton, MA 01027
Tel: (413) 529-9500

Merrimack R. Watershed Assoc., Inc.
105 Everett Street
Concord, MA 01742
Tel: (508) 369-4845

Millers R. Watershed Council, Inc.
Mineral Road
Millers Falls, MA 01349
Tel: (413) 659-3497

Nashua R. Watershed Assoc., Inc.
592 Main Street
Groton, MA 01450
Tel: (508) 448-0299

Neponset R. Watershed Assoc., Inc.
2468A Washington Street
Canton, MA 02021
Tel: (617) 575-0354

Westfield R. Watershed Assoc., Inc.
P.O. Box 256
Westfield, MA 01086
Tel: (413) 562-3657

Westport R. Watershed Alliance
1151 Main Road, Box 3427
Westport, MA 02790
Tel: (508) 636-3016

Hoosic R. Watershed Assoc.
P.O. Box 268
North Adams, MA 02147
Tel: (413) 458-4094

Housatonic R. Watershed Assoc.
P.O. Box 3062
Pittsfield, MA 01202

SuAsCo Watershed Assoc.
89 Wilson Road
Concord, MA 01742
Tel: (508) 369-6878

Quaboag R. Watershed Assoc.
Millstone Hollow, RFD 1
Palmer, MA 01069
Tel: (413) 267-5480

Service: Watershed Associations were established to promote the restoration, conservation, wise development and use of the natural resources of the Massachusetts watersheds; to protect and conserve fish and wildlife, forests, and other plant life, water resources, and soils; to promote and encourage water and air pollution abatement; to promote and encourage an understanding among the citizens of the watershed of the need for such conservation; to encourage scientific and investigations and research to aid the accomplishment of the above purposes; to help promote through coordination and integration those activities of other agencies and organizations having an interest in the natural resources of the watersheds.

17. Name: **THE NATURE CONSERVANCY**
Address: The Nature Conservancy
79 Milk Street, Suite 300
Boston, MA 02109
Phone: (617) 423-2545



Service: The Nature Conservancy is a national, non-profit organization whose resources are devoted to the protection of ecologically significant areas and the diversity of life they support. First priority is given to preserving those areas that safeguard rare or endangered species of plants and animals. The Conservancy protects habitat and natural systems, usually through acquisition or purchase; developing and using new alternative methods of protection; assisting or advising government or other conservation organizations.

18. Name: **PLYMOUTH COUNTY WILDLANDS TRUST**
Address: Plymouth County Wildlands Trust, Inc.
P.O. Box 2282
Duxbury, MA 02331
Phone: (508) 224-2765

Service: The Plymouth County Wildlands Trust is a local non-profit land trust dedicated to the preservation of natural areas in southeastern Massachusetts.

19. Name: **REGIONAL ENVIRONMENTAL COUNCIL, INC.**
Address: Regional Environmental Council, Inc.
P.O. Box 255
Worcester, MA 01613
Phone: (508) 793-5551

Service: The Regional Environmental Council is a volunteer citizen organization concerned with the restoration, protection and conservation of our natural resources and the preservation of a quality environment. Its primary focus is on local and regional environmental issues of central Massachusetts.

20. Name: **SIERRA CLUB**
Address: Sierra Club, New England Chapter
3 Joy Street
Boston, MA 02108
Phone: (617) 227-5339

Service: The Sierra Club is a non-profit organization whose interests include protecting all aspects of a healthy natural environment - air, water, coasts, etc. The Sierra Club Foundation is the part of the Sierra Club concerned with research and education.

21. Name: **BAY STATE ROADS PROGRAM**
Address: Baystate Roads Program
Dept. of Civil Engineering
University of Massachusetts
214 Marston Hall
Amherst, MA 01003
Phone: (413) 545-2604

Service: The Baystate Roads Program, which publishes MA Interchange each quarter, is a technology transfer center created under the Federal Highway Administration's (FHWA) Rural Technical Assistance Program. FHWA is joined by the Massachusetts Department of Public Works, the Department of Civil Engineering at the University of Massachusetts/Amherst, and local public works departments in an effort to share and



apply the best in transportation technologies as accomplished with environmental best management practices. The Bay State Roads Program also facilitates information exchange by conducting workshops, providing reports, publications, and videotapes on request, and offering one-to-one technical assistance on specific roadway issues.

22. Name: **MASSACHUSETTS HARBORMASTERS ASSOCIATION**
Address: Massachusetts Harbormasters Association
100 Cole Parkway
Scituate, MA 02066
Phone: (617) 545-2130

Service: The Massachusetts Harbormasters Association was established to provide effective harbor management. The Association deals with: commercial and sports fisheries, shellfisheries, boating, coastal and marine environments, coastal planning and permitting, local oil spill cleanup coordination, marine and coastal recreation, and maritime law enforcement.

23. Name: **LLOYD CENTER FOR ENVIRONMENTAL STUDIES**
Address: Lloyd Center for Environmental Studies
430 Potomska Road
P.O. Box 87037
South Dartmouth, MA 02748
Phone: (508) 990-0505

Service: Some of the Lloyd Center's functions are: to provide educational programs; to promote, support, and initiate research on coastal and estuarine ecosystems; and to monitor, manage, and inventory these natural resources through extensive long term research. The Center specializes in: salt marshes, tidal flats, barrier beaches, marine flats and coastal and marine ecosystems in general.

24. Name: **MASSACHUSETTS SHELLFISH OFFICERS ASSOCIATION**
Address: Massachusetts Shellfish Officers Association
c/o Natural Resources Department
597 Forest Road
South Yarmouth, MA 02664
Phone: (508) 760-4800

Service: The Association provides a forum for coastal municipalities' shellfish officers to exchange information about shellfish research, management, law enforcement, and water quality issues. In addition, the Association works closely with the Massachusetts Division of Marine Fisheries on shellfish related issues, and provides input to legislators on shellfish related issues. The Association specializes in: shellfish propagation, management, regulation and enforcement; aquaculture dealing with shellfish; water quality and land-use practices as they relate to estuaries; and public education of the above topics and others related to shellfish.



25. Name: **NEW ENGLAND AQUARIUM**
Address: New England Aquarium
Central Wharf
Boston, MA 02110
Phone: (617) 973-5200

Service: The Aquarium educates the public as to the world of water through educational programs, research, conservation, and exhibits.

26. Name: **NEW ENGLAND GOVERNORS CONFERENCE FEDERAL/STATE WATER RESOURCES COMMITTEE**
Address: New England Governors Conference Fed/State Water Resources Committee
76 Summer Street
Boston, MA 02110
Phone: (617) 423-6900

Service: This group provides information to the governors of New England about coastal-ocean policy, environmental policy and acid rain.

27. Name: **WOODS HOLE OCEANOGRAPHIC INSTITUTION**
Address: Woods Hole Oceanographic Institution
86 Water Street
Woods Hole, MA 02543
Phone: (508) 548-1400

Service: The Institution maintains a professional staff of marine scientists and engineers to pursue marine science and publish research results. The Institution specializes in the basic disciplines of biology, chemistry, geology, geophysics, physical oceanography, and applied ocean physics and engineering. The Institution has three research centers focused on marine policy, coastal research, and marine exploration.

28. Name: **NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION**
Address: New England Interstate Water Pollution Control Commission
255 Ballardvale Street
Wilmington, MA 01887
Phone: (508) 658-0500

Service: The New England Interstate Water Pollution Control Commission (NEIWPC) has an agreement with the EPA to coordinate water pollution abatement activities in surface and groundwater among the New England states. In addition to working on interstate programs, NEIWPC assists the states to ensure compatibility among state programs and to make the states aware of future needs.

29. Name: **MASSACHUSETTS FARM BUREAU**
Address: P.O. Box 651
Bedford, MA 01730
Phone: (617) 275-4374

Service: The Farm Bureau is a private, nationwide organization representing farmers regardless of the size of the farm. The Farm Bureau was primarily setup to share



agricultural information of all topics with its members. The Farm Bureau also acts as a "watchdog" for various forms of pending legislation that pertains to agriculture and acts as an agricultural lobby. There are many local county offices that have been setup as outreaches of the main center in Bedford, MA to provide more efficient delivery of information to the farmer.

30. Name: **MASSACHUSETTS CONGRESS OF LAKE AND POND ASSOCIATIONS, INC.**
Address: Massachusetts Congress of Lake and Pond Associations, Inc.
135 Washington Street
Holliston, MA 01746
Phone: (508) 429-5085

Service: Numerous Lake and Pond Associations throughout Massachusetts work to improve lake water quality, recreational values, aesthetics, and lakeshore property values through maintenance and improvement of lake watershed management, lake water level control, and other factors. The Massachusetts Congress of Lake and Pond Associations (COLAP) acts as an umbrella organization for the various associations. The Massachusetts COLAP also produces a quarterly publication called Water Wisdom to keep all members informed of pending legislation and current technology. A publication entitled, "Directory of Lake and Pond Associations in Massachusetts," is available from the DEP, Division of Water Pollution Control.

31. Name: **MASSACHUSETTS ASSOCIATION OF HEALTH BOARDS**
Address: Massachusetts Association of Health Boards
56 Taunton Street
Plainville, MA 02762
Phone: (508) 643-0234

Service: The Massachusetts Association of Health Boards is a non-profit association dedicated to the advancement of public and environmental health through local Health Boards. The MAHB serves the needs of elected and appointed Boards of Health throughout Massachusetts. MAHB is represented on the Hazardous Waste Facility Site Safety Council, the Pesticides' Board Advisory Council, and the Lawn Care Task Force. MAHB has a Legal Advisory Council to help answer questions from local Boards and to give legal advice and interpretations. A vital function is to track legislation affecting Boards of Health. The MAHB communicates and provides valuable information to town Boards through the issuance of a periodic newsletter.

32. Name: **MASSACHUSETTS SOCIETY OF MUNICIPAL CONSERVATION PROFESSIONALS**
Address: Massachusetts Society of Municipal Conservation Professionals
10 Juniper Road
Belmont, MA 02178

Service: The Massachusetts Society of Municipal Conservation Professionals is a non-profit organization dedicated to serving and supporting Conservation Commission staff in order to raise the level of professionalism by: providing a forum for professional information exchange; sponsoring technical and scientific seminars and conferences; fostering cooperation among contiguous or regionally related Conservation Commissions; and promoting the advancement of professional staffing.



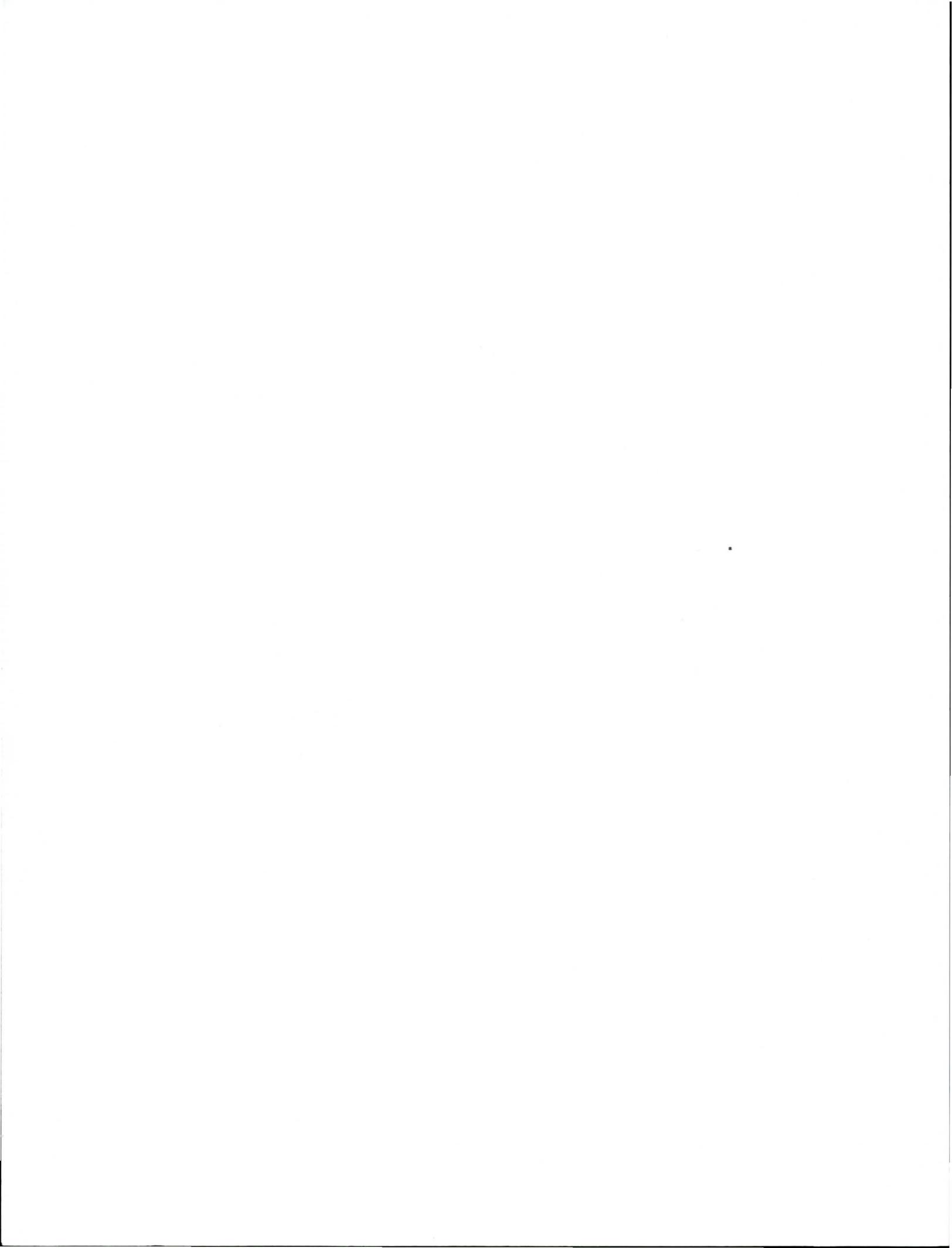
33. Name: **MASSACHUSETTS MUNICIPAL ASSOCIATION**
Address: Massachusetts Municipal Association
60 Temple Place
Boston, MA 02111
Phone: (617) 426-7272

Service: The Massachusetts Municipal Association (MMA) is composed of the Massachusetts Selectmen's Association, the Massachusetts Mayors Association, the Massachusetts Municipal Management Association, the Massachusetts Municipal Councillors Association, and the Association of Town Finance Committees. Through monthly publication of the Beacon, the MMA sends out current information on a wide variety of town and city subjects. Information on nonpoint source pollution strategies adopted by Massachusetts' cities and towns can also be found in the Beacon.

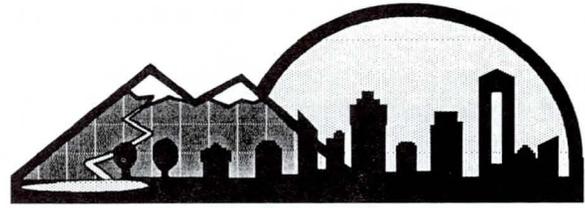
34. Name: **RURAL COMMUNITY ASSISTANCE PROGRAM**
Address: 218 Central Street
P.O. Box 429
Winchendon, MA 01475
Phone: (508) 297-1376

Service: The Rural Community Assistance Program (RCAP) was established in 1979 as one of six regional centers providing technical assistance on rural water supply and waste disposal problems. The RCAP acts in an advisory capacity to facilitate the selection of appropriate technologies compatible with an area's physical, cultural and economic environment. RCAP provides educational materials and workshops to enhance local awareness and planning. RCAP provides staff time and expertise for evaluation of local water and sewer needs, and water supply protection; technical review of engineering plans; and planning financial strategies and preparing funding applications.





APPENDIX B



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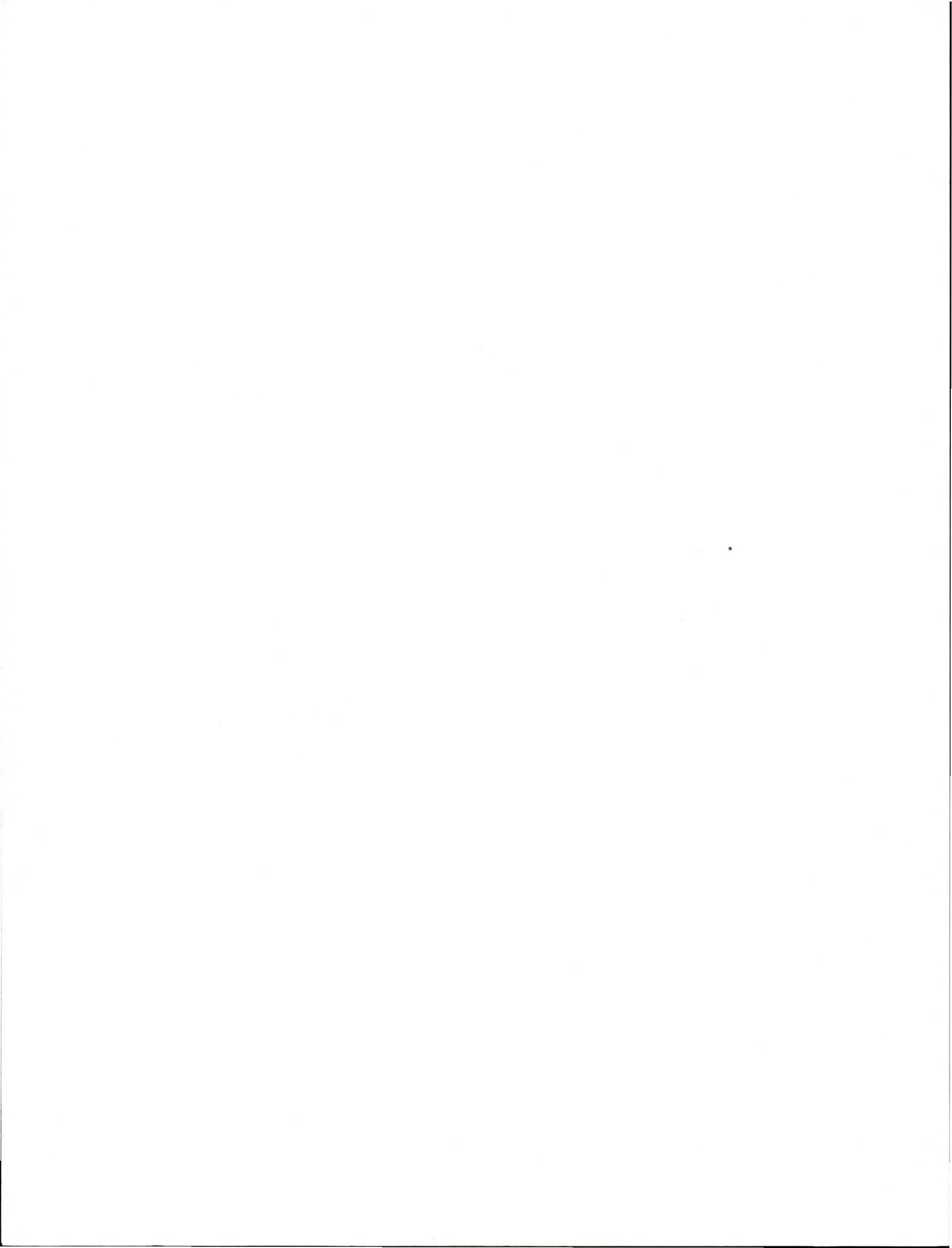
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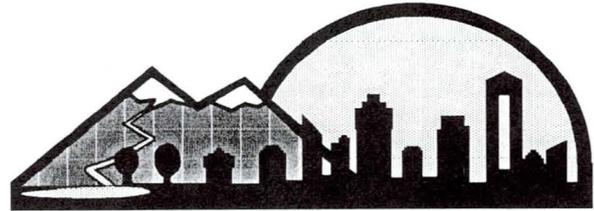
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APPENDIX C



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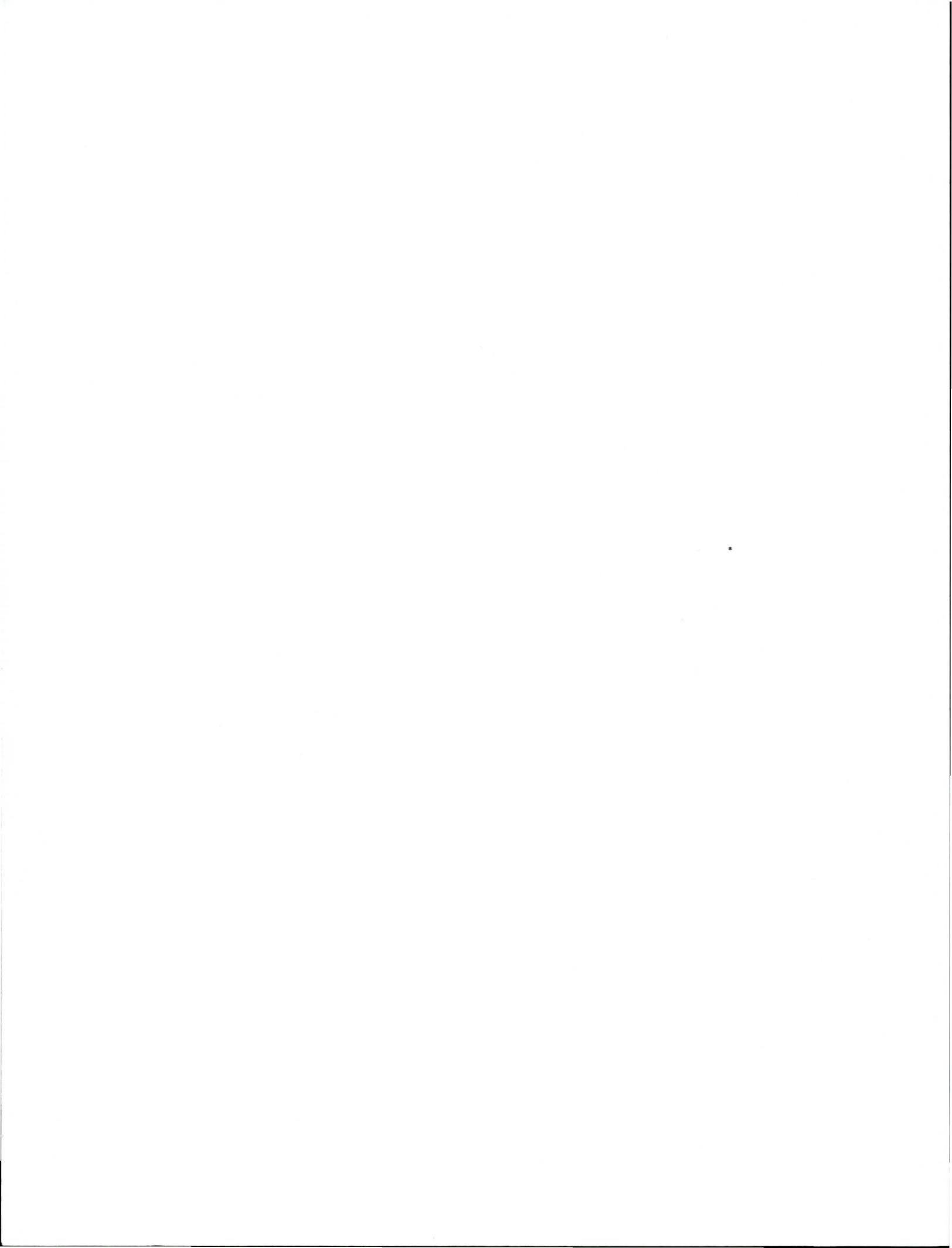
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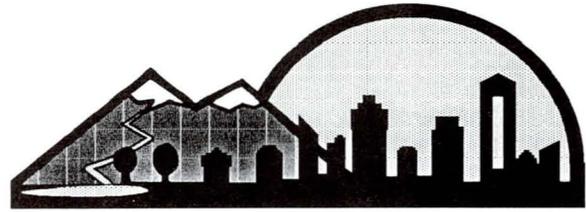
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APPENDIX D



EXAMPLE MODEL BYLAWS/ORDINANCES AND REGULATIONS

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MODEL OPEN SPACE COMMUNITY ZONING BYLAW

(Source: Growth Management Workbook. EOCD and PVPC, 1988)

(Based on a bylaw adopted by the Town of Granby, Massachusetts
and Town of Whately, Massachusetts)

OPEN SPACE COMMUNITIES

- 1.00 Open Space Communities shall be permitted in the ___ districts only upon issuance of a Special Permit with Site Plan Approval from the Planning Board, as specified in Sections ___ and ___ of this bylaw, and in accordance with the additional requirements specified herein.
- 1.01 General Description
An "Open Space Community" shall mean a single family residential development in which the houses are clustered together into one or more groups on the lot and separated from each other and adjacent properties by permanently protected open space.
- 1.02 Purposes
The purposes of open space community developments are to:
- a. allow for greater flexibility and creativity in the design of residential subdivisions, provided that the overall density of the development is no greater than what is normally allowed in the district;
 - b. encourage the permanent preservation of open space, agricultural lands, and other natural resources;
 - c. maintain the traditional New England rural character and land use pattern in which small villages contrast with open space and farmlands;
 - d. facilitate the construction and maintenance of streets, utilities and public services in a more economical and efficient manner;
 - e. encourage a less sprawling form of development that consumes less open land.
- 1.03 Additional General Requirements
The following standard shall be used as additional requirements in the special permit/site plan approval process for all open space communities:
- a. The development shall include single family dwellings only.
 - b. The minimum land required for open space community development shall be five (5) acres and the parcels shall be held in single ownership or control at the time of application.
 - c. Each lot shall have adequate access on a public or private way.
 - d. Each lot shall be of a size and shape to provide a building site which shall be in harmony with the natural terrain and other features of the land.
 - e. There shall be an adequate, safe, and convenient arrangement of pedestrian circulation, facilities, roadways, driveways, and parking.
 - f. The site plan shall identify the location and extent of all wetlands on the site as determined by the Conservation Commission under the Massachusetts Wetlands Protection Act, M.G.L. Chapter 131, Section 40.
- 1.04 Additional Utility Requirements
- 1.041 All structures which require plumbing shall be connected to a public sanitary sewer, if available, or to a community septic system at no expense to the municipality.
- 1.042 For dwellings to be served by on-site waste disposal systems, the applicant shall submit a septic system design prepared by a certified engineer and approved by the Board of Health and a plan illustrating the location of water supply wells with the special permit applications. No community septic system serving the development shall exceed sewage flow of 2,000 gallons per day. Septic systems shall be placed in the development to maximize the distance between systems and shall be placed within common areas rather than on individual lots. Maintenance of community septic



systems shall be the responsibility of the community association specified in Section 1.08.

- 1.043 No open space community development served by on-site waste disposal systems shall be approved unless the applicant can demonstrate to the satisfaction of the Planning Board that the potential for groundwater pollution is no greater from the proposed open space community development than would be expected from a conventional subdivision with single family houses on lots meeting the normal lot size requirements located on the same parcel. Where necessary, the Planning Board may hire a Professional Engineer to analyze and certify groundwater quality impacts, and may charge the applicant for the cost of such analysis.

1.05 Dimensional and Density Requirements

- 1.051 A one-family detached dwelling, or lawful accessory building may be constructed on a lot within an Open Space Community development although such lot has less area and frontage than normally required, as herein specified.
- 1.052 The maximum number of dwelling units permitted in an open space community shall be calculated based upon (the minimum lot size normally required in the district, i.e., one unit per acre) for the net developable acreage remaining once the area of all wetlands and all areas unsuitable for on-site sewage disposal have been subtracted from the total acreage of the property.
- 1.053 Under the supervision of the Conservation Commission and in accordance with the provisions of the Wetlands Protection Act, M.G.L. Ch. 131, Sec. 40, all wetlands shall be identified, and their area subtracted from the net developable acreage of the total parcel.
- 1.054 Under the supervision of the Board of Health and in conformance with Title V, percolation tests shall be conducted for all lots in the total acreage of the property which would be developed in a standard subdivision layout. The area of those lots which is determined to be not suitable for on-site sewage disposal shall be subtracted from net developable acreage of the total parcel.
- 1.055 Lot sizes in a cluster development shall not be less than one-half (50%) of the minimum lot size normally required in the district, i.e., twenty thousand (20,000) square feet per lot.
- 1.056 In no instance shall a designated lot have less than 100 feet of frontage on a public or private way.
- 1.057 Minimum front, rear, and side yard setbacks shall be the same as normally required in the district.
- 1.058 All residential structures and accessory uses with the development shall be set back from the boundaries of the development by a buffer strip of at least fifty (50) feet in width which shall include trees and shall be kept in a natural landscaped condition.

1.06 Common Open Space Requirements

- 1.061 All land not devoted to dwellings, accessory uses, roads, or other development shall be set aside as common land for recreation, conservation, or agricultural uses which preserve the land in essentially its natural condition.
- 1.062 The total area of common open space shall equal or exceed the area by which all single-family dwelling lots are reduced below the basic minimum lot area normally required in the zoning district.
- 1.063 The following lands shall not be used to meet the common open space requirements:
- a. Lands within the floodplain district;
 - b. Lands identified as wetlands in accordance with the Massachusetts Wetlands Protection Act;
 - c. Lands with slopes greater than twenty-five percent (25%).
- 1.064 Further subdivision of common open land or its use for other than recreation, conservation, or agriculture, except for easements for underground utilities and septic systems, shall be prohibited. Structures or buildings accessory to recreation, conservation, or agricultural uses may be erected but shall not exceed 5% coverage of such common open land.

1.07 Common Open Space Ownership

1.071 All common open land shall be either:

- a. conveyed to a community association owned or to be owned by the owners of lots within the development. If such a community association is utilized, ownership thereof shall pass with conveyance of the lots in perpetuity;
- b. conveyed to a non-profit organization, the principal purpose of which is the conservation or preservation of open space;
- c. conveyed to the Town, at no cost, and be accepted by it for a park or open space use. Such conveyance shall be at the option of the Town and shall require the approval of the voters at a Town Meeting; and
- d. if the parcel is located in an agricultural district, farmland owners are not required to sell the part of their property which is to become permanent agricultural open space, provided that they convey the development rights of that open space in a conservation easement prohibiting future development of the property in accordance with Section 1.071 (a-c).

1.072 In any case where such land is not conveyed to the Town, a restriction enforceable by the Town shall be recorded to ensure that such land shall be kept in an open or natural state and not be built for residential use or developed for accessory uses such as parking or roadways. Such restrictions shall further provide for maintenance for the common land in a manner which will ensure its suitability for its function, appearance, cleanliness, and proper maintenance of drainage, utilities and the like.

1.08 Community Association

1.081 A non-profit, incorporated community association shall be established, requiring membership of each lot owner in the open space community. The community association shall be responsible for the permanent maintenance of all communal water and septic systems, common open space, recreational and thoroughfare facilities. A community association agreement of covenant shall be submitted with the special permit/site plan approval application guaranteeing continuing maintenance of such common utilities, land and facilities, and assessing each lot a share of maintenance expenses. Such agreement shall be subject to the review and approval of Town Counsel and the Planning Board.

1.082 Such agreements or covenants shall provide that in the event that the association fails to maintain the common open land in reasonable order and condition in accordance with the agreement, the Town may, after notice to the association and public hearing, enter upon such land and maintain it in order to preserve the taxable values of the properties within the development and to prevent the common land from becoming a public nuisance. The covenants shall also provide that the cost of such maintenance by the Town shall be assessed ratably against the properties within the development.

1.09 Procedures and Pre-Application Review

1.091 Applicants for Open Space Communities shall follow the Special Permit procedures specified in Section ___ and the Site Plan Approval procedures specified in ___.

1.092 To promote better communication and to avoid misunderstanding, applicants are encouraged to submit a Preliminary Plan for review by the Planning Board prior to the application for a special permit. Such Preliminary Plans shall comply with the Town's Subdivision Control Regulations.

1.093 The Planning Board approval of a special permit hereunder shall not substitute for compliance with the Subdivision Control Act, nor oblige the Planning Board to approve a related Definitive Plan for subdivision, nor reduce any time periods for Board consideration under the law. However, in order to facilitate processing, the Planning Board shall, insofar as practical under law, adopt regulations establishing procedures for submission of a combined Special Permit application/Subdivision Plan which shall satisfy the Board's regulations under the Subdivision Control Act.

- 1.094 A Site/Plan Development Plan shall be submitted to the Planning Board with the application for a special permit. Following approval of the special permit, a Definitive Plan shall be submitted to the Planning Board consistent with their Subdivision Regulations and in substantial conformity with the approved Site Plan/Development Plan, except where the Cluster Development does not constitute a subdivision under the Subdivision Control Law.



MODEL AGRICULTURAL PRESERVATION ZONING BYLAW
(Source: Growth Management Workbook. EOCD and PVPC, 1988)
(Based upon a bylaw adopted by the Town of Granby, Massachusetts)

AGRICULTURAL PRESERVATION DISTRICT

1.00 Purpose

The purposes of the Agricultural Preservation District are to:

- a. Protect prime agricultural lands for future food production;
- b. Maintain an adequate agricultural land base in (town) to ensure continued economic viability for local agriculture and the availability of agricultural support service;
- c. Promote adequate and efficient provision of public service by preventing unplanned urban growth in areas more appropriate for agriculture;
- d. Preserve scenic, historic and other farming-related values which help define the character of (town) culture and landscape;
- e. Allow landowners a reasonable return on the value of their holdings while protecting the majority of existing farmland for use by future generations;
- f. Promote and protect the practice of farming in (town).

1.01 District Delineation

The Agricultural Preservation District is defined as all lands designated on the map entitled "Agricultural Preservation District, Town of (town)", on file with the Town Clerk.

1.02 Permitted Uses

- a. Agricultural production, including raising of crops, livestock, poultry, nurseries, orchards, or hay;
- b. Normal agricultural practices, including but not limited to manure storage, farm machine operation, and fertilizer and pesticide use as regulated by state and federal law;
- c. Uses accessory to farm operations, including greenhouses, farm animal veterinary facilities, agricultural processing, and storage facilities;
- d. Farm-related dwelling units owned and occupied by persons actively engaged in farming;
- e. Single family homes on frontage lots not requiring approval under the Massachusetts Subdivision Control Law, M.G.L., Ch. 41, which comply with the Site Design standards in Section 1.06 and other dimensional requirements of this bylaw.

1.03 Uses Permitted with Site Plan Approval

All residential subdivisions in the Agricultural Preservation District which require approval under M.G.L., Ch. 41 shall be laid out in accordance with the Cluster Development Standards in Section 1.07 and the Site Design Standards in Section 1.06 of this bylaw, and shall require Site Plan Approval from the Planning Board. All applicants for Site Plan Approval shall comply with Section ___ of this bylaw.

1.04 Additional Requirements for Site Plan Approval

The applicant shall comply with the minimum requirements for site plan contents in Section ___ of this bylaw, and shall also submit to the Planning Board the following information:

- a. Description or illustration of the physical characteristics within and adjacent to this site, including: prime agricultural soils, soils of state and local importance, other soils and soil characteristics, and areas used for crop or other agricultural production.
- b. Description of compliance with Cluster Development Standards in Section 1.07 and Site Design Standards in Section 1.06.

1.05 Criteria for Review

In addition to the Site Plan Approval criterion contained in Section ___ the Planning Board shall also consider the following criteria:

- a. is in compliance with Cluster Development Standards in Section 1.07;
- b. will not interfere with farming operations on adjacent lands;
- c. is situated on the portion of the site with soils least suitable for the production of crops or livestock; and
- d. is integrated into the existing landscape through features such as vegetative buffers, and through retention of open agricultural land.

1.06 Site Design Standards

These standards shall apply to subdivisions requiring approval under Chapter 41 and to lots or subdivisions not requiring approval under Chapter 41;

- a. All buildings, homes and structures shall be located a minimum of 100 feet from agricultural land and shall be separated by a 50-foot wide buffer strip of trees and fencing sufficient to minimize conflicts between farming operations and residences.
- b. Each structure shall be integrated into the existing landscape on the property so as to minimize its visual impact and maintain visibility of adjacent agricultural lands from public ways through use of vegetative and structural screening, landscaping, grading, and placement on or into the surface of the lot.

1.07 Cluster Development Standards

Residential subdivision developments in the Agricultural Preservation District shall be laid out according to the cluster development standards contained herein. Single-family detached dwellings, or lawful accessory buildings, in a cluster development may be constructed on lots which have less area or frontage than normally required in the underlying district, as herein specified.

- 1.071 All buildings and roads shall be located away from soils which are most suitable for agriculture (based on U.S. Soil Conservation Service classifications for prime farmland soils and soils of state and local importance) to the maximum practical extent. This provision does not apply to the location of on-site septic disposal facilities which must be placed in soils meeting the Massachusetts Environment Code.
- 1.072 All roads, drainage systems and utilities shall be laid out in a manner so as to have the least possible impact on agricultural lands and uses.
- 1.073 The minimum lot size for any cluster development lot shall be 20,000 square feet. The minimum frontage for such lots shall be 100 feet. All other dimensional requirements shall be the same as normally required in the district.
- 1.074 The maximum number of dwelling units permitted in a residential cluster development shall be calculated according to the following procedures:
 - a. The maximum number of dwelling units permitted on a parcel of land shall be determined based upon unit per acre for the net developable acreage remaining once the area of all wetlands and all areas unsuitable for on-site sewage disposal have been subtracted from the total acreage of the property, if appropriate.
 - b. Under the supervision of the Conservation Commission and in accordance with the provisions of the Wetlands Protection Act, M.G.L. Ch. 131, Sec. 40, all wetlands shall be identified, and their area subtracted from the net developable acreage of the total parcel.
 - c. Under the supervision of the Board of Health, and in conformance with Title 5 percolation tests shall be conducted for all lots in the total acreage of the property which would be developed in a standard subdivision layout. The area of these lots which is determined to be not suitable for on-site sewage disposal shall be subtracted for the net developable acreage of the total parcel.

- 1.075 The required open land within a cluster shall be determined as follows:



- a. At least fifty (50) percent of the net acreage remaining after the area of all wetlands have been subtracted shall be retained as open agricultural land. Remaining open agricultural land shall have appropriate acreage, configuration and access to enable continued farming operations.
- 1.076 All buildings, homes, and structures shall be located a minimum of 75 feet from agricultural land and shall be separated from agricultural uses by a 50-foot wide buffer strip of trees and fencing sufficient to minimize conflicts between farming operations and residences.
- 1.077 The following standards shall apply to development requiring on-site sewage disposal.
- a. The applicant shall submit a septic system design prepared by a certified engineer and approved by the Board of Health and a plan illustrating the location of water supply wells with the special permit application. No community septic system serving the development shall exceed sewage flow of 2,000 gallons per day. Septic systems shall be placed in the development to maximize the distance between systems and may be placed within common areas or in individual lots. Maintenance of community septic systems shall be the responsibility of the home-owners' association specified in Section 1.09.
 - b. No cluster development shall be approved unless the applicant can demonstrate to the satisfaction of the Planning Board that the potential for ground-water pollution is no greater from the proposed cluster development than would be expected from a conventional subdivision with single-family houses on lots meeting the normal lot size requirements located on the same parcel. Where necessary, the Planning Board may hire a Professional Engineer (P.E.) to analyze and certify groundwater quality impacts and may charge the applicant for the cost of such analysis.
- 1.08 Protection of Open Agricultural Land
The following standards shall apply to open agricultural land to be protected as part of the development of residential cluster developments:
- 1.081 Farmland owners are not required to sell the part of their property which is to become permanent agricultural open space, provided that they do convey the development rights of that open space in a conservation easement prohibiting future development of this property to any of the official bodies named in Section 1.082 below.
- 1.082 All remaining open agricultural land shall be permanently protected by either:
- a. A permanent conservation easement or deed restriction conveyed to the Town of (town) with Town approval or to a non-profit farmland trust or conservation organization whose principal purpose is to conserve farmland and open space. At a minimum, such an easement or restriction shall entail the use of management practices that ensure existing fields or pastures will be plowed or mowed at least once every year.
 - b. Ownership in fee simple conveyed to the Town of (town) with Town approval or to a non-profit farm trust, open space or conservation organization as a gift or for consideration.
- 1.09 Community Association
- 1.091 A non-profit, incorporated community association shall be established, requiring membership of each lot owner in the open space community. The community association shall be responsible for the permanent maintenance of all community water and septic systems, common open space, recreation and thoroughfare facilities. A community association agreement of covenant shall be submitted with the special permit application guaranteeing continuing maintenance of such common utilities, land and facilities, and assessing each lot a share of maintenance expenses. Such agreement shall be subject to the review and approval of Town Counsel and the Planning Board.
- 1.092 Such agreements or covenants shall provide that in the event that the association fails to maintain the common open land in reasonable order and condition in accordance with the agreement, the Town may, after notice to the association and public hearing, enter upon such land and maintain it in order to preserve the taxable values of the properties within the development and to prevent the common land from becoming a public nuisance. The covenants shall also provide that the cost of such maintenance by the Town shall be assessed ratably against the record owners of the properties within the development, their successors or assigns.



1.10 Relationship to Agricultural Incentive Area

All land which is enrolled in the Agricultural Preservation Zoning district shall become eligible for enrollment in the (town) Agricultural Incentive Area and, once enrolled in the Incentive Area, shall receive any and all benefits and incentives included therein.

Note: The adoption of this bylaw will also require the following addition to the zoning bylaw's Table of Dimensional Regulations.

District	Minimum Lot Size	Minimum Frontage	Minimum Side Yard	Minimum Rear Yard	Maximum Height	Max. Lot Coverage
Agricultural						
Preservation	80,000	200	50	50	50	25%

Note: Communities should consider a parallel amendment to the Town's subdivision regulations to ascertain and promote consistency with this zoning bylaw.

MODEL SITE PLAN APPROVAL BYLAW

(Source: Growth Management Workbook. EOCD and PVPC, 1988)
(Based upon a zoning bylaw adopted by the Town of Granby, Massachusetts)

SITE PLAN APPROVAL

10.00 Projects Requiring Site Plan Approval

10.001 No special permit or building permit shall be issued for any of the following uses:

- a. the construction or exterior alteration of a commercial structure;
- b. the construction or exterior alteration of an industrial structure;
- c. residential developments requiring approval under the Subdivision Control Law (M.G.L., Ch. 41);
- d. any other use specified in the Schedule of Use Regulations, which indicates Site Plan Approval is required.

Unless a site plan has been endorsed by the Planning Board, after consultation with other boards, including but not limited to the following: Building Inspector, Board of Health, Board of Selectmen, Conservation Commission, Highway Department, Fire Department, and Police Department. The Planning Board may waive any or all requirements of site plan review for external enlargements of less than 25% of the existing floor area.

10.01 Purpose

The purpose of site plan approval is to further the purposes of this bylaw and to ensure that new development is designed in a manner which reasonably protects visual and environmental qualities and property values of the Town, and to assure adequate drainage of surface water and safe vehicular access.

10.02 Application

10.021 Each application for Site Plan Approval shall be submitted to the Planning Board by the current owner of record, accompanied by eight (8) copies of the site plan. The Planning Board shall, within five (5) days transmit one copy each to the Building Inspector, Board of Health, Conservation Commission, Board of Selectmen, Highway Department, Fire Department, and Police Department.

10.022 The Planning Board shall obtain with each submission, a deposit sufficient to cover any expenses connected with a public hearing and review of plans, including the costs of any engineering or planning consultant services necessary for review purposes.

10.03 Required Site Plan Contents

10.031 All site plans shall be prepared by a registered architect, landscape architect, or professional engineer unless this requirement is waived by the Planning Board because of unusually simple circumstances. All site plans shall be on standard 24" x 36" sheets and shall be prepared at a sufficient scale to show:

- a. The location and boundaries of the lot, adjacent streets or ways, and the location and the owner's names of all adjacent properties.
- b. Existing and proposed topography, including contours, the location of wetlands, streams, waterbodies, drainage swales, areas subject to flooding, and unique natural land features.
- c. Existing and proposed structures, including dimensions and elevations.
- d. The location of parking and loading areas, driveways, walkways, and access and egress points.
- e. The location and description of all proposed septic systems, water supply, storm drainage systems, utilities, and refuse and other waste disposal methods.
- f. Proposed landscape features including the location and a description of screening, fencing, and plantings.



- g. The location, dimensions, height, and characteristics of proposed signs.
- h. The location and a description of proposed open space or recreation areas.

10.032 The Planning Board may waive any information requirement it judges to be unnecessary to the review of a particular plan.

10.04 Procedures for Site Plan Review

10.041 The Planning Board shall refer copies of the application within 15 days to the Conservation Commission, Board of Health, and Building Inspector, who shall review the application and submit their recommendations and comments to the Planning Board. Failure of the Boards to make recommendations within 35 days of the referral of the application shall be deemed to be lack of opposition.

10.042 The Planning Board shall hold a public hearing within sixty-five (65) days of the receipt of an application and after due consideration of the recommendations of the Board shall take final action within 90 days from the time of hearing.

10.043 The period of review for a special permit requiring site plan approval shall be the same as any other special permit and shall conform to the requirements of Chapter 40A, Sec. 9, "Special Permits." Specifically, a joint public hearing to address the Special Permit application and Site Plan Approval application shall be held within sixty-five (65) days of the filing of a special permit application with the Planning Board or Board of Appeals. The Planning Board shall then have 90 days following the public hearing in which to act.

10.05 Site Plan Review Criteria

10.051 The following criteria shall be considered by the aforementioned Boards in the review and evaluation of a site plan, consistent with a reasonable use of the site for the purposes permitted or permissible by the regulations of the district in which it is located:

- a. If the proposal requires a special permit, it must conform to the special permit requirements as listed in Section ___ of this bylaw.
- b. The development shall be integrated into the existing terrain and surrounding landscape, and shall be designed to protect abutting properties and community amenities. Building sites shall, to the extent feasible: a) minimize use of wetlands, steep slopes, floodplains, hilltops; b) minimize obstruction of scenic views from publicly accessible locations; c) preserve unique natural or historical features; d) minimize tree, vegetation and soil removal and grade changes, e) maximize open space retention; and f) screen objectionable features from neighboring properties and roadways.
- c. Architectural style to be in harmony with the prevailing character and scale of buildings in the neighborhood and the Town through the use of appropriate building materials, screening, breaks in roof and wall lines and other architectural techniques. Variation in detail, form and siting shall be used to provide visual interest and avoid monotony. Proposed buildings shall relate harmoniously to each other with adequate light, air, circulation and separation between buildings.
- d. The development shall be served with adequate water supply and waste disposal systems. For structures to be served by on-site waste disposal systems, the applicant shall submit a septic system design prepared by a Certified Engineer and approved by the Board of Health.
- e. The plan shall maximize the convenience and safety of vehicular and pedestrian movement within the site and in relation to adjacent ways. The plan shall describe estimated average daily and peak hour vehicle trips to be generated by the site and traffic flow patterns for vehicles and pedestrians showing adequate access to and from the site and adequate circulation within the site.
- f. The site plan shall show adequate measures to prevent pollution of surface or groundwater, to minimize erosion and sedimentation, and to prevent changes in groundwater levels, increased run-off and potential for flooding. Drainage shall be designed so that run-off shall not be increased, groundwater recharge is maximized, and neighboring properties will not



be adversely affected.

- g. The development will not place excessive demands on Town services and infrastructure.
- h. Electric, telephone, cable TV, and other such utilities shall be underground where physically and environmentally feasible.
- i. Exposed storage areas, machinery, service areas, truck loading areas, utility buildings and structures and other unsightly uses shall be set back or screened to protect the neighbors from objectionable features.
- j. The site plan shall comply with all zoning requirements for parking, loading dimensions, environmental performance standards, and all other provisions of this bylaw.

10.052 Before approval of a site plan, the reviewing board may request the applicant to make modifications in the proposed design of the project to ensure that the above criteria are met.

10.06 Final Action

10.061 The Planning Board's final action shall consist of either:

- a. A determination that the proposed project will constitute a suitable development and is in compliance with the criteria set forth in this bylaw;
- b. A written denial of the application stating the reasons for such denial; or
- c. Approval subject to any conditions, modifications, and restrictions as the Planning Board may deem necessary.

10.07 Enforcement

10.071 The Planning Board may require the posting of a bond to assure compliance with the plan and conditions and may suspend any permit or license when work is not performed as required.

10.072 Any special permit with site plan approval issued under this section shall lapse within one (1) year if a substantial use thereof has not commenced sooner except for good cause.

10.073 The Planning Board may periodically amend or add rules and regulations relating to the procedures and administration of this section.



MODEL WATER SUPPLY PROTECTION ZONING BYLAW
(Prepared by Pioneer Valley Planning Commission, Amended 12/31/91)

Note: This bylaw has been designed to meet the requirements of the Massachusetts Department of Environmental Protection Wellhead Protection "Source Approval" Regulations 310 CMR 22.21 within designated Zone II areas. Please refer to 310 CMR 22 if your community is in the source approval process. This model provides, in some areas, more stringent protection than the DEP regulations.

WATER SUPPLY PROTECTION DISTRICT

1.0 Purpose of District

To promote the health, safety and welfare of the community by protecting and preserving the surface and groundwater resources of the Town and the region from any use of land or buildings which may reduce the quality and quantity of its water resources.

1.1 Definitions

- 1.11 Groundwater: All water found beneath the surface of the ground.
- 1.12 Watershed: Lands lying adjacent to water courses and surface water bodies which create the catchment or drainage areas of such water courses and bodies.
- 1.13 Impervious Surfaces: Materials or structures on or above the ground that do not allow precipitation to infiltrate the underlying soil.
- 1.14 Trucking Terminal: Business which services or repairs commercial trucks which are not owned by the business.
- 1.15 Hazardous Waste: A waste which is hazardous to human health or the environment. Hazardous wastes have been designated by the Regulations of the Massachusetts Hazardous Waste Management Act, Massachusetts General Laws, Chapter 21C.
- 1.16 Aquifer: Geologic formation composed of rock or sand and gravel that contains significant amounts of potentially recoverable potable water.
- 1.17 Primary Aquifer Recharge Area: Areas which are underlain by surficial geologic deposits including glaciofluvial or lacustrine stratified drift deposits or alluvium or swamp deposits, and in which the prevailing directions of groundwater flow is toward the area of influence of water supply wells.
- 1.18 Secondary Aquifer Recharge Area: Areas which are underlain by surficial geologic deposits including till or bedrock, and in which the prevailing direction of surface waterflow is toward public water supply wells or potential sites for such wells.
- 1.19 "Hazardous material": Material including but not limited to, any material, in whatever form, which, because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment, when improperly stored, treated, transported, disposed of, used, or otherwise managed. The term shall not include oil.
- 1.195 "Zone II": means that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone II shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary).



1.2 Scope of Authority

The Water Supply Protection District is an overlay district and shall be superimposed on the other districts established by this bylaw. All regulations of the Town of _____ Zoning By-law applicable to such underlying districts shall remain in effect, except that where the Water Supply Protection District imposes additional regulations, such regulations shall prevail.

Note: For systems in DEP's Source Approval process, the Water Supply Protection District must include, at a minimum, the DEP-approved Zone II. DEP also encourages, but does not require, protection of the Zone III area. 310 CMR 22.21 provides that, under certain circumstances, DEP may waive Zone II delineation requirements, if Zone III is adequately protected.

1.3 District Delineation

1.31 The Water Supply Protection District is herein established to include all lands within the Town of _____, lying within the primary and secondary recharge areas of groundwater aquifers and watershed areas of reservoirs which now or may in the future provide public water supply. The map entitled "Water Supply Protection District", Town of _____, on file with the Town Clerk, delineates the boundaries of the district.

1.32 Where the bounds delineated are in doubt or in dispute, the burden of proof shall be upon the owner(s) of the land in question to show where they should properly be located. At the request of the owner(s) the Town may engage a professional hydrogeologist to determine more accurately the location and extent of an aquifer or primary recharge area, and may charge the owner(s) for all or part of the cost of the investigation.

1.4 Permitted Uses

The following uses are permitted within the Water Supply Protection District, provided that they comply with all applicable restrictions in this bylaw, including but not limited to Section 1.5-1.8:

1.41 Single family residences;

1.42 Residential accessory uses, including garages, driveways, private roads, utility rights of way, and on-site wastewater disposal systems;

1.43 Agricultural uses such as farming, grazing and horticulture;

1.44 Forestry and nursery uses;

1.45 Outdoor recreational uses, including fishing, boating, and play areas;

1.46 Conservation of water, plants, and wildlife; wildlife management areas;

1.47 Excavation for earth removal, provided that the requirements of Section 1.6 are met, and an earth removal permit is granted by the Board of Selectmen.

1.5 Prohibited Uses

The following uses are prohibited within the Water Supply Protection District:

1.51 Business and industrial uses, not agricultural, which generate use, treat, process, store or dispose of hazardous wastes, including but not limited to metal plating, chemical manufacturing, wood preserving, furniture stripping, dry cleaning, and auto body repair, except for the following:

a) very small quantity generators of hazardous waste, as defined by 310 CMR 30.00 which generate less than 20 kilograms or 6 gallons of hazardous waste per month may be allowed by Special Permit in accordance with Section 1.9 of this bylaw;

b) household hazardous waste collection centers or events operated pursuant to 310 CMR 30.390;

c) waste oil retention facilities required by M.G.L. C.21, s.52A, and;

- d) treatment works approved by Mass. Department of Environmental Protection and designed in accordance with 314 CMR 5.00 for the treatment of contaminated ground or surface waters;

Note: The above section of the model bylaw recommends a more restrictive minimum threshold level for businesses which generate hazardous waste than does 310 CMR 22 which allows very small quantity generators which generate less than 100 kilograms (220 pounds) per month. Also, 310 CMR 22 does not specify particular industries which are prohibited, but rather relies on a broader definition of business that "generate, treat, store or dispose of hazardous waste".

- 1.52 Business or industrial uses, not agricultural, which dispose of process wastewaters on-site.

Note: The above clause is not required in DEP's source approval regulations.

- 1.53 Trucking terminals, bus terminals, car washes, motor vehicle gasoline sales, automotive service and repair shops, commercial fuel oil storage and sales;

Note: The above clause is not required in DEP's source approval regulations.

- 1.54 Solid waste landfills, dumps, auto recycling, auto graveyards, junk and salvage yards, landfilling or storage of sludge and septage, with the exception of the disposal of brush or stumps;

- 1.55 Storage of liquid petroleum products of any kind, except for the following:

- (a) Storage which is incidental to:

- (1) normal household use and outdoor maintenance or the heating of a structure;
- (2) emergency generators required by statute, rule or regulation, or;
- (3) waste oil retention facilities required by Mass. General Laws C.21, s.52A;
- (4) treatment works approved by the Mass. Department of Environmental Protection designed in accordance with 314 CMR 5.00 for the treatment of contaminated ground or surface waters;

provided that such storage shall be in a free standing, above ground container within a structure or within the basement of a structure, within a diked impermeable area sufficient to contain the volume of the tank plus 10% to prevent spills or leaks from reaching groundwater, and provided that the storage tank and piping must comply with all applicable provisions of 527 CMR 9.00 Massachusetts Board of Fire Prevention regulations.

Note: This model bylaw is more restrictive than DEP's source approval regulations which allow outside, unprotected storage tanks for liquid petroleum products other than gasoline, provided they have a direct secondary spill containment area.

- (b) Replacement of storage tanks or systems for the keeping, dispensing or storing of gasoline, which existed at the time of adoption of this bylaw, provided that:

- (1) all such replacement storage tanks or systems shall be located underground as required by Mass. Board of Fire Prevention regulation 527 CMR 14;
- (2) all such storage systems shall be protected by one of the secondary containment systems specified in Mass. Board of Fire Prevention regulation 527 CMR 9.08(3);
- (3) the head of the Fire Department may deny an application for tank replacement, or approve it subject to conditions if he or she determines that it constitutes a danger to public or private water supplies, in accordance with 527 CMR 9.26(4)(d).

Replacement of all other storage tanks for liquid petroleum products other than gasoline must be above ground, in accordance with Section 1.55 above.

Note: The model bylaw provides specific standards for replacement of existing (grandfathered) gasoline storage systems. The DEP source approval regulations do not address this issue.



- 1.56 Outdoor storage of salt, de-icing materials, pesticides or herbicides;
- 1.57 Dumping or disposal on the ground, in water bodies, or in residential septic systems of any toxic chemical, including but not limited to septic system cleaners which contain toxic chemicals such as methylene chloride and 1-1-1 trichlorethane, or other household hazardous wastes. (See list of prohibited chemicals at Board of Health or Town Clerk's office);

Note: DEP's source approval regulations do not require the above clause.

- 1.58 Stockpiling and disposal of snow or ice removed from highways and streets located outside of the Water Supply Protection District that contains sodium chloride, calcium chloride, chemically treated abrasives or other chemicals used for snow and ice removal;

Note: The DEP source approval regulations restrict stockpiling in Zone II, of snow or ice removed from outside of Zone II. This model bylaw, is consequently, somewhat more restrictive than DEP's regulations. The principal reason for this approach is that most communities do not have approved Zone II areas.

- 1.59 Individual sewage disposal systems that are designed to receive more than 110 gallons of sewage per quarter acre per day or 440 gallons of sewage per acre per day, whichever is greater, provided that:
 - (a) the replacement or repair of an existing system, which will not result in an increase in design capacity above the original design, shall be exempted;
 - (b) in calculating maximum sewage disposal system density, it shall be assumed that each residential bedroom will generate 110 gallons of sewage;
 - (c) maximum sewage disposal system density may be calculated either:
 - (1) on an individual per lot basis (i.e., a 3-bedroom home generates 330 gallons of sewage per day requiring a 3/4 acre minimum lot area, or;
 - (2) on a net density basis for an entire development, which includes individual lots and common open space of varying size (i.e., a cluster development of eight 3-bedroom homes generates 2,640 gallons of sewage per day requiring a minimum total parcel area of 6 acres including lots and common open space).
 - (d) In addition to meeting the standards above, all lots shall conform to any applicable minimum lot size requirements contained in this Zoning Bylaw.

Note: This section is required by DEP regulations and is essentially the equivalent of a 3/4 acre minimum lot size for a typical 3-bedroom home.

- 1.595 Wastewater treatment works subject to 314 CMR 5.00 (those treatment works which discharge over 15,000 gallons per day to the ground), except the following:
 - a. the replacement or repair of an existing system(s) that will not result in a design capacity greater than the design capacity of the existing system(s);
 - b. the replacement of an existing subsurface sewage disposal system(s) with wastewater treatment works that will not result in a design capacity greater than the design capacity of the existing system(s), and;
 - c. treatment works designed for the treatment of contaminated ground or surface waters subject to 314 CMR 5.00.

1.6 Restricted Uses

The following are restricted in the Water Supply Protection District:

- 1.61 Excavation for removal of earth, loam, sand, gravel and other soils or mineral substances shall not extend closer than five (5) feet above the historical high groundwater table (as determined from on-site monitoring wells and historical water table fluctuation data compiled by the United States Geological survey, whichever is higher). A monitoring well shall be installed by the property owner to verify groundwater elevations. This section shall not apply to excavations incidental to permitted



uses, including but not limited to providing for the installation or maintenance of structural foundations, freshwater ponds, utility conduits or on-site sewage disposal.

Note: DEP's source approval regulations sets the limit for excavation at four feet. PVPC's model bylaw limit of five feet is based on the recommendation of hydrogeologic studies completed for area communities.

- a. Access road(s) to extractive operation sites shall include a gate or other secure mechanism to restrict public access to the site.
 - b. Upon completion of earth removal operations, all altered areas shall be restored with topsoil and vegetative plantings suitable to control erosion on the site. All fine materials, such as clays and silts, removed as part of the earth removal operation and leftover as by-products, shall be disposed of off-site to prevent damage to aquifer recharge characteristics.
- 1.62 Sodium chloride for ice control shall be used at the minimum salt to sand ratio which is consistent with the public highway safety requirements, and its use shall be eliminated on roads which may be closed to the public in winter.
- 1.63 The storage of sodium chloride, calcium chloride, chemically treated abrasives or other chemicals used for the removal of ice and snow on roads shall be covered and located on a paved surface with berms, or within a structure designed to prevent the generation and escape of contaminated run-off.
- 1.64 Fertilizers, pesticides, herbicides, lawn care chemicals, or other leachable materials shall be used in accordance with the Lawn Care Regulations of the Massachusetts Pesticide Board, 333 CMR 10.03 (30, 31), as amended, with manufacturer's label instructions and all other necessary precautions to minimize adverse impacts on surface and groundwater.
- 1.65 In cases where soil percolation rates are faster than two minutes per inch, additional measures such as appropriate fill materials, may be imposed by the Board of Health to slow the percolation rate for on-site sewage disposal systems, (See Board of Health Regulations).

Note: Concurrent regulations should be adopted by the Board of Health.

- 1.66 The storage of commercial fertilizers and soil conditioners shall be within structures designed to prevent the generation and escape of contaminated run-off or leachate.
- 1.67 To the extent feasible, all new permanent animal manure storage areas shall be covered and/or contained to prevent the generation and escape of contaminated run-off or leachate.
- 1.68 All liquid hazardous materials, as defined in M.G.L. Chapter 21E, must be stored either in a free standing container within a building, or in a free standing container above ground level with protection to contain a spill the size of the container's total storage capacity.
- 1.7 Drainage
- 1.71 For commercial and industrial uses, to the extent feasible, run-off from impervious surfaces shall be recharged on the site by being diverted toward areas covered with vegetation for surface infiltration. Such run-off shall not be discharged directly to rivers, streams or other surface water bodies. Dry wells shall be used only where other methods are infeasible, and shall be preceded by oil, grease and sediment traps to facilitate removal of contamination. All recharge areas shall be permanently maintained in full working order by the owner(s).
- 1.8 Area Regulations
- 1.81 Within the primary aquifer recharge area the minimum allowable lot size shall be 40,000 square feet in areas not served by municipal sewerage systems.

Note: The above regulation is not required by DEP's source approval regulations. The establishment of a minimum lot size for water supply areas should be based upon careful consideration of soils and surficial geology in the district. See the "Planner's Handbook" for additional information on this subject.

1.9 Special Permit Uses

- 1.91 Uses Allowed by Special Permit



The following uses may be allowed by Special Permit obtained from the Planning Board:

- a. Commercial, industrial, governmental or educational uses which are allowed in the underlying district, and which are not prohibited in Section 1.5;
- b. Any enlargement, intensification, alteration, or change of use of an existing commercial or industrial use;
- c. The rendering impervious of more than 15%, or 2,500 square feet of any lot, provided that a system for artificial recharge of precipitation to groundwater is developed, which shall not result in degradation of groundwater (see Section 1.71).

1.92 Requirements for Special Permit in the Water Supply Protection District

The applicant shall file six (6) copies of a site plan prepared by a qualified professional with the Special Permit Granting Authority. The site plan shall at a minimum include the following information where pertinent.

- a. A complete list of chemicals, pesticides, fuels and other potentially hazardous materials to be used or stored on the premises in quantities greater than those associated with normal household use.
- b. Those business using or storing such hazardous materials shall file a hazardous materials management plan with the Planning Board. Hazardous Materials Coordinator, Fire Chief, and Board of Health which shall include:
 1. Provisions to protect against the discharge of hazardous materials or wastes to the environment due to spillage, accidental damage, corrosion, leakage or vandalism, including spill containment and clean-up procedures.
 2. Provisions for indoor, secured storage of hazardous materials and wastes with impervious floor surfaces.
 3. Evidence of compliance with the Regulations of Massachusetts Hazardous Waste Management Act 310 CMR 30, including obtaining an EPA identification number from the Mass. Department of Environmental Protection.
- c. Drainage recharge features and provisions to prevent loss of recharge.
- d. Provisions to control soil erosion and sedimentation, soil compaction, and to prevent seepage from sewer pipes.

1.93 Additional Procedures for Special Permit in the Water Supply Protection District:

- a. The Special Permit Granting Authority shall follow all special permit procedures contained in Section ___ of this By-law. In addition the Special Permit Granting Authority shall distribute copies of all application materials to the Board of Health, the Conservation Commission, and the Water Commissioners, each of which shall review the application, and following a vote, shall submit recommendations and comments to the Special Permit Granting Authority. Failure of boards to make recommendations within 35 days of distribution of the applications shall be deemed to be lack of opposition. One copy of the application materials shall be transmitted to or retained by the Town Clerk for viewing by the public during office hours.
- b. The Special Permit Granting Authority may grant the required special permit only upon finding that the proposed use meets the following standards and those specified in Section ___ of this bylaw. The proposed use must:
 - (1) in no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the Water Supply Protection District, and;
 - (2) be designed to avoid substantial disturbance of the soils, topography, drainage, vegetation and other water-related natural characteristics of the site to be developed.

- c. The Special Permit Granting Authority shall not grant a special permit under this section unless the petitioner's application materials include, in the Board's opinion, sufficiently detailed, definite and credible information to support positive findings in relation to the standards given in this section.

1.95 Non-conforming Use

Non-conforming uses which were lawfully existing, begun or in receipt of a building or special permit prior to the first publication of notice of public hearing for this bylaw may be continued. Such non-conforming uses may be extended or altered, as specified in M.G.L. Ch. 40a, Sec. 6, provided that there is a finding by the Planning Board that such change does not increase the danger of surface or groundwater pollution from such use.

Note: The provisions of Section 1.9, above, are not required in DEP's source approval regulations, except for Section 1.91(c) which is a DEP requirement.

MODEL BYLAW/ORDINANCE GROUNDWATER PROTECTION DISTRICT

(This bylaw has been designed to conform to the minimum local control standards specified by the Department of Environmental Protection in 310 CMR 22.21(2).)

Acknowledgements: This model bylaw/ordinance was prepared by an ad-hoc committee convened and directed by the Massachusetts Water Resources Authority. Members include Tara Gallagher from the Department of Environmental Protection, Martin Pillsbury from the Metropolitan Area Planning Council, Alexandra Dawson from the Water Supply Citizens Advisory Committee, Jonathan Yeo and Fred Brandon from the Massachusetts Water Resources Authority, and Philip Chernin of Camp Dresser & McKee Inc. Kim Smith, a MWRA intern, also assisted in the project. The committee's purpose in creating this document is to provide a generic example of bylaw/ordinance language which can be modified and adopted by Massachusetts communities as an internal component of a local water supply protection program. The state Attorney General's office has reviewed this model bylaw and concluded that it does not appear to be inconsistent with state law. This Attorney General's office review does not mean that a community's bylaw that is based on this model will automatically be approved by the Attorney General's office.

1. PURPOSE OF DISTRICT

The purpose of this Groundwater Protection District is:

- a. to promote the health, safety, and general welfare of the community by ensuring an adequate quality and quantity of drinking water for the residents, institutions, and businesses of the (Town)(City) of _____;
- b. to preserve and protect existing and potential sources of drinking water supplies;
- c. to conserve the natural resources of the (town)(city); and
- d. to prevent temporary and permanent contamination of the environment.

2. SCOPE OF AUTHORITY

The Groundwater Protection District is an overlay district superimposed on the zoning districts. This overlay district shall apply to all new construction, reconstruction, or expansion of existing buildings and new or expanded uses. Applicable activities or uses which fall within the Groundwater Protection District must comply with the requirements of this district as well as with the underlying zoning. Uses that are prohibited in the underlying zoning districts shall not be permitted in the Groundwater Protection District.

3. DEFINITIONS

For the purposes of this section, the following words and phrases shall have the following meanings:

Aquifer:	Geologic formation composed of rock, sand, or gravel that contains significant amounts of potentially recoverable water.
Groundwater Protection District: ¹	The zoning district defined to overlay other zoning districts in the (Town)(City) of _____. The groundwater protection district may include specifically designated recharge areas.

¹. The Massachusetts Dept. of Environmental Protection (DEP) defines two specific types of recharge areas - Zone II and Zone III to which certain regulations may apply (See Section 6B). If these zones are a part of the District, and have been approved by DEP, the following definitions should be included:

Zone II: The area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield with no recharge from precipitation), as defined in 310 Code of Massachusetts Regulations (CMR) 22.00.

Zone III: The land area beyond the area of Zone II from which surface water and groundwater drain into Zone II, as defined in 310 CMR 22.00.

Impervious Surface:	Material or structure on, above, or below the ground that does not allow precipitation or surface water to penetrate directly into the soil.
Mining:	The removal or relocation of geologic materials such as topsoil, sand, gravel, metallic ores, or bedrock.
Recharge Areas: ¹	Areas that collect precipitation or surface water and carry it to aquifers. Recharge areas may include areas designated as Zone 1, Zone II, or Zone III.
Toxic or Hazardous Material:	Any substance or mixture of physical, chemical, or infectious characteristics posing a significant, actual or potential hazard to water supplies or other hazards to human health if such substance or mixture were discharge to land or water of the (Town)(City) of _____. Toxic or hazardous materials include, without limitation, synthetic organic chemicals, petroleum products, heavy metals, radioactive or infectious wastes, acids and alkalis, and all substances defined as Toxic or Hazardous under Massachusetts General Laws (M.G.L.) Chapter 21C and 21E and 310 CMR 30.00, and also include such products as solvents and thinners in quantities greater than normal household use.

4. ESTABLISHMENT AND DELINEATION OF GROUNDWATER PROTECTION DISTRICT

For the purposes of this district, there are hereby established within the (town)(city) certain groundwater protection areas, consisting of aquifers or recharge areas which are delineated on a map. This map is at a scale of 1 inch to _____ feet and is entitled "Groundwater Protection District, (Town)(City) of _____," dated _____. This map is hereby made a part of the (town)(city) zoning (bylaw) (ordinances) and is on file in the Office of the (Town)(City) Clerk.

5. DISTRICT BOUNDARY DISPUTES

If the location of the District boundary in relation to a particular parcel is in doubt, resolution of boundary disputes shall be through a Special Permit application to the Special Permit Granting Authority (SPGA). Any application for a special permit for this purpose shall be accompanied by adequate documentation.

The burden of proof shall be upon the owner(s) of the land in question to show where the bounds should properly be located. At the request of the owner(s), the (town)(city) may engage² a professional engineer (civil or sanitary), hydrologist, geologist, or soil scientist to determine more accurately the boundaries of the district³ with respect to individual parcels of land, and may charge the owner(s) for all or part of the cost of the investigation.

6. USE REGULATION

In the Groundwater Protection District the following regulations shall apply:

A. Permitted Uses

The following uses are permitted within the Groundwater Protection District, provided that all necessary permits, orders, or approvals required by local, state, or federal law are also obtained:

- i. conservation of soil, water, plants, and wildlife;
- ii. outdoor recreation, nature study, boating, fishing, and hunting where otherwise legally permitted;
- iii. foot, bicycle and/or horse paths, and bridges;
- iv. normal operation and maintenance of existing water bodies and dams, splash boards, and other water control, supply and conservation devices;

². It may be desirable to specify the professional requirements for the people permitted to redefine districts boundaries under this paragraph. For example, a land surveyor, registered with the state of Massachusetts, may be acceptable for the definition of watershed it, but not recharge area boundaries.

³. For disputes which may arise related to Zone II areas, (if included in the District) the following provision would be appropriate: The determination of the location and extent of Zone II shall be in conformance with the criteria set forth in 310 CMR 22.00 and in the DEP's Guidelines and Policies for Public Water Systems.



- v. maintenance, repair, and enlargement of any existing structure, subject to Section B (prohibited uses) and Section C (special permitted uses);
- vi. residential development, subject to Section B (prohibited uses) and Section C (special permitted uses);
- vii. farming, gardening, nursery, conservation, forestry, harvesting, and grazing, subject to Section B (prohibited uses) and Section C (special permitted uses);
- viii. construction, maintenance, repair, and enlargement of drinking water supply related facilities such as, but not limited to, wells, pipelines, aqueducts, and tunnels. Underground storage tanks related to these activities are not categorically permitted.

B. Prohibited Uses

The following uses are prohibited.^{4,5}

- i.⁶ landfills and open dumps as defined in 310 CMR 19.006;
- ii.⁷ storage of liquid petroleum products, except the following:
 - a. normal household use, outdoor maintenance, and heating of a structure;
 - b. waste oil retention facilities required by statute, rule, or regulation;
 - c. emergency generators required by statute, rule, or regulation;
 - d. treatment works approved under 314 CMR 5.00 for treatment of ground or surface waters;

provided that storage, listed in items a. through d. above, is in free-standing containers within buildings or above ground with secondary containment adequate to contain a spill the size of the container's total storage capacity.
- iii.⁷ landfilling or sludge or septage as defined in 310 CMR 32.05;
- iv.⁷ storage of sludge and septage, unless such storage is in compliance with 310 CMR 32.30 and 310 CMR 32.31;
- v.^{8,9} individual sewage disposal systems that are designed in accordance with 310 CMR 15.00 to receive more than 110 gallons of sewage per quarter acre under one ownership per day, or 440 gallons of sewage on any one acre under one ownership per day, whichever is greater, except the replacement or repair of an existing system that will not result in an increase in design capacity above the original design;

⁴. The boundary of the district to which these prohibitions apply should be specifically indicated. DEP requirements (310 CMR 22.21) apply to Zone II areas only.

⁵. Federal and State agencies, and counties are not subject to local zoning regulations. This is a long established principle, recently reinforced by decisions of the Mass. Supreme Judicial Court (SJC). In its zoning enabling act and amendments, the state has never delegated the power to regulate activities on state properties, or the properties of its political subdivisions.

⁶. It may be the preference of counsel to include an "as of effective date" clause in relation to all prohibitions which reference state or federal statutes.

⁷. This could be supplemented through a Board of Health Regulation or other non-zoning bylaw/ordinances.

⁸. This may be best prohibited through a Board of Health Regulation or other non-zoning bylaw/ordinance.

⁹. Another way to meet this DEP requirement and protect supply wells from excessive nitrogen concentrations is to conduct a nitrogen loading analysis within each Zone II. New development within Zone IIs will be allowed only if it will not cause the planning goal of 5 mg/l nitrate to be exceeded. DEP must approve the nitrogen loading methodology for wells subject to 310 CMR 22.21(2).

- vi.^{7,10} storage of deicing chemicals unless such storage, including loading areas, is within a structure designed to prevent the generation and escape of contaminated runoff or leachate;
- vii. storage of animal manure unless covered or contained;
- viii.¹¹ earth removal, consisting of the removal of soil, loam, sand, gravel, or any other earth material (including mining activities) to within 6 feet of historical high groundwater as determined from monitoring wells and historical water table fluctuation data compiled by the United States Geological Survey, except for excavations for building foundations, roads or utility works;
- ix.^{7,12} facilities that generate, treat, store, or dispose of hazardous waste subject to M.G.L. 21C and 310 CMR 30.00, except the following:
 - a. very small quantity generators as defined under 310 CMR 30.00;
 - b. household hazardous waste collection centers and events under 310 CMR 30.390;
 - c. waste oil retention facilities required by M.G.L. C21, s. 52A;
 - d. water remediation treatment works approved under 314 CMR 5.00;
- x. automobile graveyards and junkyards, as defined in M.G.L. c. 140B, s.1;
- xi. treatment works that are subject to 314 CMR 5.00 including privately owned sewage treatment facilities, except the following:
 - a. the replacement or repair of an existing treatment works that will not result in a design capacity greater than the design capacity of the existing treatment works;
 - b. the replacement of existing subsurface sewage disposal system(s) with wastewater treatment works that will not result in a design capacity greater than the design capacity of the existing system(s);
 - c. treatment works approved by the Massachusetts Department Environmental Protection designed for the treatment of contaminated groundwater;
- xii. storage of liquid hazardous materials, as defined in M.G.L. c. 21E, unless in a free standing container within building or above ground with secondary containment adequate to contain a spill the size of the container's total storage capacity;
- xiii.^{7,13} industrial and commercial uses in which discharge process wastewater on-site;
- xiv. stockpiling and disposal of snow and ice containing deicing chemicals if brought in from outside the district;
- xv. storage of commercial fertilizers and soil conditions, as defined in M.G.L., c. 128, s. 64, unless such storage is within a structure designated to prevent the generation and escape of contaminated runoff or leachate;
- xvi.^{8,13} the use of septic system cleaners which contain toxic or hazardous chemicals.

¹⁰. Uncovered storage of salt in water supply areas is forbidden by M.G.L. Ch. 85 S.7A.

¹¹. All towns and cities should have earth removal regulations to restrict new and existing earth removal activities. The 6 foot buffer above the high groundwater is more restrictive than the 4 feet required by DEP for new source approval under 310 CMR 22.21.

¹². Includes most vehicular maintenance facilities, dry cleaners, print and photo processing operations as well as many industrial uses.

See however M.G.L. Ch. 40A, Section 9 and Chapter 21D, S.21.

¹³. Provision not required for new source approval under 310 CMR 22.21.

C. Uses and Activities Requiring a Special Permit

The following uses and activities are permitted only upon the issuance of a Special Permit by the Special Permit Granting Authority¹⁴ (SPGA) under such conditions as they may require:

- i.^{13,15} enlargement or alteration of existing uses that do not conform to the Groundwater Protection District;
- ii.^{13,16} the application of pesticides, including herbicide, insecticides, fungicides, and rodenticides, for non-domestic or non-agricultural uses in accordance with state and federal standards. The special permit shall be granted if such standards are met. If applicable, the applicant should provide documentation of compliance with a Yearly Operating Plan (YOP) for vegetation management operations under 333 CMR 11.00 or a Department of Food and Agriculture approved Pesticide Management Plan or Integrated Pest Management (IPM) program under 333 CMR 12.00;
- iii.¹³ the application of fertilizers for non-domestic or non-agricultural uses. Such applications shall be made in a manner so as to minimize adverse impacts on groundwater due to nutrient transport, deposition, and sedimentation;
- iv.¹³ those activities that involve the handling of toxic or hazardous materials in quantities greater than those associated with normal household use, permitted in the underlying zoning (except as prohibited under Section B). Such activities shall require a special permit to prevent contamination of groundwater;
- v.¹³ the construction of dams or other water control devices, ponds, pools or other changes in waterbodies or courses, created for swimming, fishing, or other recreational uses, agricultural uses, or drainage improvements. Such activities shall not adversely affect water quality or quantity;
- vi. any use that will render impervious more than 15% or 2,500 square feet of any lot, whichever is greater. A system for groundwater recharge must be provided which does not degrade groundwater quality. For non-residential uses, recharge shall be by stormwater infiltration basins or similar system covered with natural vegetation, and dry wells shall be used only where other methods are infeasible. For all non-residential uses, all such basins and wells shall be preceded by oil, grease, and sediment traps to facilitate removal of contamination. Any and all recharge areas shall be permanently maintained in full working order by the owner.

¹⁴. This model bylaw/ordinance identifies, in Section 6C, a series of standard governed uses/activities and conditions for a special permit. A town or city may want to identify additional or more specific governed uses/activities or conditions that are especially relevant to its own situation. None of the special permit requirements are mandated by 310 CMR 22.21 except C.vi.

¹⁵. Local conditions will affect how extensive this and similar provisions may become. If there are many industrial and commercial uses in Groundwater Protection District, and their expansion is probable, specific conditions should be included in the (bylaw) (ordinance).

¹⁶. The use of herbicides and pesticides is regulated by the Massachusetts Department of Food and Agriculture. Regulations (333 CMR 11.00 and 12.00) that became effective in January, 1992, impose strict requirements on the application of specific pesticides and herbicides in Zone II areas and will require the use of alternative forms of pest management.

7. PROCEDURES FOR ISSUANCE OF SPECIAL PERMIT

- A. The Special Permit Granting Authority (SPGA)¹⁷ under this bylaw shall be the _____. Such special permit shall be granted if the SPGA determines, in conjunction with the Board of Health, the Conservation Commission, (Town) (City) Engineer/Department of Public Works, and Planning Board that the intent of this bylaw, as well as its specific criteria, are met. The SPGA shall not grant a special permit under this section unless the petitioner's application materials include, in SPGA's opinion, sufficiently detailed, definite, and credible information to support positive findings in relation to the standards given in this section. The SPGA shall document the basis for any departures from the recommendation of the other (town)(city) boards or agencies in its decision.
- B. Upon receipt of the special permit application, the SPGA shall transmit one copy to the Planning Board, Board of Health, the Conservation Commission, and (Town)(City) Engineer/Department of Public Works for their written recommendations.¹⁷ Failure to respond in writing within 35 days of receipt by the Board shall indicate approval or no desire to comment by said agency. The necessary number of copies of the application shall be furnished by the applicant.
- C. The SPGA may grant the required special permit only upon finding that the proposed use meets the following standards, those specified in Section 6 of this bylaw, and any regulations or guidelines adopted by the SPGA. The proposed use must:
1. in no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the Groundwater Protection District, and
 2. be designed to avoid substantial disturbance of the soils, topography, drainage, vegetation, and other water-related natural characteristics of the site to be developed.
- D. The SPGA may adopt regulations to govern design features of projects. Such regulations shall be consistent with subdivision regulations adopted by the municipality.¹⁸
- E. The applicant shall file ____ copies of a site plan and attachments. The site plan shall be drawn at proper scale as determined by the SPGA and be stamped by a professional engineer. All additional submittals shall be prepared by qualified professionals. The site plan and its attachments shall at a minimum include the following information where pertinent:
1. a complete list of chemicals, pesticides, herbicides, fertilizers, fuels, and other potentially hazardous materials to be used or stored on the premises in quantities greater than those associated with normal household use;
 2. for those activities using or storing such hazardous materials, a hazardous materials management plan shall be prepared and filed with the Hazardous Materials Coordinator, Fire Chief, and Board of Health. The plan shall include:
 - a. provisions to protect against discharge of hazardous materials or wastes to the environment due to spillage, accidental damage, corrosion, leakage, or vandalism, including spill containment and clean-up procedures.
 - b. provisions for indoor, secured storage of hazardous materials and wastes with impervious floor surfaces;
 - c. evidence of compliance with the Regulations of the Massachusetts Hazardous Waste Management Act 310 CMR 30.00, including obtaining an EPA identification number from the Massachusetts Department of Environmental Protection.

¹⁷. M.G.L. Ch. 40A, Section 9 specifies that the SPGA must be one of the following: Board of Selectmen; Board of Appeals; or Planning Board. Applications should be routed to and reviewed by all town or city boards, department and commissions having an interest in or responsibility for review and approval of actions taken by the applicant.

¹⁸. The SPGA is encouraged to adopt regulations to administer this (bylaw) (ordinance). The SPGA should consider including performance and/or design standards in such regulations. This may mean changing other regulations such as those for subdivisions.

3. proposed down-gradient location(s) for groundwater monitoring well(s) should the SPGA deem the activity a potential groundwater threat.

F. The SPGA shall hold a hearing in conformity with the provision of the M.G.L. ch. 40A, s.9, within 65 days after the filing of the application and after the review by the (Town)(City) Boards, Departments and Commissions.

Notice of the public hearing shall be given by publication and posting and by first-class mailings to "parties of interest" as defined in M.G.L. ch. 40A, s.11. The decision of the SPGA and any extension, modification, or renewal thereof shall be filed with the SPGA and (Town)(City) Clerk within 90 days following the closing of the public hearing. Failure of the SPGA to act within 90 days shall be deemed as a granting of the permit. However, no work shall commence until a certification is recorded as required by said s.11.

G. Written notice of any violations of this (Section)(Article)(Ordinance) shall be given by the (Code Enforcement Officer)(Building Inspector) to the responsible person as soon as possible after detection of a violation or a continuing violation. Notice to the assessed owner of the property shall be deemed notice to the responsible person. Such notice shall specify the requirement or restriction violated and the nature of the violation, and may also identify the actions necessary to remove or remedy the violations and preventive measures required for avoiding future violations and a schedule of compliance. A copy of such notice shall be submitted to the Building Inspector, the Board of Health, Conservation Commission, (Town)(City) Engineer/Department of Public Works, and Water Department. The cost of containment, clean-up, or other action of compliance shall be borne by the owner and operator of the premises.

For situations that require remedial action to prevent adverse impact to the water resources within the Groundwater Protection District, the (Town)(City) of _____, the Building Inspector, the Board of Health, or any of their agents may order the owner or operator of the premises to remedy the violation. If said owner and/or operator does not comply with said order, the (Town)(City) of _____, the Building Inspector, the Board of Health, or any of their agents, if authorized to enter upon such premises under the terms of the special permit or otherwise, may act to remedy the violation. The remediation costs shall be the responsibility of the owner and operator of the premises.

8. SEVERABILITY

A determination that any portion or provision of this overlay protection district is invalid shall not invalidate any other portion or provision thereof, nor shall it invalidate any special permit previously issued thereunder.

MODEL FLOODPLAIN MANAGEMENT ZONING BYLAW
(Source: Growth Management Workbook, EOCD and PVPC, 1988)
(Based upon a zoning bylaw adopted by the Town of Granby, Massachusetts)

FLOODPLAIN DISTRICT

2.0 Purpose

The purpose of the Floodplain District are:

- a. To provide that lands in the Town of _____ subject to seasonal or periodic flooding as described hereinafter shall not be used for residence or other purposes in such manner as to endanger the health or safety of the occupants thereof.
- b. To protect, preserve, and maintain the water table and water recharge areas within the Town so as to preserve present and potential water supplies for the public health and safety of the Town of _____.
- c. To assure the continuation of the natural flow pattern of the water course(s) within the Town of _____ in order to provide adequate and safe floodwater storage capacity to protect persons and property against the hazards of flood inundation.

2.01 Scope of Authority

The Floodplain District is an overlay district and shall be superimposed on the other districts established by this bylaw. All regulations on the (town) Zoning Bylaw applicable to such underlying districts shall remain in effect, except that where the Floodplain District imposes additional regulations, such regulations shall prevail.

2.02 District Delineation

- a. The Floodplain District is defined as all lands designated as Zone A or Zones A 1-30 on the Town of _____ Flood Insurance Rate Maps (FIRM), panels (panel numbers), effective date (date).
- b. The floodway boundaries are delineated on the (town) Flood Boundary and Floodway Map (FBFM) dated (town).
- c. The FIRM and FBFM maps are incorporated herein by reference and are on file with the Town Clerk.

2.03 Permitted Uses

In the Floodplain District no new building shall be erected or constructed, and no existing structure shall be altered, enlarged or moved; no dumping, filling or earth transfer or relocation shall be permitted; nor shall any land, building or structure be used for any purposes except:

- a. Outdoor recreation, including play areas, nature study, boating, fishing and hunting where otherwise legally permitted, but excluding buildings and structures.
- b. Wildlife management or conservation areas, foot, bicycle, and/or horse paths and bridges, provided such uses do not affect the natural flow pattern on any water course.
- c. Grazing and farming, including truck gardening and harvesting of crops.
- d. Forestry and nurseries.
- e. Dwellings lawfully existing prior to the enactment of this bylaw.

2.04 Uses by Special Permit

- 2.041 No structure or building shall be erected, constructed, substantially improved over 50 percent of assessed market value or otherwise created or moved; no earth or other materials dumped, filled, excavated, or transferred, unless a special permit is granted by the Zoning Board of Appeals.
- 2.042 The following uses may be allowed by Special Permit from the Zoning Board of Appeals in accordance with the Special Permit regulations of this bylaw, and additional restrictions and criteria contained herein:



- a. Single family detached dwelling
- b. Commercial golf course, recreation, or camp facility
- c. Commercial landing strip or heliport

2.043 The following additional requirements apply in the Floodplain District:

- a. Within Zone A or Zones A 30, where base flood elevation is not provided on the FIRM or FBFM, the applicant shall obtain any existing base flood elevation data. These data will be reviewed by the Building Inspector for their reasonable utilization toward meeting the elevation or floodproofing requirements, as appropriate, of the State Building Code.

2.044 The following provisions apply in the Floodplain designated on the FBFM:

- a. Within the Floodway designated on the FBFM, no encroachments (including fill, new construction, substantial improvements to existing structures, or other development) shall be allowed unless it is demonstrated by the applicant that the proposed development, as a result of compensating actions, will not result in any increase in flood levels with the Town during the occurrence of a 100-year flood in accordance with the Federal Emergency Management Agency's regulations for the National Flood Insurance Program.
- b. Any encroachment in the Floodway meeting the above standard must also comply with the floodplain requirements of the State Building Code.

2.05 Additional Special Permit Criteria

In addition to the Special Permit criteria specified in (bylaw section), the Zoning Board of Appeals may grant a Special Permit if it finds:

- a. The proposed use will not create increased flood hazards which shall be detrimental to the public health, safety and welfare.
- b. The proposed use will comply in all respects to the provisions of the underlying District or Districts within which land is located.
- c. The proposed is in compliance with all applicable state and federal laws, including the Massachusetts Building Code and the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, Sec. 40).

2.06 Prohibited Uses

The following uses are specifically prohibited and may not be allowed by special permit:

- a. Solid waste landfills, junkyards, and dumps.
- b. Business and industrial uses, not agricultural, which manufacture, use, process, store, or dispose of hazardous materials or wastes as a principal activity, including but not limited to metal plating, chemical manufacturing, wood preserving, furniture stripping, dry cleaning, and auto body repair.
- c. The outdoor storage of salt, other de-icing chemicals, pesticides, or herbicides shall be prohibited without suitable overhead protection from weather and an impervious containment area to hold the volume of store chemicals.
- d. Drainage, dredging, excavation, or disposal of soil or mineral substances, except as necessary for permitted uses or uses allowed by special permit, as specified in the Earth Removal Bylaw, (bylaw section).



MODEL RIVER PROTECTION ZONING BYLAW

(Source: Growth Management Workbook. EOCD and PVPC, 1988)

(Based upon a bylaw developed for Connecticut River communities by Pioneer Valley Planning Commission)

RIVER PROTECTION DISTRICT

3.00 Purposes

The purposes of the (town) River Protection District are to:

- a. Promote the preservation of the scenic qualities of the natural landscape along the River;
- b. Prevent any disruptions to the natural flow of the river;
- c. Protect fisheries and wildlife habitat within and along the river;
- d. Control erosion and siltation;
- e. Enhance and preserve existing agricultural lands, floodplains, and other environmentally sensitive areas along the shoreline;
- f. Conserve shore cover and encourage well-designed developments.

3.01 Scope of Authority

The River Protection District is an overlay district and shall be superimposed on the other districts established by this bylaw. All regulations of the (town) Zoning Bylaw applicable to such underlying districts shall remain in effect, except that where the River Protection District imposes additional regulations, such regulations shall prevail.

3.02 District Delineation

The area affected by this Bylaw shall be the portion of the River under the jurisdiction of this Town, its shores, and landward up to two hundred (200) feet from each bank (as defined by the M.G.L. Ch. 131, Sec. 40). All distances shall be measured in horizontal feet.

3.03 Permitted Uses

The following uses are permitted provided they are in conformance with the River Protection Standards in Section 3.09:

- a. Agricultural production, including raising of crops, livestock, poultry, nurseries, orchards, or hay;
- b. Recreational uses, provided there is minimal disruption of wildlife habitat;
- c. Maintenance and repair usual and necessary for continuance of an existing use;
- d. Conservation of water, plants, and wildlife, including the raising and management of wildlife;
- e. Emergency procedures necessary for safety or protection of property;
- f. Single-family residences on frontage lots not requiring approval under the Massachusetts Subdivision Control Law, M.G.L. Chapter 41.

3.04 Prohibited Uses

- 3.041 No altering, dumping, filling, removal of riverine materials or dredging is permitted. Maintenance of the river may be done under requirements of M.G.L. Ch. 131, Sec. 40, and any other applicable laws, bylaws, and regulations.
- 3.042 No clear-cutting of existing vegetation and no more than minimal disruption of wildlife habitat is permitted except in those cases where the purposes of M.G.L. Ch. 131, Sec. 40, would be adversely affected, as determined by the Conservation Commission.
- 3.043 All other uses not specifically permitted or allowed by Special Permit within the overlay zone are



prohibited.

3.05 Uses By Special Permit

3.051 Construction of one dock providing access to the river per parcel or set of contiguous parcels in common ownership shall be allowed upon issuance of a Special Permit from the Planning Board, as specified in _____ of this bylaw.

3.06 Uses By Site Plan Approval

3.061 All residential subdivisions which require approval under M.G.L. Ch. 41 shall be laid out in accordance with the cluster development standards contained in Section 3.10, and shall require site plan approval from the Planning Board, as specified in _____ of this bylaw. Each building lot and residence within a residential subdivision shall comply with Section 3.09 of this bylaw.

3.07 Additional Site Plan Approval Criteria

3.071 In addition to the Site Plan Approval Criteria contained in Section ____, the Planning Board shall also consider whether uses proposed for Site Plan Approval in the River Protection District meet the following criteria:

- a. Complies with River Protection Standards in Section 3.09 and Riverbank Cluster Development Standards in Section 3.10;
- b. Is situated on a portion of the site that will most likely conserve shoreland vegetation and the integrity of the buffer strip;
- c. Is integrated into the existing landscape through features such as vegetative buffers and through retention of the natural shoreline;
- d. Will not result in erosion or sedimentation;
- e. Will not result in water pollution.

3.08 Site Plan Approval Procedures for Cluster Developments

3.081 In addition to the Site Plan Approval procedures contained in Section ____ the following procedures shall be followed in the ____ River Protection District:

- a. To promote better communication and to avoid misunderstanding, applicants are encouraged to submit a Preliminary Plan for review by the Planning Board prior to the application for a special permit. Such Preliminary Plans shall comply with the Town's Subdivision Control Regulation.
- b. The Planning Board granting of site plan approval hereunder shall not substitute for compliance with the Subdivision Control Act nor oblige the Planning Board to approve a related Definitive Plan for subdivision, nor reduce any time periods for Board consideration under that law. However, in order to facilitate processing, the Planning Board shall, insofar as practical under law, adopt regulations establishing procedures for submission of a combined Site Plan Approval Application and Subdivision Review Application which shall satisfy this section and the board's regulations under the Subdivision Control Act.
- c. A Site Plan Approval Application and Subdivision Review Application shall be submitted to the Planning Board. Following granting of Site Plan approval, a Definitive Plan shall be submitted to the Planning Board consistent with their Subdivision Regulations and in substantial conformity with the approved Special Permit Application and Subdivision Review Application, except where the Cluster Development does not constitute a subdivision under the Subdivision Control Law.

3.09 River Protection Standards

3.091 All land uses, including all residences developed either on frontage lots or within a cluster development, shall comply with the following standards:

- a. A buffer strip extending at least one hundred (100) feet in depth, to be measured landward from each bank of the ____ River shall be required for all lots within the River Protection District. If any lot, existing at the time of adoption of this bylaw, does not contain sufficient depth, measured landward from the river bank, to provide a one hundred foot buffer strip, the buffer strip may be reduced to 50% of the available lot depth, measured landward from the river bank.
 - 1. The buffer strip shall include trees and shall be kept in a natural or scenic condition.
 - 2. No buildings nor structures shall be erected, enlarged, altered or moved within the buffer strip.
 - 3. On-site disposal system shall be located as far from the ____ River as is feasible.
- b. All new development shall be integrated into the existing landscape on the property so as to minimize its visual impact and maintain natural beauty and environmentally sensitive shoreline areas through use of vegetative and structural screening, landscaping, grading, and placement on or into the surface of the lot.
- c. Run-off from new development shall be directed towards areas covered with vegetation for surface infiltration. Catch basins, and piped storm sewers shall be used only where other methods are infeasible.

3.10 Riverbank Cluster Development Standards

3.101 Residential subdivision developments in the ____ River Protection District shall be laid out according to the cluster development standards contained herein. Single-family detached dwellings, or lawful accessory buildings, may be constructed on lots in a cluster development, although such lots have less area on frontage than normally required in the underlying district, as herein specified.

- a. The minimum lot size for any cluster development lot shall be 20,000 square feet. The minimum frontage for such lots shall be 100 feet. All other dimensional requirements shall be the same as in the regulations for the underlying district.
- b. The maximum number of dwelling units permitted in a residential cluster development shall be calculated according to the following procedures:
 - 1. The maximum number of dwelling units permitted on a parcel of land shall be determined based upon one unit per acre for the net developable acreage remaining once the area of all wetlands and all areas unsuitable for on-site sewage disposal have been subtracted from the total acreage of the property, if appropriate.
 - 2. Under the supervision of the Conservation Commission and in accordance with the provisions of the Wetlands Protection Act, M.G.L. Ch. 131, Sec. 40, all wetlands shall be identified, and their area subtracted from the net developable acreage of the total parcel.
 - 3. Under the protection of the Board of Health, and in conformance with Title V, percolation tests shall be conducted for all lots in the total acreage of the property which would be developed in a standard subdivision layout. The area of those lots which is determined to be not suitable for on-site sewage disposal shall be subtracted from net developable acreage of the total parcel.
- c. All buildings, roads, drainage systems and utilities shall be laid out in a manner to have the least possible impact on the scenic qualities of the river, and on important natural resources including prime farmlands, wetlands, and tributary watercourses.
- d. The required open land within a cluster shall be determined as follows:
 - 1. At least fifty (50) percent of the net acreage remaining after the area of all wetlands have been subtracted shall be retained as open land.



2. Open land shall be configured in order to protect river areas, shorelines and other important natural resource areas such as prime farmlands to the extent feasible.
 3. All open land shall be permanently protected as provided for in Section 3.11.
- e. All residential structures and accessory uses within the development shall be set back from the boundaries of the development by a buffer strip of at least fifty (50) feet in width which shall include trees and shall be kept in a natural or landscaped condition.
- f. The following standards shall apply to developments requiring on-site sewage disposal:
1. The applicant shall submit a septic system design prepared by a certified engineer and approved by the Board of Health and a plan illustrating the location of water supply wells with the special permit applications. No community septic system serving the development shall exceed sewage flow of 2,000 gallons per day. Septic systems shall be placed in the development to maximize the distance between systems and shall be placed within common areas rather than on individual lots. Maintenance of community septic systems shall be the responsibility of the homeowners' association specified in Section 3.12.
 2. No cluster development shall be approved unless the applicant can demonstrate to the satisfaction of the Planning Board that the potential for groundwater pollution is no greater from the proposed cluster development than would be expected from a conventional subdivision with single-family houses on lots meeting the normal lot size requirements located on the same parcel. Where necessary, the Planning Board may hire a Professional Engineer to analyze and certify groundwater quality impacts, and may charge the applicant for the cost of such analysis.

3.11 Common Space Ownership

3.111 All common open land shall be either:

- a. Conveyed to a community association owned or to be owned by the owners of lots within the development. If such a community association is utilized, ownership thereof shall pass with conveyances of the lots in perpetuity.
- b. Conveyed to a non-profit organization, the principal purpose of which is the conservation or preservation of open space;
- c. Conveyed to the Town, at no costs, and be accepted by it for park or open space use. Such conveyance shall be at the option of the Town and shall require the approval of the voters at a Town Meeting.

3.112 In cases where such land is not conveyed to the Town, a restriction enforceable by the Town shall be recorded to ensure that such land shall be kept in an open or natural state and not be built for residential use nor developed for accessory uses such as parking or roadways. Such restrictions shall further provide for maintenance of the common land in a manner which will ensure its suitability for its function, appearance, cleanliness, and proper maintenance of drainage, utilities and the like.

3.12 Community Association

3.121 A non-profit, incorporated community association shall be established, requiring membership of each lot owner in the open space community. The community association shall be responsible for the permanent maintenance of all community water and septic systems, common open space, recreational and thoroughfare facilities. A community association agreement of covenant shall be submitted with the special permit application guaranteeing continuing maintenance of such common maintenance expenses. Such agreement shall be subject to the review and approval of Town Counsel and the Planning Board.

3.122 Such agreements or covenants shall provide that in the event that the association fails to maintain the common open land in reasonable order and condition in accordance with the agreement, the Town may, after notice to the association and public hearing, enter upon such land and maintain it in order to preserve the taxable values of the properties with the development and to prevent the common land from becoming a public nuisance. The covenants shall also provide that the cost of



such maintenance by the Town shall be assessed ratably against the record owners of the properties within the development, their successors or assigns.

3.13 Non-Conforming Uses

- 3.131 Any lawful use, building, structures, premises, land or parts thereof existing at the effective date of this bylaw or amendments thereof and not in conformance with the provisions of this bylaw shall be considered to be a non-conforming use.
- 3.132 Any existing use or structure may continue and may be maintained, repaired, and improved but in no event made larger.
- 3.133 Any non-conforming structure which is destroyed may be rebuilt on the same location but no larger than its overall original square footage.

3.14 Hardships

- 3.141 To avoid undue hardship, nothing in this bylaw shall be deemed to require a change in design, construction, or intended use of any structure for which a building permit was legally issued prior to the effective date of this bylaw. Such construction may be completed within two years from the effective date of this bylaw, or such construction shall be required to conform to this bylaw.

MODEL SCENIC UPLAND ZONING BYLAW

(Source: Growth Management Workbook. EOCD and PVPC, 1988)
(Based upon a zoning bylaw adopted by the Town of Monson,
Massachusetts and on the Berkshire Scenic Mountains Act,
M.G.L. Chapter 131, Section 39a)

SCENIC UPLAND REVIEW

4.00 Purpose

The purposes of the Scenic Upland District are:

- a. To preserve and enhance areas in the Town of _____ of natural scenic beauty including mountain, ridges, wooded canyons, exceptional vistas or viewsheds, and related natural resources;
- b. To regulate new construction, vegetation removal, filling, or excavation of land which could adversely affect natural resources of scenic qualities;
- c. To prevent erosion, sedimentation, water pollution, flooding and other adverse impacts of development in sensitive upland areas.

4.01 Scope of Authority

The Scenic Upland District is an overlay district and shall be superimposed on the other districts established by this bylaw. All regulations of the _____ Zoning Bylaw applicable to such underlying districts shall remain in effect, except that where the Scenic Upland District imposes additional regulations, such regulations shall prevail.

4.02 District Delineation

4.021 The Scenic Upland District Bylaw shall be applied to sensitive mountain or steep slope areas of scenic and natural resource value as designated on the overlay map entitled "Scenic Upland District, Town of _____", on file with the Town Clerk.

4.022 The Scenic Upland District is intended to include those mountain or upland areas which have one or more of the following characteristics:

- a. Steep slopes greater than 15%.
- b. Unique landforms, including bedrock outcrops, till-covered hills, geological rarities, cliffs, or other unusual topographic features;
- c. Areas of high visual amenity including areas with scenic views, farmlands, streams, wetlands, waterways, and forested slopes.

4.03 Permitted Uses

- a. Agricultural production, including raising of crops, livestock, poultry, nurseries, orchards, or hay;
- b. Recreational uses, provided there is minimal disruption of wildlife habitat;
- c. Maintenance and repair usual and necessary for continuance of an existing use;
- d. Conservation of water, plants and wildlife, including the raising and management of wildlife.
- e. Uses permitted under M.G.L. Chapter 40a, Section 3 with the limitations imposed therein.

4.04 Prohibited Uses

All uses not permitted in Sections 4.03 or 4.05 shall be deemed prohibited.

4.05 Uses Permitted With Scenic Upland Review

The following uses shall be permitted subject to Scenic Upland Review of project site plans prior to the



issuance of a building permit or Special Permit or approval of a definitive plan under the Massachusetts Subdivision Control Law:

- a. Any construction or significant alteration of any dwelling or other structure, if any such action affects the exterior appearance. A significant alteration is defined as any alteration exceeding ___ percent of the existing square footage of the structure, or which adds to the height of a structure, or which substantially alters the visual profile of the property or structures thereon;
- b. Any commercial or industrial use allowed by Special Permit in the underlying district;
- c. Any subdivision which requires approval under the Massachusetts Subdivision Control Law, M.G.L., Ch. 40.

4.06 Scenic Upland Review Board

- 4.061 In accordance with the provisions of Chapter 40A of the Massachusetts General Laws, a Scenic Upland Review Board shall review applications and site plans for all actions that are subject to this bylaw, and shall make recommendations to the Building Inspector, Planning Board or Zoning Board of Appeals as described in Section 4.08 concerning the conformance of the proposed action to the design and development standards contained herein.
- 4.062 The Scenic Upland Review Board shall consist of five members, two of whom are registered architects, landscape architects, or persons with equivalent professional training, and one of whom owns property in the affected areas. Appointments to the Scenic Upland Review Board shall be made by the Board of Selectmen.
- 4.063 The terms of all members of the Scenic Upland Review Board shall be three years, except that when the Board is originally established, the Board of Selectmen shall make two of their appointments for a three-year term, two appointments for a two-year term, and the remaining appointment shall be for a one-year term.

4.07 Application Contents and Procedures

- 4.071 Applications for all actions subject to review by the Scenic Upland Review Board shall be made by completing an application form and site plan and submitting it to the Building Inspector. Application forms are available from the Office of the Building Inspector.
- 4.072 All applications to the Scenic Upland Review Board shall include all information required by the rules and regulations of the Scenic Upland Review Board, as applicable, in addition to any other information that is required under this bylaw as part of an application for a special permit variance or building permit.
- 4.073 To facilitate siting and design of buildings sensitively related to the natural setting, application for Scenic District Review of proposed development in the scenic district must be accompanied by a site plan which describes or illustrates:
- a. The location and boundaries of the lot, adjacent streets or ways, and the location and owner's names of all adjacent properties;
 - b. Existing and proposed topography including contours, the location of wetlands, streams, waterbodies, drainage swales, areas subject to flooding and unique natural land features;
 - c. Placement, height and physical characteristics of all existing and proposed buildings and structures located on the development site;
 - d. Architectural rendering illustrating design of all proposed structures;
 - e. Proposed landscape features including the location and a description of screening, fencing, and planting;
 - f. View points - Photographs of the development site taken from points along the street, together with a map indicating the distance between these points and the site;
 - g. The location of parking and loading areas, driveways, walkways, access and egress points;



- h. The location and a description of all proposed septic systems, water supply, storm drainage systems, utilities, and refuse, and other waste disposal methods;
- i. The location and a description of proposed open space or recreation areas;
- j. Measures to be undertaken during and after construction to prevent erosion, sedimentation, flooding, or water pollution.

4.08 Review Procedures

- 4.081 Upon receipt of an application for Scenic Upland Review, the Building Inspector shall immediately transmit the application to the Scenic Upland Review Board. The Scenic Upland Review shall review the application and return its recommendations in writing to the Building Inspector within thirty-five (35) days of the receipt of the application. If the application for Scenic Upland Review is associated with an application for a variance, special permit, or subdivision review, the Scenic Upland Review Board shall immediately transmit their recommendations to the Planning Board or Zoning Board of Appeals as appropriate.
- 4.082 If the Scenic Upland Review does not submit its recommendations to the Building Inspector within thirty-five (35) days, such failure to act shall constitute approval of the application.
- 4.083 The Scenic Upland Review Board's action shall be advisory and shall consist of either:
 - a. A determination that the proposed project will constitute a suitable development and is in compliance with the criteria set forth in this bylaw;
 - b. Approval subject to conditions, modifications, and restrictions as the Scenic Upland Review Board may deem necessary.
- 4.084 The applicant shall be given written notice of the public meeting at which their application will be reviewed, and shall be given an opportunity to be heard on the application.
- 4.085 The Building Inspector, Planning Board, and Zoning Board of Appeals shall, in making their permit granting decisions, give due consideration to the Scenic Upland Review Board's recommendations, and shall communicate all subsequent decisions to said Board.

4.09 Scenic District Review Criteria

- 4.091 Scenic District Review should ensure that when man-made structures are built in scenic areas, they are sensitively related to the natural setting and that special consideration has been given to their siting and design.
- 4.092 A Scenic District application may be approved where consistent with the following criteria:
 - a. Buildings, building materials, and landscaping are designed and located on the site to blend with the natural terrain and vegetation and preserve the scenic character of the site;
 - b. Where public views will unavoidably affected by the proposed use, architectural and landscaping measures have been employed so as to minimize significant degradation of the existing scenic or aesthetic qualities of the site;
 - c. Safeguards have been employed where needed to mitigate against environmental degradation from erosion, sedimentation, water pollution, or flooding.

4.10 Design and Development Standards

All applications for Scenic Upland Design Review shall comply with the following design and development standards:

4.101 Siting of Structures

- a. The placement of buildings, structures, or signs shall not detract from the site's scenic qualities or obstruct significant views, and shall blend with the natural landscape.



- b. Building sites shall be directed away from the crest of hills in order to preserve the visual integrity of the district.
- c. Developments for more than one structure shall incorporate variable setback, multiple orientations, and other site-planning techniques to avoid the appearance of a solid line of development.
- d. Foundations should be constructed to reflect the natural slope of the terrain. Excessive support members or mechanical systems should be covered or screened.

4.102 Building Materials, Colors, and Architectural Style

- a. Natural building materials which blend with the natural landscape, such as brick, stone, masonry or wood should be emphasized in the design of the exterior.
- b. Architectural style shall reflect the traditional New England character of community.
- c. In selecting exterior colors for structures, reference shall be given to "earth" colors, such as olive, ochre, sienna, gray, gray green, gray blue, etc. Warm colors may be appropriate for small accessory uses or for design details.
- d. Business or industrial uses other than restaurants, recreational uses or travel-related uses such as gasoline service stations and roadside stands are to be conducted entirely within enclosed buildings.

4.103 Landscaping and Site Preparation

- a. In landscaping, preference shall be given to native trees and plants.
- b. The removal of native vegetation or trees shall be minimized to the extent feasible in clearing sites for new structures or roads. Selective clearing of vegetation may be permitted where views may be presently obscured by such vegetation adjoining or within 200 feet of a public or private way, subject to approval of the Scenic Upland Review Board.
- c. Retaining walls may be used to create usable yard space in the side and rear yard. Retaining walls in the exposed side and downhill portions of a lot shall be screened with appropriate landscaping materials.
- d. Any grading or earth-moving operation in conjunction with a proposed development shall be planned and executed in such manner that final contours are consistent with the existing terrain both on and adjacent to the site.

4.104 Accessory Uses and Utilities

- a. Utilities shall be constructed and routed underground except in those situations where natural features prevent the underground siting or where safety considerations necessitate above-ground construction and routing. Above-ground utilities shall be constructed and routed to minimize detrimental effects on the visual setting.
- b. Potentially unsightly accessory uses such as parking lots, storage areas, equipment sheds, above-ground swimming pool, and communications towers shall be located in areas not visible from streets, or shall be screened by dense evergreen plantings or landscaped earthen berms.
- c. Antennae shall not be silhouetted against the view, preferably not mounted on roof.

4.105 Signs

- a. Signs shall be constructed and located on the site so as to, as nearly as possible, satisfy the standards in Section 4.101(a).
- b. Signs shall be of the minimum size and height necessary for identification of the business, and shall be located on the building premises.
- c. Signs shall not be internally illuminated. Signs shall be illuminated only with steady, stationary, shielded light sources directed solely onto the sign without causing glare.

4.106 Prevention of Water Pollution and Flooding

- a. Storage and/or transmission of petroleum or other refined petroleum products is prohibited except within buildings which they will heat. Petroleum products stored within a building shall be placed on a diked, impermeable surface to prevent spills or leaks from reaching groundwater.
- b. The amount of sanitary waste discharged to an on-site sewerage system shall not exceed 330 gallons per day per acre.
- c. All run-off from impervious surfaces shall be recharged on the site by being diverted to stormwater infiltration basins covered with natural vegetation. Stormwater infiltration basins must be designed to handle a 25-year storm. Dry wells shall be used only where other methods are infeasible, and shall be preceded by oil, grease, and sediment traps to facilitate removal of contamination. Any and all recharge areas shall be permanently maintained in full working order by the owner.

4.107 Prevention of Erosion and Sedimentation

- a. No area or areas totalling two (2) acres or more on any parcel or contiguous parcels in the same ownership shall have existing vegetation clear-stripped or be filled six (6) inches or more so as to destroy existing vegetation unless in conjunction with agricultural activity or unless necessarily incidental to construction on the premises under a currently valid building permit or unless within streets which are either public or designated on an approved subdivision plan or unless a special permit is approved by the Planning Board on the condition that run-off will be controlled, erosion avoided and either a constructed surface or cover vegetation will be provided not later than the first full spring season immediately following completion of the stripping operation. No stripped area or areas which are allowed by special permit shall remain through the winter without a temporary cover of winter rye or similar plant materials being provided for soil control, except in the case of agricultural activity where such temporary cover would be infeasible.
- b. Sediment and erosion control measures shall be employed to minimize such impacts during and after construction, in accordance with guidelines established by the U.S. Soil Conservation Service "Guidelines for Soil and Water Conservation in Urbanizing Areas of Massachusetts."

MODEL WETLANDS PROTECTION BYLAW

(Source: Growth Management Workbook. EOCD and PVPC, 1988)
(Based upon a bylaw adopted by the Town of Amherst, Massachusetts)

WETLAND PROTECTION BYLAW

5.00 Purpose

The purposes of this bylaw are to protect the wetlands, related water resources, and adjoining land areas in the Town of _____ by prior review and control of activities deemed by the Conservation Commission likely to have a significant or cumulative effect upon wetland values, including, but not limited to the following: public water supply, private water supply, groundwater, flood control, erosion and sedimentation control, storm damage prevention, prevention of water pollution, fisheries, wildlife, wildlife habitat, recreation, and aesthetic values; these values are to be known collectively as the "wetlands protected by this bylaw."

5.01 Jurisdiction

Except as permitted by the Conservation Commission or as provided in this bylaw, no person shall remove, fill, dredge, build upon, or alter the following resource areas:

- a. Any freshwater wetland, riverine wetlands, marsh, wet meadow, bog or swamp, or within one hundred (100) feet of said areas:
- b. Any bank or beach, or within one hundred (100) feet of said areas;
- c. Any lake, river, pond, or stream, whether intermittent or continuous, natural or man-made;
- d. Any land under aforesaid waters;
- e. Any land subject to flooding or inundation by groundwater, surface water, storm flowage, or within one hundred (100) feet of said areas;
- f. Isolated wetlands including kettle holes, or within one hundred (100) feet of said areas;
- g. Seasonal wetlands, or within one hundred (100) feet of said areas.

5.02 Exceptions

The application and permit required by this bylaw shall not be required for maintaining, repairing, or replacing, but not substantially changing or enlarging (more than 50% of structure area), an existing or lawfully located structure or facility used in the service of the public to provide electric, gas, water, telephone, telegraph or other telecommunication services, sanitary sewers and storm sewers, provided that the structure or facility is not substantially changed or enlarged, provided that written notice has been given to the Commission at least forty-eight (48) hours prior to commencement of work, and provided that the work conforms to performance standards in regulations adopted by the Commission.

The application and permit required by this bylaw shall not apply to emergency projects necessary for the protection of the health or safety of the public, provided that the work is to be performed by or has been ordered to be performed by an agency of the Commonwealth or a political subdivision thereof, provided that advance notice, oral or written, has been given to the Commission prior to commencement of work or within twenty-four (24) hours after commencement, provided that the Conservation Commission or its agent certifies the work as an emergency project, provided that the work is performed only for the time and place certified by the Conservation Commission for the limited purposes necessary to abate the emergency, and provided that within twenty-one (21) days of commencement of an emergency project a permit application shall be filed with the Commission for review as provided in this bylaw. Upon failure to meet these and other requirements of the Commission, the Commission may, after notice and public hearing, revoke or modify an emergency project approval and order restoration and mitigation measures.

The application and permit required by this bylaw shall not be required for work performed for the normal maintenance or improvement of lands in agricultural use.

The application and permit required by this bylaw shall not be required for work performed when covered by a proper notice of intent/forest cutting plan as filed under M.G.L. ch. 132, sect. 40-46. (Forest Cutting Practices Act).

5.03 Requests for Determinations and Applications for Permits

Any person desiring to know whether or not a proposed activity or an area is subject to this bylaw may request in writing a determination from the Commission. Such a request for determination shall contain data and plans specified by the regulations of the Commission.

The Commission in an appropriate case may accept as the request under this bylaw the Request for Determination of Applicability filed under the Wetlands Protection Act, G.L. Ch. 131, Sec. 40.

Written application shall be filed with the Commission to perform activities regulated by this bylaw affecting resource areas protected by this bylaw. The application shall include such information and plans as area deemed necessary by the Commission to describe proposed activities and their effects on the environment. No activities shall commence without receiving and complying with a permit issued pursuant to this bylaw.

The Commission in an appropriate case may accept as the application and plans under this bylaw the Notice of Intent and plans filed under the Wetlands Protection Act, G.L., Ch. 131, Sec. 40.

At the time of an application request, the applicant shall pay a filing fee specified in regulations of the Commission. This fee is in addition to that required by the Wetlands Protection Act, G.L., Ch. 131, Sec. 40. In addition, the Commission is authorized to require the applicant to pay the costs and expenses of any expert consultant deemed necessary by the Commission to review the application. The Commission may waive the filing fee and costs and expenses for an application or request filed by a government agency, and may waive the filing fee for a request for determination filed by a person having no financial connection with the property which is the subject of the request.

5.04 Public Notice and Hearings

An application or a request for determination shall be hand delivered or sent by certified mail to the Commission. The Commission shall notify all abutters according to the most recent records of the assessors, including those across a traveled way or body of water. The notice to abutters shall state where the request or application, including any accompanying documents, may be examined or obtained. When a person requesting a determination is other than the owner, the request, the notice of the hearing, and the determination itself shall be sent by the Commission to the owners as well as to the person making a request.

The Commission shall conduct a public hearing on any application or request for determination, with written notice given at the expense of the applicant, five (5) working days prior to the hearing, in a newspaper of general circulation in the Town of _____. The Commission in an appropriate case may combine its hearing under this bylaw with the hearing conducted under the Wetlands Protection Act, G.L., Ch. 131, Sec. 40.

The Commission shall commence the public hearing within twenty-one (21) days from receipt of a completed application or request for determination, unless the applicant extends the twenty-one (21) day time period by a signed written waiver.

The Commission shall have authority to continue the hearing to a certain date announced at the hearing or to an unspecified date, for reasons stated at the hearing, which may include the receipt of additional information offered by the applicant or others, information and plans required of the applicant, deemed necessary by the Commission in its discretion, or comments and recommendation of boards and officials listed in Section 6. If a date for continuation is not specified, the hearing shall reconvene within twenty-one (21) days after the submission of a specified piece of information or the occurrence of a specified action. The date, time and place of said continued hearing shall be published in a newspaper of general circulation in the Town of _____, five (5) working days prior to the continuation, at the expense of the applicant, and written notice shall be sent to any person who so requests in writing.

The Commission shall issue its permit or determination in writing within twenty-one (21) days of the close of the public hearing thereon.

5.05 Coordination with Other Boards

Any person filing a permit application or a request for determination with the Commission shall provide written notice thereof at the same time, by certified mail or hand delivery, to the Board of Selectmen, Planning Board, Zoning Board of Appeals, Board of Health, Town Engineer, and Building Commissioner. The Commission shall not take final action until such boards and officials have had fourteen (14) days from receipt of notice to file written comments and recommendations with the Commission, which the Commission shall take into account but which shall not be binding on the Commission. The applicant shall have the right to receive any such comments and recommendations, and to respond to them at a hearing of the Commission, prior to final action.



5.06 Determination, Permits and Conditions

The Commission shall have the authority, after a public hearing, to determine whether a specific parcel of land contains or does not contain resource areas protected under this bylaw. If the Commission finds that no such resource areas are present, it shall issue a negative determination.

If the Commission, after a public hearing on the permit application, determines that the activities which are the subject of the application are likely to have a significant or cumulative detrimental effect upon the wetland values protected by this bylaw, the Commission within twenty-one (21) days of the close of the hearing, shall issue or deny a permit for the activities requested. If it issues a permit, the Commission shall impose conditions which the Commission deems necessary or desirable to protect those values, and all activities shall be done in accordance with those conditions.

The Commission is empowered to deny a permit for failure to meet the requirements of this bylaw, for failure to submit necessary information and plans requested by the Commission; for failure to meet the design specification, performance standards, and other requirements in regulations of the commission; for failure to avoid or prevent significant or cumulative detrimental effects upon the wetland values protected by this bylaw; and where no conditions are adequate to protect those values.

A permit shall expire three years from the date of issuance. Notwithstanding the above, the Commission in its discretion may issue a permit expiring five years from the date of issuance for recurring or continuous maintenance work, provided that annual notification of time and location of work is given to the Commission. Any permit may be renewed once for an additional one year period.

For good cause the Commission may revoke or amend a permit issued under this bylaw after public notice and public hearing, and notice to the holder of the permit.

The Commission in an appropriate case may combine the permit or other action on an application issued under this bylaw with the Order of Conditions or other action issued or taken under the Wetlands Protection Act, G.L., Ch.131, Sec. 40.

5.07 Regulations

After public notice and public hearing the Commissions shall promulgate rules and regulations to accomplish the purposes of this bylaw. These regulations shall be consistent with the terms of this bylaw. The Commission may amend the rules and regulations after public notice and public hearing.

Failure by the Commission to promulgate such rules and regulations or a legal declaration of their invalidity by a court of law shall not act to suspend or invalidate the effect of this bylaw.

Unless otherwise stated in this bylaw or in the rules and regulations promulgated under this bylaw, the definitions, procedures, and performance standards of the Wetlands Protection Act. G.L. Ch. 131, Sec. 40 and associated Regulations, 310 CMR 10.00 as promulgated April 1983, shall apply.

5.08 Definitions

The following definitions shall apply in the interpretation and implementation of this bylaw:

The term "person" shall include any individual, group of individuals, association, partnership, corporation, company, business organization, trust, estate, the Commonwealth or political subdivision thereof to the extent subject to town bylaws, administrative agency, public or quasi-public corporation or body, this municipality, and any other legal entity, its legal representatives, agents, or assigns.

The term "alter" shall include, without limitation, the following activities when undertaken to, upon, within or affecting areas protected by this bylaw:

- a. Removal, excavation or dredging of soil, sand, gravel, clay, minerals, or aggregate materials of any kind;
- b. Changing or pre-existing drainage characteristics, flushing characteristics, salinity distribution, sedimentation patterns, flow patterns, or flood retention characteristics;
- c. Drainage, or other disturbance of water level or water table;
- d. Dumping, discharging, or filling with any material which may degrade water quality;

- e. Placing of fill, or removal of material, which would alter elevation;
- f. Driving of piles, erection or repair of buildings, or structures of any kind;
- g. Placing of obstructions or objects in water;
- h. Destruction of plant life including cutting of trees;
- i. Changing water temperature, biochemical oxygen demand, or other physical, chemical, or biological characteristics of surface and groundwater;
- j. Any activities, changes or work which may cause or tend to contribute to pollution of any body of water or groundwater.

5.09 Security

As part of a permit issued under this bylaw, in addition to any security required by any other municipal or state board, agency or official, the Commission may require that the performance and observance of the conditions imposed hereunder be secured wholly or in part by a proper bond or deposit of money or negotiable securities or other undertaking of financial responsibility sufficient in the opinion of the Commission.

In addition or in the alternative, the Commission may accept as security a conservation restriction, easement, or other covenant enforceable in a court of law, executed and duly recorded by the owner of record, running with the land to the benefit of this municipality and observed before any lot may be conveyed other than by mortgage deed.

5.10 Enforcement

The Commission, its agents, officers, and employees shall have the authority to enter upon privately owned land for the purpose of performing their duties under this bylaw and may make or cause to be made such examinations, surveys, or samplings as the Commission deems necessary.

The Commission shall have authority to enforce this bylaw, its regulations, and permits issued thereunder by violation notices, administrative orders, and civil and criminal court actions.

Upon request of the Commission, the Selectboard and the Town Counsel will take legal action for enforcement under civil law. Upon request of the Commission, the Chief of Police shall take legal action for enforcement under criminal law.

Any person who violates any provision of this bylaw, regulations thereunder, or permits issued thereunder, shall be punished by a fine of not more than three-hundred dollars (\$300). Each day or portion thereof during which a violation continues shall constitute a separate offense, and each provision of the bylaw, regulations, or permit violated shall constitute a separate offense. This fine may be in addition to any levied under the Wetlands Protection Act, G.L., Ch. 131, Sec. 40.

In the alternative to criminal prosecution, the Commission may elect to utilize the non-criminal disposition procedures set forth in G.L., Ch. 40, Sec. 21D.

5.11 Burden of Proof

The applicant for a permit shall have the burden of proving by a preponderance of credible evidence that the work proposed in the application will not have any significant or cumulative detrimental effect upon the wetland values protected by this bylaw. Failure to provide adequate evidence to the Commission supporting this burden shall be sufficient cause for the Commission to deny a permit or grant a permit with conditions.

5.12 Relation to the Wetlands Protection Act

This bylaw is adopted under the Home Rule Amendment of the Massachusetts Constitution and the Home Rule statutes, independent of the Wetlands Protection Act, M.G.L., Ch. 131, Sec. 40, and the regulations thereunder.

5.13 Severability

This invalidity of any section or provision of this bylaw shall not invalidate any other section or provision thereof, nor shall it invalidate any permit or determination which previously has been used.



REGULATION PROVIDING FOR SEPTIC SYSTEM INSPECTION
UPON SALE OF PROPERTY OR CHANGE IN USE
(Based on Health Regulations passed in Whatley, Sunderland and Gill,
Massachusetts, effective Feb., 1991)

I. INSPECTION OF SEWAGE DISPOSAL SYSTEMS PRIOR TO TRANSFER OF REAL ESTATE OR CHANGE IN USE.

A. Purpose and Authority

1. Authority. These regulations shall be effective on and after (date) and so remain until modified or amended by the Board of Health. They are enacted by the board of health under authority which includes, but is not limited to one or more of the following: Massachusetts General Laws, Chapter 111, Sections 31, 122, 122A, 127, 143, 155, 187, 188, 310 CMR (Code of Massachusetts Regulations) 11.02. Board of health regulations are an exercise of the police power under which the various levels of government are responsible for protection of the public health, safety and welfare.
2. Purpose. This regulation of the board of health has been enacted for the purpose of protection of the public health, safety and welfare, by identifying failed, or otherwise inadequate subsurface sewage disposal systems, and correcting any deficiencies which may exist. It is also intended to ensure that systems are not used for purposes for which they were not designed.

B. Definitions

CHANGE OF USE - is when the use of the property is altered or extended in any way.

DEVELOPED PROPERTY - is any real estate with a human-made structure used or intended for human occupancy or use, or with an existing subsurface sewage disposal system located on the property, or both.

FAILED SYSTEM - is defined as a septic system in which there is evidence, based upon the inspection required by this regulation, of one or more of the following problems:

- a. sewage flow to the surface or into any waters of the Commonwealth,
- b. outlet tee or baffle is not in place or is damaged in the septic tank,
- c. inlet tee or baffle is not in place or is damaged in the septic tank,
- d. liquid level in tank is above the tank outlet,
- e. after or during tank pumping, liquid is observed flowing from the outlet back into the tank,
- f. leaching facility is not in place after the septic tank,
- g. any other problem, as defined by the board of health, representing an actual threat to the public health.

INSPECTION - shall consist of the following:

- a. visual inspection of the ground surface around the septic system to look for signs of sewage or high ground water,
- b. review of all available records and inquiry to the owner, installer, and board of health, to identify, if possible, location and type of leaching facility and distribution box,
- c. review of all available records and inquiry to the owner and licensed plumbers, to determine, if possible, how often the septic tank has been pumped during the two years preceding the inspection,



- d. location of all domestic water supply wells, lakes, ponds, streams, and watercourses, within one hundred feet (100') of the leaching facility if its location can be determined, or, if the location of the leaching facility cannot be determined, within one hundred feet (100') of the septic tank,
- e. opening the septic tank and pumping out its contents,
- f. determine materials of tank construction,
- g. fill the bathtub with water and releasing, checking for slow wastewater discharge to the system,
- h. personal observation, by a registered professional engineer or registered sanitarian, of the pumping of the septic tank. A representative of the board of health must be present for the observation to be valid,
- i. recording observations of the following:
 - (1) address and owner of tank,
 - (2) determine tank construction material,
 - (3) the amount of septage pumped from the tank,
 - (4) whether an outlet tee or baffle is in place and not damaged in the septic tank,
 - (5) whether an inlet tee or baffle is in place and not damaged in the septic tank,
 - (6) whether the liquid level in tank, prior to pumping, is above the tank outlet,
 - (7) whether liquid is observed flowing from the outlet back into the tank during or after pumping.

Nothing in the foregoing definition of INSPECTION is intended to require any registered professional engineer or registered sanitarian to excavate or directly certify the condition of any leaching facility, distribution box, or septic tank inlet/outlet lines. This definition adopts the approach that visual inspection of the property, inspection of any available records, and observation of pumping of the septic tank, together provide a reasonable indicator of the functioning of the septic system. Any opinion or certification provided by the registered professional engineer or registered sanitarian is based solely upon this limited inspection.

OWNER - means every person who alone or severally with others (a) has legal title to any developed property, or (b) has care, charge, or control of the developed property, in any capacity including but not limited to agent, executor/rix, administrator/rix, trustee, or guardian of the estate of the holder of legal title, or (c) mortgagee in possession, or (d) agent, trustee, or other person appointed by the courts, or (e) any officer or trustee of the association of unit owners of a condominium.

REAL ESTATE TRANSFER - is any sale or conveyance of real estate, except:

- a. conveyance or devise of the property to a surviving spouse,
- b. a sale under a power of sale contained in a bona fide recorded mortgage affecting the property,
- c. in the case of joint ownership, if the property is conveyed to one of the original joint owners.

SEPTIC SYSTEM - is the septic tank, distribution box (if available), and surface land area of the lot on which the system is most likely located, unless exact location is known.

C. Inspection of Existing Sewage Disposal Systems

- 1. The inspection of existing commercial and residential sewage systems shall be the responsibility of the owner and real estate agent if applicable, prior to real estate transfers or change in use.
- 2. The owner of a developing property shall order and complete an inspection of the existing subsurface sewage system not more than one hundred eighty (180) days and not less than thirty (30) days prior to the time of transfer of the real estate, or of a change in use. The Board of Health may, at its discretion, grant a variance in these time limitations.



3. For the purpose of this regulation, reference is made to the standards and provisions of Title 5 of the State Environmental Code (310 CMR 15.00), and to any applicable regulations of the Board of Health for subsurface sewage disposal.
4. In the case of a change of use, the applicant shall have the responsibility of proving to the Board of Health that the septic system is adequate for safely handling the proposed change of use.
5. After an inspection by, a registered professional engineer or registered sanitarian, that engineer or sanitarian shall file an Inspection Form with the Board of Health, and shall provide copies to the owner or seller, seller's attorney, seller's real estate broker/salesperson, and buyer, stating whether the system is believed to be in operational, or failed condition, based upon the inspection required by this regulation, and whether the system is adequate for a proposed change in use. The filing with the Board of Health shall be accompanied by a filing fee, in an amount to be established by the Board of Health.

D. Exemptions

1. Any new or replacement Title 5 system having been installed and having received final inspection approval by the Board of Health within a period of five years preceding the transfer of the property, shall be exempt from this regulation, providing additional living space which exceeds the capacity has not been added, nor has anything been added to the house which is not in accordance with the original approved design of the system; such as a garbage grinder, addition, or roof drains. And further providing that there has been no change in intended use. A copy of the Disposal Works Construction Permit and Certificate of Compliance, as approved by the Board of Health must be submitted, together with the filing fee, in lieu of the Inspection Form not less than thirty days prior to each transfer.
2. Real estate transfers, which are otherwise subject to this regulation, and which take place within two (2) years following the date of an inspection under this regulation and found to be in operational working order, may be exempt from the inspection requirement, but not the pumping requirement as found in this regulation, upon review and approval by the Board of Health. A copy of the original Inspection Form must be submitted, together with a new filing fee, to the Board of Health for review thirty (30) days prior to the real estate transfer. Systems that were found to be in a failed condition are required to be repaired and to be inspected prior to a real estate transfer, unless meeting the requirements of paragraph three below. The Board of Health may, in its discretion, provide for review in a period less than thirty (30) days. There shall be a fee, in an amount to be established by the Board of Health, for any reinspection.
3. Sellers and Buyers who transfer an existing structure with the intent to replace the existing septic system with a system in compliance with Title 5 of the State Environmental Code and all applicable local bylaws and regulations, may submit, together with the filing fee, an application to the Board of Health for exemption from this regulation. The Seller and the Buyer together must apply in writing showing that both parties have agreed to the arrangement and accept joint responsibility for seeing that the new system is installed. The application for exemption must include a written statement from a registered professional engineer or registered sanitarian (a) that he/she has been placed under contract by the parties to design the replacement system and (b) that a replacement septic system in compliance with Title 5 of the State Environmental Code, and any applicable local regulations, can be installed on the property, and (c) that all work necessary for installation of the replacement septic system will be completed by a stated date, which must be within one year from the date of transfer. The repair/replacement work may not be done by the same professional engineer or professional sanitarian or associated firms as conducted the original inspection under this regulation. Applications under this paragraph may be granted or denied at the discretion of the Board of Health.

E. Enforcement

1. If it is determined by the Board of Health that the system constitutes a danger to the public health, the board shall order the owner to make repairs/replacement of the system, in accordance with all applicable laws and regulations, within a time limit to be determined by the Board of Health. If the work is not completed within the time designated by the Board of Health, the board may impose fines and may repair or replace the system at the cost of the owner. The repair/replacement work may not be done by the same professional engineer or professional sanitarian or associated firms as conducted the original inspection under this regulation.

2. If it is determined by the Board of Health that the system is inadequate for a proposed change in use, the board shall require the upgrading of the systems to meet the anticipated use, in accordance with all applicable laws and regulations, within a time limit to be determined by the Board of Health. If the work is not completed within the time designated by the Board of Health, the board may impose fines and may repair or replace the system at the cost of the owner. The upgrading work may not be done by the same professional engineer or professional sanitarian or associated firms as conducted the original inspection under this regulation.
3. In addition to any other remedy, the Board of Health may take any enforcement action deemed appropriate and lawful, including but not limited to criminal prosecution, to seek a fine in accordance with Chapter III, Section 31, or Civil Action for injunctive relief or money damages or both.
4. The Board of Health is authorized to issue notices of violation, cease and desist orders, or other administrative enforcement orders to compel compliance with these regulations.
5. After an inspection by a registered professional engineer or registered sanitarian, that engineer or sanitarian shall file an Inspection Form with the Board of Health, together with the required filing fee, and shall provide copies to the Board of Health, the seller, and buyer, stating whether the system is in operational condition or needs to be repaired. A representative of the Board of Health must be present during said inspection in order for it to be valid.
6. Each part of this regulation shall be construed as separate to the end that if any paragraph, sentence, clause or phrase thereof shall be held invalid for any reason, the remainder of that regulation and all other regulations shall continue in full force.

F. Instructions for Inspections

NOTE: See the definition of INSPECTION in Section B of this regulation, as well as the definitions of FAILED SYSTEMS.

1. The Inspection by the registered professional engineer or registered sanitarian shall take place no more than one hundred eighty (180) days nor less than thirty (30) days prior to the real estate transfer, or change in use. A representative of the Board of Health must be present at said inspection. The Board of Health must receive the Inspection Form within seven (7) days of the inspection. In addition, the copies must be given to the owner and to the buyer at that time. Inspection Forms are provided by the Board of Health.
2. If the inspection finds evidence of a failed system, the Board of Health shall determine within fourteen (14) days after receiving the Inspection Form, whether the system constitutes a danger or potential danger to the public health and should be repaired or replaced. By the end of the fourteen day time period, the Board of Health must notify the owner by certified or registered mail, with return receipt requested, whether the system must be repaired or replaced, or that some other available alternative must be pursued. Follow-up inspection(s) may be required by the Board of Health. A representative of the Board of Health must be present at such an inspection. There shall be a fee for each follow-up inspection.
3. The time allowed for the repair or replacement will be determined by the Board of Health and will be contained in the letter of notification to the owner.
4. If repair or replacement is required, the owner must conduct the site inspection as provided by Title 5 of the State Environmental Code (310 CMR 15.00) and by local regulations of the Board of Health. Any such repair or replacement shall be done only in accordance with a disposal works construction permit obtained by the owner in accordance with said Title 5 and local regulations.

MODEL SOIL EROSION AND SEDIMENT CONTROL BYLAW

(Source: Middlesex and Essex Conservation Districts)¹⁹

MEMORANDUM ON MODEL SOIL EROSION AND SEDIMENT CONTROL BYLAW

The following bylaw has been published by the Middlesex and Essex Conservation Districts to assist those communities wishing to utilize Home Rule authority to enact local protection against unregulated land-disturbing activities, causing erosion and sedimentation of waterbodies and other natural resources and jeopardizing the public health, safety, welfare, and the environment. During 1988 we reviewed bylaws in various forms in place in Massachusetts and we researched what permit procedure would be simplest. We encourage cities and towns to use their powers to require basic soil erosion and sediment control wherever land-disturbing activities take place. The appropriate measures are relatively inexpensive to incorporate in development plans and they are a cheap form of insurance against very expensive environmental damage.

This draft, published in March 1989, has been reviewed by planners, scientists, local officials, and lawyers. Yet we want to caution that no model is perfect for every local situation. Any bylaw must be tailored to your community. Identify erosion problems in your city or town, reflect these problems in the purpose section of the bylaw, select the board to which you wish to give jurisdiction, set the thresholds for project review, describe the basic permit procedures, add any application and plan requirements, consider what performance standards to impose, and shape the monitoring and enforcement approach to adopt.

In other words, this model bylaw is a starting point for your deliberations and discussed, not an end. We commend it as a good foundation, a solid structure.

This bylaw would require extensive land-disturbing activities to obtain a full permit from the Conservation Commission, with detailed plans and specifications to avoid unacceptable erosion and sedimentation. Smaller projects are not subject to this full procedure, but are required to obtain limited permits.

Copies of the permit application are shared with other community boards and officials, and with the local conservation district, for review and comment. The Conservation Commission, though, is the agency with jurisdiction to promulgate regulations and grant permits.

The procedure is kept simple on purpose. Erosion control is something to be incorporated in development plans. The Commission will review erosion control measures needed, not the wisdom of the project or any other board issue. The Commission will render its decision within forty-five days. The permit is recorded in the Registry of Deeds. If desiring to change the project or its erosion control measure substantially, the applicant must notify the Commission, which may require an amended application.

The Commission is directed to adopt a fee schedule by regulation, adequate to reimburse its actual costs of project review and approval.

In addition, the Commission is authorized to require the applicant to pay the expense of an expert engineer or consultant to assist Commission review, up to a maximum of \$2,500. Again, only the cost attributable to the project may be charged.

This bylaw adopts a state statute allowing the community to set up a special fund into which such fees and charges go, to be available to the Commission during the fiscal year without the need for appropriation. The bylaw provides for a refund of any unused fees or charges. This special account procedure was adapted from the Town Braintree Home Rule wetlands protection bylaw, approved by the Attorney General during 1988.

Massachusetts lacks an erosion control statute at the state level. Siltation of a body of water is defined as water pollution, but the Clean Water Act does not yet prevent dangerous erosion. Erosion can be reduced under the Wetlands Protection Act, but only relative to work which already is subject to that statute because it is in or near wetlands. State drinking water laws mandate that cities and towns protect water supplies, but leave to you the decision how best to do that. The Zoning Act empowers communities to adopt wetland, watershed, floodplain, and aquifer zoning, but operates largely through announcing what land uses are legal, where, without specifying erosion control measures to prevent problems. The Subdivision Control Act sets up planning boards to review subdivisions, but erosion control measures may be required only if the planning board adopts regulations on that subject, and they only apply to the subdivision of land.

¹⁹ Beth Handler, EIP Intern; Gregor I. McGregor, Esq., Legal Counsel; Rhett R. Grant, Supervisor MCD Technical Adviser; Fourth Revision, March 1989.



Consequently we strongly urge that cities and towns seriously consider adopting this model soil erosion and sediment control bylaw. Remember that it reflects the best wisdom as of this date. Be sure to contact either the Middlesex or Essex Conservation District for advice on experience with the bylaw in practice, and to obtain the most current version of this model.

SOIL EROSION AND SEDIMENT CONTROL BYLAW

I. TITLE

This bylaw shall be known as the Soil Erosion and Sediment Control Bylaw.

II. PURPOSE

The Purpose of this bylaw is to eliminate or reduce the harmful impacts of soil erosion and sedimentation on the public health, safety, and welfare, and the environment by prohibiting increase in sediment-laden runoff from land-disturbing activities and by prohibiting streambank erosion along bodies of water. This bylaw regulates activities with potential for such impacts by requiring permits and pre-activity review. For activities above the thresholds of jurisdiction under this bylaw, either a full or limited land disturbance permit is required, and compliance with permit conditions. By implementing the controls in permit conditions and in this bylaw, and in regulations promulgated pursuant to this bylaw, erosion and sediment shall be controlled so as to protect water quality, flood storage, stream flow, wildlife habitat, aquatic resources, and public safety.

III. JURISDICTION

No person shall clear, cut, grade, or perform any land-disturbing activity on an area of land 5000 square feet or greater without first applying for and receiving an approved full or limited land disturbance permit from the Conservation Commission in accordance with this bylaw. The Commission shall have authority to promulgate rules and regulations to implement this bylaw, to review permit applications, to perform monitoring and inspections, to grant or deny permits, and to enforce the provisions of this bylaw, and to take any other actions reasonable and appropriate to implement this bylaw. The Conservation District may provide technical services to the Commission in the review of plans or any other matter under this bylaw.

IV. APPLICATION PROCEDURES

Where a full or limited land disturbance permit is required, a written application shall be submitted to the Commission. The application shall be signed by the owner of the property on which the proposed activity is to be conducted. In addition, the applicant, if the applicant is not the owner, shall sign the application. If the owner or applicant is a business entity, the chief executive officer or other officer with authority shall sign the application. Any application or other submittal in support thereof shall be submitted to the Commission in duplicate by certified mail or hand delivery. Upon receipt, the application shall be marked with the date and time received and a file number shall be assigned.

V. COORDINATION WITH OTHER BOARDS

Any person filing a permit application with the Commission shall submit a copy thereof at the same time, by certified mail or hand delivery, to the City Council/Board of Selectmen, Planning Board, Board of Appeals, Board of Health, Building Inspector, and Conservation District. The person filing such application shall at the same time submit to the Commission a written notice that these copies have been submitted to these other agencies. The Commission shall not take final action on an application until such boards and officials have had twenty-one calendar days from their receipt to submit written comments, if any, to the Commission. The applicant shall have the right to receive such written comments, if any, and to respond to them, if desired, prior to final action.

VI. COMPLIANCE

No land-disturbing activity shall take place, unless exempt by the terms of this bylaw, without compliance with a land disturbance permit issued by the Commission, with the plans approved by that permit, and with any rules and regulations promulgated by the Commission. In addition, any land-disturbing activity shall comply with all federal, state and local statutes, regulations, and bylaws/ordinances and shall obtain and comply with any other necessary permits, licenses, or other approvals.

VII. MODIFICATION OF PLANS

Any change, in or alteration of, a land-disturbing activity approved in a permit, and any approved plans, shall be submitted to the Commission, prior to any further land-disturbing activities, for prior review and approval. If in the judgement of the Commission the change or alteration is substantial, the Commission may require that an amended application shall be submitted. If any change or alteration takes place during land-disturbing activities, the Commission may require the installation of interim erosion and sediment control measures before the change or alteration may be approved.



VIII. FEES

The Commission by regulation shall promulgate an application fee schedule for full and limited land-disturbance applications and compliance certificates. The fee specified in such a fee schedule shall be made payable to the Commission and shall accompany the permit application or request for certificate of compliance. The Commission may require a fee for review of any change in or alteration from an approved permit or plan.

Said fee shall be paid into a special account of the Commission set up by the Town/City Treasurer and may be expended by the Commission for the purpose allocated without further appropriation. Any balance in said account at the end of the fiscal year shall be deposited into the general treasury of the town/city. This town/city hereby accepts the provisions of General Laws, Chapter 44, Section 53E. The Commission may draw upon said special account for costs and expenses in processing applications, plans, changes or alterations, certificates of compliance, providing notices, conducting hearings, meetings field inspections and other reviews, performing services by Commission staff and other departments, agencies, boards, officers and employees of the town/city in reviewing matters pending, performing measurements, testing, monitoring, and other evaluations, and mileage, recording, and telephone costs. Provided, however, that only those costs and expenses reasonably attributable to review, approval, disapproval, or other actions on applications, plans, changes or alterations, or certificates of compliance may be so charged against said special account. This filing fee schedule has been determined by the town/city to be commensurate with the expense of providing these municipal services to applicants.

The application fee is non-refundable except as provided herein. Any unused portion of said fee shall be returned by the Commission to the applicant within forty-five calendar days or written request for same by the applicant, unless the Commission decides in a public meeting that other action is necessary. Said Treasurer shall return such portion, if any, as directed by the Commission. Any applicant aggrieved by the imposition of, or size of, the fee, or any act related thereto, may appeal according to the provisions of the Massachusetts General Laws.

In addition to the filing fee imposed by this bylaw and by regulations promulgated by the Commission hereunder, the Commission is authorized to require the applicant to pay the reasonable costs and expenses borne by the Commission for specific expert engineering and consulting service deemed necessary by the Commission to review an application, plan, change or alteration, or certificate of compliance, up to a maximum of \$2,500. Said payment may be required by the Commission at any point in reviewing or deliberating prior to a final decision being rendered. Said services may include but are not necessarily limited to soil survey and delineation, hydrogeologic and drainage analysis, erosion and sedimentation potential, and environmental/land use law.

The Commission is hereby authorized to charge said fee for expert engineering and consulting services when an application proposes any of the following: 500 square feet or greater of alteration of a freshwater or costal wetland; 50 linear feet or greater of alteration of a bank or waterway; 500 square feet or greater of alteration of land within 100 feet of a body of water; alteration of greater than 500 square feet of land under a waterbody; discharge of any sediment or siltation into or contributing to surface or groundwater; or construction of a detention or retention basin or other drainage device.

Said fee for expert engineering and consulting services shall be paid into a special account of the Commission set up by the town/city treasurer and may be expended by the Commission for the purpose allocated without further appropriation. Any balance in said account at the end of the fiscal year shall be deposited into the general treasury of the town/city. This town/city hereby accepts the provisions of General Laws, Chapter 44, Section 53 E. The Commission may draw upon said special account for services approved by the Commission at a public meeting. Provided, however, that only those costs and expenses reasonably attributable to review, approval, disapproval, or other action on applications, plan, changes or alterations, or certificates of compliance may be so charged against said special account.

Fees are non-refundable except as provided herein. Any unused portion of said fee for expert engineering or consulting services shall be returned by the Commission to the applicant within forty-five calendar days of written request for same by the applicant, unless the Commission decides in a public meeting that other action is necessary. Said treasurer shall return such portion, if any, as directed by the Commission. Any applicant aggrieved by the imposition of, or size of, the fee or any act related thereto, may appeal according to the provisions of Massachusetts General Laws.

IX. BOND

The Commission may require that the applicant post a performance bond, as a condition of a permit, in form and content approved by the municipal attorney before construction may commence. This bond shall ensure that the installation and maintenance of soil erosion and sediment control procedures are completed as approved by the Commission, within a time specified in the permit.

If satisfactory to the Commission, the applicant may substitute a certificate of guarantee, irrevocable letter of credit, or cash bond in lieu of a performance bond. Any performance bond or letter of credit shall be executed and maintained by a financial institution, surety, or guaranty company qualified to do business in the Commonwealth.

X. CERTIFICATION

At the time of application, the applicant shall certify in writing the name of the person who is responsible for sediment control for the land-disturbing activity which is the subject of the application. Said person shall ensure that said activity takes place in accordance with the application, plan and permit conditions.

XI. REGISTRY OF DEEDS

Prior to commencement of any land-disturbing activity, the applicant shall record the permit with the registry of deeds for the county in which the activity is to take place, or the appropriate land court section of said registry, and shall submit to the Commission written proof of such recording.

XII. FULL LAND DISTURBANCE PERMIT

The following land-disturbing activities shall require a full land disturbance permit:

- A. Clearing and grading activity disturbing an area of more than 20,000 square feet; OR
- B. Volume of earth resulting in a total quantity of 500 cubic yards or more of earth; OR
- C. Land-disturbing activities on two or more contiguous lots within a twelve month period.

The following information shall be submitted, at a minimum, with any full land disturbance application: a plan adequately describing the proposed activity; the items specified below; and any additional information specified in regulations promulgated by the Commission. The applicant shall submit any additional information requested by the Commission or the Conservation District during review of the application.

Detailed engineering plans for proper soil erosion and sediment control shall be submitted including the following, at a minimum:

1. A locus map, legend, and north arrow;
2. A scale showing one inch equals forty feet;
3. Title blocks identified by project name or parcel;
4. Delineation of the total land area to be disturbed;
5. Boundary lines of lots and delineation of land area where activity is to be performed;
6. Contours showing existing and proposed elevations and/or contours at two foot intervals;
7. Symbols for sediment and erosion control practices including detail and elevation;
8. Existing and proposed roadways;
9. Delineation of wetland areas;
10. Delineation of the 100 year floodplain;
11. Street profiles showing proposed grades and elevations;
12. Proposed storm drainage systems;
13. All bodies of water, including streams, rivers, lakes and ponds, within 100 feet of the proposed activity;
14. A description of construction activities, in sequence, which specifies the expected date of soil stabilization and completion;
15. Temporary and permanent soil erosion and sediment control measures;
16. Temporary and permanent seeding and other vegetative controls.



If any structural soil erosion and sediment control is deemed necessary in the judgement of the Commission, the detailed engineering plans shall include the following additional information:

1. Detailed location of any dam or basin;
2. Plan view of any dam or basin;
3. Spillway designs showing calculations and profiles;
4. Emergency spillway designs showing calculations, profiles, and cross-sections;
5. Runoff calculations for peak runoff during a 100 year storm;
6. Notes and construction specifications;
7. Type of sediment trap;
8. Drainage area to any sediment trap;
9. Volume of storage required;
10. Outlet length or pipe sizes;
11. Storage depth below outlet or cleanout elevation;
12. Embankment height and elevation;
13. A portable safety fence surrounding any basin or trap, not less than forty-two inches in height with openings not more than three inches in height, firmly anchored at spacing no greater than eight feet.

The Commission shall review and respond to any completed permit application with forty-five calendar days of receipt, or such additional time as is necessary to provide coordination with other local boards and officials in accordance with Section V above. If the application is denied by the Commission, the Commission shall specify its reasons in writing. The decision with permit or denial shall be mailed or hand delivered by the Commission to the applicant.

Any person aggrieved by the decision of the Commission may appeal in the nature of certiorari to the Superior Court.

XIII. LIMITED LAND DISTURBANCE PERMIT

Any land-disturbing activity not requiring a Full Land Disturbance Permit if it meets the limitations below, shall require a Limited Land Disturbance Permit application:

- A. Activity disturbing an area of land no more than 20,000 square feet and no less than 5,000 square feet; AND
- B. Volume of earth movement resulting in a total quantity of no more than 500 cubic yards of earth and no less than 100 cubic yards; AND
- C. Activity involving a parcel of land having a final graded slope no steeper than three horizontal units to one vertical unit, equivalent to a slope of 33 percent; AND
- D. Any area of soil cut or filled not exceeding four feet in vertical depth at its deepest point as measured from the natural ground level.

An application for a Limited Land Disturbance Permit shall, at a minimum, include a sketch of the parcel or parcels on which the activity is to take place, drawn so as to include soil erosion and sediment control practices, roadways, waterways, building or buildings to be constructed, topography, and a stabilized construction entrance.

The Commission shall review and respond to the permit application within forty-five calendar days of receipt, or such additional time as necessary to provide coordination with other boards as specified in Section V above. If the permit is denied, the Commission shall specify its reasons in writing. The decision with permit or denial shall be mailed or hand delivered by the Commission to the applicant.

Any person aggrieved has a right to appeal a decision of the Commission in the nature of certiorari to the appropriate Superior Court.

XIV. STABILIZATION

Vegetative stabilization measures shall be employed. All perimeter dikes and slopes, basin or trap embankments shall be stabilized with sod, seed, and anchored straw mulch within seven calendar days of disturbance. All other disturbed areas shall be stabilized with sod, seed, and anchored straw mulch within fourteen calendar days after disturbing activities have ceased.

Topsoil shall be stripped from disturbed areas and stockpiled in an approved area and stabilized with temporary vegetative cover if left for more than thirty calendar days. Perimeter sediment controls shall be installed around stockpiled topsoil.

During the months of October through March, when seeding and sodding may be impractical, an anchored mulch shall be applied as approved by the Commission.

XV. EXTENSION

A full or limited land-disturbance permit shall be valid for one year from the date the permit is issued. The Commission may grant one extension for an additional year, upon written request for renewal no later than 30 days prior to expiration. Thereafter, a new application shall be required.

XVI. INSPECTION

The Commission, in its discretion, may conduct an inspection at any stage of construction to ensure compliance with the terms of this bylaw and any permit. The Commission also may require the applicant to submit periodic oral or written reports at any stage of construction. The Commission shall be authorized to conduct announced or unannounced inspections at any reasonable time. In any event, upon completion of the land-disturbing activities approved by a permit, the applicant shall notify the Commission to request an inspection.

XVII. COMPLIANCE CERTIFICATE

Upon request of the Commission, the City Council/Board of Selectmen and the City Solicitor/Town Counsel shall take legal action for enforcement of this bylaw under civil law. Upon request of the Commission, the Chief of Police shall take legal action for enforcement under criminal law. Municipal boards and officers, including any police officer or other officer having police powers, shall have authority to assist the Commission in enforcement.

The Commission shall have the power and duty to enforce this bylaw, regulations thereunder, and permits, including but not limited to issuance of violation notices and enforcement orders. An enforcement order may require the halt to any illegal work, removal of equipment and site restoration.

XIX. VIOLATIONS/PENALTIES

Violations of this bylaw, any regulations hereunder, or any permit shall be punished by a fine of not more than \$300 per day.

As an alternative to criminal prosecution in a specific case, the Commission may elect to utilize the non-criminal disposition procedure set forth in General Laws, Chapter 40, Section 21D (recite complete text of Section 21D here, in order for your Town to accept provisions of this state law).

XX. EDUCATION

The Commission, within its available resources, should provide education programs on soil erosion and sediment control to the general public and persons regulated by this bylaw. Workshops and seminars should provide guidelines and advice to ease the permit application process and foster acceptance of good erosion control practices.

XXI. DEFINITIONS

ANCHORED MULCH: Mulch consisting of straw, woodchips, emulsifier, and other appropriate materials, bound together by anchored pegs and twine.

APPLICANT: Any natural person, individual, partnership, corporation, trust, agency, department, political subdivision, or other legal entity requesting a soil erosion and sediment control permit for proposed land-disturbing activity.

CLEAR: The act of removing vegetative cover in a manner that does not disturb root mat or the existing soil surface.

CUT: The excavation of soil, sand, gravel, stones, or other earth material from the land.



CONSERVATION COMMISSION: The Conservation Commission of this municipality.

CONSERVATION DISTRICT: The Conservation District for the county in which this municipality lies.

ENGINEERING PLAN: A plan developed by a professional engineer, landscape architect, land surveyor, or person duly qualified, whose name appears on said plan.

EROSION: The process by which the ground surface is worn by natural forces such as wind, water, ice, gravity, glaciers or by artificial means.

FILL: Any act by which soil, earth, sand, gravel, rock, or any similar material is deposited, placed, pushed, pulled, or transported, and includes the conditions that result from that act.

GRADE: An act by which soil is cleared, stripped, stockpiled, or any combination thereof.

LAND-DISTURBING ACTIVITY: Any action that causes the alteration of earth, sand, rock, gravel, vegetation, or similar material on land.

ONE HUNDRED YEAR FLOODPLAIN: An area delineated under the Federal Emergency Management Act (FEMA) indicating the extent of flooding as a result of a 100 year storm.

PERIMETER CONTROL: A measure that prevents erosion and sedimentation through the use of earth and dikes at the outer extent of land-disturbing activities.

PERMIT: The full or limited land-disturbance permit issued by the Commission authorizing land-disturbing activity in accordance with the requirements of this bylaw.

SEDIMENT: Organic material or minerals transported or deposited by the movement of wind, water, ice, gravity, glaciers, or by artificial means.

SEDIMENT BASIN: A temporary barrier or dam constructed across a drainage way or at another suitable location to intercept and trap sediment.

SEDIMENT TRAP: A temporary sediment control measure formed by excavation or embankment to intercept and trap sediment.

SITE: Any lot or parcel of land or area of property where land-disturbing activities are, were, or will be performed.

SLOPE: The inclined surface of a fill, excavation, or natural terrain.

SOIL: Any earth, sand, rock, gravel, or similar material.

STRIP: Any activity which removes the vegetative surface cover including but not limited to tree removal, clearing, grubbing, and storage or removal of topsoil.

WETLAND: Any resource area which is subject to the Wetlands Protection Act, General Laws, Chapter 131, Section 40.

XXII. SEVERABILITY

If any provision of this bylaw is held to be invalid, such invalidity shall not affect any other provision of this bylaw.

XXIII. EFFECTIVE DATE

This bylaw shall take effect upon adoption by Town Meeting/City Council.

**MODEL HAZARDOUS MATERIAL
AND UNDERGROUND STORAGE TANK BYLAW**

(Source: Growth Management Workbook. EOCD and PVPC, 1988)
(Based upon a bylaw adopted in the City of Westfield, Massachusetts)

HAZARDOUS MATERIAL AND UNDERGROUND STORAGE TANK BYLAW

6.00 Authority

The Town of _____ adopts the following measures under its home rule powers, its police powers to protect the public health and welfare, and its authority under M.G.L., Ch. 40, Sec. 21.

6.01 Definitions

- a. Discharge: the spilling, leaking, pumping, emitting, or dumping of toxic or hazardous materials upon or into any land or waters of the Town of _____.
- b. Hazardous Material: any substance with such physical, chemical, or infectious characteristics as to pose a potential hazard to existing or potential water supplies or to human health. Hazardous materials include, but are not limited to, toxic chemicals, heavy metals, radioactive or infectious wastes, acids and alkalies, pesticides, petroleum products, herbicides, solvents, and thinners.
- c. Underground Storage: storage below ground level but not including storage in a free-standing container within a building.

6.02 Prohibitions

6.021 All new underground storage tanks with volumes less than 1,100 gallons are prohibited from the Water Supply Protection District.

6.022 The discharge of hazardous materials within the Town of _____ is prohibited with the following exceptions:

- a. Disposal of sanitary sewage to subsurface sewage disposal systems approved under Title 5 of the Massachusetts Environmental Code or to a wastewater treatment facility.
- b. Application of fertilizers and pesticides in accordance with label recommendations and with regulations of the Massachusetts Pesticide Control Board.
- c. Application of road salts or other de-icing chemicals provided that such use is minimized and consistent with public highway safety standards.
- d. Proper disposal of acceptable materials at a facility or site which has received and maintained all legal approvals as specified in the Massachusetts Hazardous Waste Management Act, M.G.L., Ch. 21C, Sec. 7.

6.023 The use of septic system cleaners containing toxic or hazardous materials is prohibited.

6.03 Hazardous Material Registration and Controls

6.031 Every owner, or operator of a commercial, industrial or agricultural operation storing hazardous materials in quantities totaling more than 50 gallon liquid volume or 25 pounds dry weight shall register with the Fire Department a description of the types and quantities of hazardous materials stored, and the location and method of storage. Registration required by this subsection shall be submitted within sixty (60) days of the effective date of this bylaw and annually thereafter.

6.032 The Fire Department may require that an inventory of hazardous materials be maintained on the premises and be reconciled with purchase, use, sales and disposal records on a monthly basis.

6.033 Hazardous materials shall be stored in product-tight storage containers and shall be removed and disposed of in accordance with the Massachusetts Hazardous Waste Management Act, M.G.L., Ch. 21C.

6.034 The Fire Department shall require that containers of hazardous material be stored on an impervious,



chemical-resistant surface, that the storage area be enclosed with an impermeable dike or within an impermeable basement, and that the containers be protected from weather, vandalism, corrosion, and leakage.

6.04 Underground Storage Tanks of Volumes Greater Than 1,100 Gallons

Every owner of an underground storage container for hazardous materials including petroleum products of volumes greater than 1,100 gallons shall comply with all applicable state regulations for such storage.

6.05 Permits For Existing and New Underground Storage Tanks of Volumes Less Than 1,100 Gallons

6.051 Every owner of an underground storage container for hazardous materials including petroleum products affected by this bylaw shall apply to the Fire Department for a permit to maintain a storage facility. Application shall be made within sixty (60) days of the effective date of this ___ and shall contain the following information:

- a. Name, address, and telephone numbers of the owner and operator;
- b. The type of material stored;
- c. Tank size and construction type for tank and piping;
- d. Evidence of the date of installation warranty;
- e. Plot plan of the site, including location of the tank, pumping components, and any wells or water bodies.

6.052 The head of the _____ Fire Department is required to send to the Board of Health, the Water Department and the Conservation Commission a copy of every permit application for a new storage facility, with a request for a recommendation of approval or disapproval within 30 days.

6.053 Subsequent to the effective date of this ordinance, no new underground storage containers shall be installed unless the owner shall have first obtained a permit from the Fire Department. If the Fire Department determines that the proposed storage container constitutes a danger to a water supply, water body, public health or safety, the Fire Department may deny the permit or may grant it subject to conditions which the Department determines are necessary.

6.054 These permits shall be in addition to any license or permit required by M.G.L., Ch. 148, as amended, or by any regulation issued thereunder. The fee for this permit, payable to the Town of _____ shall be _____ dollars.

6.055 If the ownership of any underground storage tank is transferred, the new owner shall notify the Fire Department within ten (10) working days.

6.06 Underground Storage Tank Installation and Construction Standards For Tanks of Volumes Under 1,100 Gallons

6.061 New underground storage containers shall be installed by a manufacturer's approved installation contractor in the presence of the head of the Fire Department or his agent. Newly installed underground storage containers shall be surrounded by at least twelve (12) inches of clean sand which shall also be placed between the tank and a firm base.

6.062 Every new or replacement tank and its piping shall be tested separately, at the owner's expense, prior to its being buried. The tank shall be tested by air pressure at not less than 3 and not more than 5 lbs. per square inch. The piping shall be tested hydrostatically to 150% of the maximum anticipated pressure of the system, or tested pneumatically, after all joints and connections have been coated with a soap solution, to 100% of the maximum anticipated pressure of the system but not less than 50 lbs. per square inch gauge at the highest point of the system. After the tank and piping have been fully buried, all subsequent testing of underground tanks shall be done by the precision test in accordance with the provisions of Pamphlet No. 329, Chapter 4-3-10, of the National Fire Protection Association, or other test of equivalent or superior accuracy. The owner shall furnish the head of the Fire Department with a certified copy of the results of all testing required by this Section which the head of the Fire Department shall keep with the records of the storage facility.

6.063 Newly installed underground storage containers shall be protected from internal and external corrosion and shall be of a design approved by the Board of Health and the head of the Fire Department. The following container construction systems are considered to provide adequate corrosion protection:

- a. UL-listed fiberglass reinforced plastic (FRP);
- b. UL-listed steel tanks provided with cathodic protection;
- c. UL-listed steel tanks with bonded fiberglass coating;
- d. UL-listed double-walled steel tanks with cathodic protection or bonded fiberglass coating;
- e. Other container construction providing equal or better protection against leakage than the above mentioned containers and approved by the head of the Fire Department.

6.064 All replacements of underground storage tanks must comply with aforementioned standards.

6.07 Testing of Underground Storage Tanks of Volumes Less Than 1,100 Gallons

6.071 The owner of every existing storage facility which does not satisfy the design requirements of Section 6.06 shall have each tank and its piping tested, at the owner's expense, during the 10th, 13th, 15th, 17th, and 19th year after installation, and annually thereafter.

6.072 The owner of every kind of new or existing tank which satisfies all the design requirements of Section 6.06 shall have the tank and its piping tested, at the owner's expense, during the 15th, and 20th years following the date of installation and at 2-year intervals thereafter.

6.073 If no satisfactory evidence of the installation date exists, annual testing shall begin upon order of the Fire Department.

6.074 It is strongly recommended that underground tanks be removed following expiration of manufacturer's warranty or 20 years after installation.

6.075 All testing of underground storage containers shall be administered by qualified persons approved by the Fire Department which shall be notified prior to administering a test. The owner of an underground storage container shall, within one week of their receipt, supply to the head of the Fire Department a certified copy of all test results. The head of the Fire Department shall keep this copy with the records of that storage facility.

6.076 Except for testing performed on a tank and its piping prior to their being covered, a tank shall be tested by any final or precision test not involving air pressure which can accurately detect a leak of 0.05 gallon per hours or less after adjustment for relevant variables such as temperature change and tank end deflection, and which has been approved by the Marshall. Piping deflection shall be tested hydrostatically to 150% of the maximum anticipated pressure of the system.

6.077 The head of the Fire Department may require the owner of any existing tank to have it and its piping tested, at the owner's expense, in any case in which the owner has failed to make a timely application for a permit as required under Section 6.05.

6.078 If any of the testing specified in this subsection discloses a leak, the owner of the storage container shall immediately comply with the requirements of Sections 6.07 and 6.08 of this bylaw. If any owner fails or refuses to complete a required test, the Fire Department may require repair or removal of the container.

6.08 Report of Leaks or Spills

Any person who is aware of any spill or loss of a toxic or hazardous material shall report such spill or loss immediately to the head of the Fire Department.

6.09 Removal or Repair of Underground Storage Tanks of Volumes Less Than 1,100 Gallons

6.091 All leaking storage containers affected by this bylaw must be emptied by the owner or operator within 24 hours of leak detection and removed or repaired by the owner or operator as specified by the head of the Fire Department in consultation with the Board of Health.



6.092 No underground storage container affected by this bylaw shall be removed, or repaired unless the Fire Department has issued written instruction to protect public health and safety during the removal or repair, or unless the head of the Fire Department or Board of Health determine that an emergency exists.

6.093 All underground storage containers affected by this bylaw which the owner has decided to take out of service for a period of less than six (6) months shall promptly notify the Fire Department of the decision and, subject to their direction, have all the product and vapors removed from the container. Before any such container may be restored to service, the owner shall notify the Fire Department which may require that the owner have the container tested, at the owner's expense. Any owner of a container affected by this bylaw which has been or will be out of service for a period of greater than six (6) months shall, subject to the directions of the head of the Fire Department, have the container removed or filled with inert material, and have the fill pipe removed or capped with concrete.

6.010 Enforcement

6.101 The Fire Department and its agents may enter upon privately-owned property for the purpose of performing their duties under this bylaw.

6.102 Any person who violates any provision of this bylaw shall be punished by a fine of not more than \$300. Each day or portion thereof during which a violation continues shall constitute a separate offense. If more than one, each condition violated shall constitute a separate offense. Upon request of the Fire Department and Town Council shall take such legal action as may be necessary to enforce this ordinance.

6.011 Costs

In every case the owner shall assume responsibility for cost incurred necessary to comply with this ordinance. The owner shall be responsible for all costs of recovering and properly disposing of any product that has leaked and for all costs of restoring the environment, including groundwater and surface water to an acceptable condition. The Fire Department may charge the owner for expenses incurred in the enforcement of the bylaw.

6.12 Variances

6.121 The Fire Department may vary the application of a provision of this bylaw, unless otherwise required by law, in any case when, in its opinion, the applicant has demonstrated that an equivalent degree of environmental protection required under this bylaw will still be achieved.

6.122 In granting a variance, the Fire Department will take into consideration the direction of the groundwater flow, soil conditions, depth to groundwater, size, shape and slope of the lot, and existing and future water supplies.

6.123 Any denial of a variance shall be in writing and shall contain a brief statement of the reasons for the denial.

6.13 Severability

The invalidity of any provisions of this bylaw shall not affect the validity of the remainder.

MODEL UNDERGROUND STORAGE TANK ORDINANCE
(Based on a Barnstable, Massachusetts Model Ordinance)

FUEL, STORAGE TANK REGULATIONS

Whereas, leaking underground storage tanks pose an immediate and serious threat to Cape Cod's sole source aquifer, and Whereas the Town of ___ does not have records to locate all such tanks in the Town, Therefore under Chapter III, Section 31, of the Massachusetts General Laws, the _____ Board of Health hereby adopts the following (revised) regulation to protect the ground and surface waters from contamination with liquid toxic or hazardous materials.

DEFINITIONS

"Toxic or hazardous materials shall be defined as all liquid hydrocarbon products including, but not limited to, gasoline, fuel and diesel oil, and any other toxic or corrosive chemicals, radioactive materials or other substance controlled as being toxic or hazardous by the Division of Hazardous Waste of the Commonwealth of Massachusetts, under the provisions of Massachusetts General Laws, Chapter 21C, Section 1, et. seq.

The following regulations apply to all toxic or hazardous material storage systems:

1.0 **Installation of Storage Tanks**

- 1.1 Following the effective date of this regulation, the installation of all underground fuel, gasoline or other chemical storage tanks shall conform with the following criteria: In that the United States Environmental Protection Agency designated the Town of _____ as overlying a sole source aquifer, secondary containment of tank and piping and an approved in-tank or interstitial space monitoring system shall be required for new or replacement tanks.
- 1.2 Following the effective date of this regulation, all tanks installed aboveground outside shall be of material approved for outside use.

2.0 **Tank Registration**

The following regulations shall apply to all underground tanks containing toxic or hazardous materials, as defined above, which are not currently registered under 527 CMR 9.26 - Tanks and Containers (tanks storing fuel oil for consumptive use on the premises, and farm and residential tanks of 1,100 gallon capacity or less used for storing motor fuel for noncommercial purposes.)

- 2.1 Owners shall file with the Board of Health, on or before _____, the size, type, age and location of each tank, and the substance stored in them. Evidence of date of purchase and installation, including fire department permit, if any, shall be included along with a sketch map showing the location of such tanks on the property. Upon registering the tank with the Board of Health, the tank owner will receive a permanent metal or plastic tag, embossed with a registration number unique to that tank. This registration tag must be affixed to the fill pipe or in a location visible to a distributor filling the tank and to any inspector authorized by the Town.
- 2.2 Effective _____, every petroleum and other chemical distributor, when filling an underground storage tank, shall note on the invoice or bill, the registration number appearing on the tag affixed to the tank which was filled. Every petroleum and other chemical distributor shall notify the Board of Health of the existence and location of any unregistered or untagged tank which they are requested to fill. Such notifications must be completed within two (2) working days of the time the distributor discovers that the tank registration tag is not present.
- 2.3 Prior to the sale of a property containing an underground storage tank, the fire department must receive from the current owner a change of ownership form for the registration of the underground storage tank. Such form can be obtained from the fire department.

3.0 **Testing**

- 3.1 The tank owner shall have each tank and its piping tested for tightness fifteen (15) years after installation and annually after twenty (20) years. Tests shall be by any final or precision test, not involving air pressure, that can accurately detect a leak of 0.10 gal/hr, after adjustment for relevant variables, such as temperature change and tank end deflection, or by any other testing system approved by the Board of Health, as providing equivalent safety and effectiveness. Certification of the testing shall be submitted to the Board of Health by the owner, at the owner's expense.



Those tanks subject to the testing requirement of this regulation shall submit the certification of testing to the Board of Health by _____. Tanks which are currently tested under the provisions of 527 CMR 9.13 are exempt from this section.

4.0 Maintenance of Fuel Storage Systems

- 4.1 All underground fuel lines which do not have secondary containment shall be replaced with an approved double-containment system at which time any service to the system requiring a permit is performed.
- 4.2 All above-ground elements of a fuel storage system shall be maintained free of leaks and visible rust.
- 4.3 All in-tank or interstitial-space monitoring systems shall be checked on a monthly basis to verify system integrity. Records of these checks shall be sent to the Board of Health annually.

5.0 Report of Leaks or Spills

- 5.1 Any person who is aware of a spill, loss of product, or unaccounted for increase in consumption which may indicate a leak shall report such spill, loss or increase immediately to the head of the fire department and to the Board of Health.

6.0 Tank Removal

- 6.1 All underground fuel, gasoline or other chemical tanks not registered under 527 GMR 9.26 (farm or residential tanks of 1,100 gallons or less and underground tanks storing fuel for consumptive use at the property) in service on the effective date of this regulation, shall be removed thirty (30) years after the date of installation. If the date of installation is unknown, it shall be assumed to be ____ (20 years after effective date of regulation). All underground storage tanks currently subject to the removal regulation must be removed by _____.
- 6.2 Prior to the removal of an underground storage tank governed by this regulation, the owner shall first obtain a permit from the head of the fire department, pursuant to M.G.L., C. 148.
- 6.3 Any person granted a permit by the Marshal or head of a local fire department to remove a tank under the provisions of M.G.L., C. 148 or 527 CMR 9.00, shall, within 72 hours, provide the permit granting authority with a receipt for delivery of said tank to the site designated on the permit.
- 6.4 Before any person is granted a permit by the Marshal or the head of a local fire department to remove a tank, under the provisions of M.G.L., C. 148 or 527 CMR 9.00, and said tank is not being transported to an approved tank yard, the person requesting the permit shall provide the permit-granting authority with written approval from the owner/manager of the disposal site.

7.0 Costs

- 7.1 In every case, the owner shall assume the responsibility for costs incurred necessary to comply with this regulation.

8.0 Variances

- 8.1 Variances from this regulation may be granted by the Board of Health after a hearing at which the applicant establishes the following:
 - 1. the enforcement thereof would do manifest injustice; and
 - 2. installation or use of an underground storage tank will not adversely affect public or private water resources. In granting a variance, the Board will take into consideration the direction of the ground water flow, soil conditions, depth to ground water, size, shape and slope of the lot, and existing and known future water supplies.

9.0 Enforcement

- 9.1 Any owner or operator violating any provision of this regulation shall be subject to the penalties provided under M.G.L. Ch. 111 s. 31, as amended. Each day during which the violation occurs shall constitute a separate offense. Upon request of the head of the fire department or the Board of Health, the licensing authority and the town counsel shall take any legal action as may be necessary to enforce the provisions of this regulation.

10.0 Severability

10.1 Provisions of this regulation are severable and if any provision hereof shall be held invalid under any circumstances, such invalidity shall not affect any other provisions or circumstances.



TABLE D.1 - EXISTING MUNICIPAL BYLAWS

Table D.1 lists Massachusetts communities that have enacted various bylaws/ordinances and regulations to prevent or reduce nonpoint source pollution as of December 1991 (DWS, 1991). Contact the community for more information on specific bylaws that may be applicable to your community.

REFERENCES:

Primary reference: **Ch. 40, and Ch. 40A** Bylaw file at the office of the Attorney General, Commonwealth of Massachusetts.

Secondary reference: CONEG (Coalition of Northeast Governors), survey completed by DEP, 1987 and updated 1989.

OTHER SOURCES:

Regional Planning Agencies' Water Protection Matricies as submitted with 1991 205(j) applications.

DWS/TS TAP files, legal files, and personnel.
Laidlaw's compiled BoH Regulations.

Compiled by DWS/TS Analyst Ron Stelline, 1991. Please contact DWS at (617) 292-5859 with corrections, updated information, or comments.

KEY and FOOTNOTES to the Water Supply Protection Matrix for the Commonwealth of Massachusetts

KEY: EXAMPLE: Status (Authority) <Special Note>, Fine/Fee

TOWN FOOTNOTES:

- P - The town/city uses only private water supplies.
- S - EPA designated Sole Source Aquifer
(may only include portion of town/city)

Status:

- Y - yes
- N - no
- ? - unknown
- N/A - Not Applicable

Authority:

The Massachusetts General Laws are cited by chapter:

- G - denotes MGL 40, general bylaw
- Z - denotes MGL 40A, zoning bylaw
- H - denotes MGL 111, Board of Health regulation
- C - denotes MGL 130, coastal wetlands conservation
- I - denotes MGL 131, in-land wetlands conservation

Fee: f - denotes a fee for registration, etc.

Fine: F - denotes a fine associated with non-compliance

SPECIAL NOTES:

- i - The town/city has filed a Vulnerability Assessment Questionnaire Emergency Plan (Form G) with the DWS.

Year/Pre - The Open Space Plan (OSP) is outdated; in some cases the date of the OSP in effect is cited (e.g. Y <'89>).

Well/Water Supply Regulations Special Notes:

- W - Well Regulations
- wp - Well Protection
- nw - New Well Regulations
- s - Water Supply Regulation
- e - Groundwater Elevation Regulations

TABLE D.1 - Water Supply Protection Matrix for the Commonwealth of Massachusetts (Updated to December 10, 1991)

TOWN NAME	Groundwater Protection District	Watershed Protection District	Floodplain District Bylaw	Wetlands Protection District	Toxic & Hazardous Materials	Underground Storage Tanks	Earth Removal/Erosion Control	Env. Impact Analysis for Major Dev.	Spill Response Plan	Contingency Plan / Water Emergencies	Open Space Plan	Regional Protection Committee	Title 5 Revisions/ Amendment	Private Well/ Water Sup. Regulations	Other Regulations
Abington	Y	N	Y(Z)	Y(Z&I)	N	Y(G),f	Y(Z)	N	N	?	?	?	Y		Road Salt Res., Mand. Sewer Hookup
Acton	Y(G,Z,H)	N/A	Y(Z)	Y(G)	Y(G),f	Y,fF	Y(G)	?	?	Y<i>	Y(G&Z)	?	Y	Y<e>	
Acushnet	N	N	?	N	?	N	Y	Y	?	?	Y<'88>	Y	?		
Adams	?	N	Y(Z)	N	N	N	Y(Z)	N	?	Y<i>	N	Y	N		
Agawam	N/A	?	N	N	?	?	N	?	?	?	?	?	Y		
Alford(P)	Y	N/A	?	?	?	?	?	?	?	?	?	?	Y	Y<w>	2 Acre Zoning
Amesbury	N	Y(G)	Y(Z)	Y(G)	N	Y(G)	Y(Z)F	N	N	Y	?	?	Y		Herbicide/Pesticide Ban (H)
Amherst	Y(Z)	Y(Z)	Y(Z)	Y(Z)F	Y	Y(Z&H)F	Y(Z)	?	?	?	?	Y	Y		Herbicide Use Regulations (H),F
Andover	N/A	Y	Y(Z)	?	Y	Y	Y(Z)	Y	Y	?	?	Y	N	Y<w>	
Arlington	N/A	?	Y(Z)	Y(Z)	?	?	Y(Z)	?	?	?	?	?	?		
Ashburnham	N/A	Y(Z)	Y(Z)	Y(Z)	N	N	Y(G&Z)	N	N	Y<i>	?	N	Y	Y<w>	
Ashby	N	N/A	?	?	Y(G)	N	?	N	N	?	?	Y	?	Y<wp>	2 Acre Zoning
Ashfield	?	?	?	?	Y(G),fF	N	Y(Z)	Y	?	?	?	?	Y	Y<w>	
Ashland	?	N/A	Y(Z)	?	N	N	?	N	?	?	?	?	N	Y<s>	
Athol	N	?	Y(Z)	?	Y	Y	?	N	?	?	?	?	?	Y<w>	
Attleboro	Y(G)	N	Y	?	Y	Y	Y	?	?	Y<i>	N	N	?		
Auburn	Y(Z)	N	Y(Z)	Y(G&I)	Y(G)	Y(G),f	Y	Y	?	Y<i>	?	?	Y	Y<w>	
Avon	Y(Z)	N/A	Y(Z)	Y	N	Y(G),F	Y(Z)	N	N	?	N	N	Y		Salt Use Controls
Ayer	N	N/A	Y(Z)	?	N	Y	Y(G)	N	?	Y<i>	?	Y	?		
Barnstable	Y(G&Z)	Y(Z)	Y(Z)	Y(G&C)	Y(G&Z)	Y(Z&H)	Y(G)	?	?	Y<i>	Y(G)	Y	?	Y<w>	Herbicide Use Regulations (H)
Barre	N	N	Y(Z)F	Y(G),fF	Y,fF	?	?	Y	?	Y<i>	?	?	Y		
Becket	?	N/A	?	?	?	?	?	Y	?	?	?	?	?		
Bedford	?	?	Y(Z)	Y(G,Z,I)	Y(G),F	Y(G)F	Y(Z)	?	?	?	?	?	?	Y<w>	
Belchertown	Y(Z)	N/A	Y(Z)	Y(Z)	Y(G)	?	Y	?	?	Y<i>	?	Y	?		Road Salt Policy Statement
Bellingham	Y(Z)	Y(Z)	Y(Z)	N	Y(Z)	N	Y(Z)	?	?	Y<i>	Y<Pre>	N	?		Water Resources District
Belmont	N/A	?	Y(Z)	?	?	Y(G)f	?	?	?	?	?	?	?		
Berkley(P)	N	N/A	?	N	Y	Y(G)F	Y(G)	?	?	?	N	N	?		
Berlin	N/A	N/A	Y(Z)	?	Y	?	Y	Y	?	?	?	?	Y	Y<w>	
Bernardston	Y	N/A	Y(Z)	?	?	?	Y	Y	Y	Y<i>	Y	?	?	Y<w>	
Beverly	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Billerica	N/A	N	Y(H&Z)	Y	N	Y	Y(Z)	N	N	N	Y<Pre>	N	?		
Blackstone	Y(Z)	N/A	Y(Z)	Y(G)	Y(Z)	?	Y(G)f	Y	?	?	?	?	Y		Watercourse Setbacks (H)
Blandford	N/A	Y(Z)	N	?	Y(Z)	?	N	?	?	?	?	?	?		
Bolton(P)	Y(Z&G)	N/A	Y(Z&G)	?	?	Y(G&H)	?	?	?	?	?	?	Y	Y<e>	2 Acre Zoning
Boston	N/A	?	?	?	?	?	?	?	?	Y<i>	?	?	?		
Bourne(S)	Y(Z)	N/A	?	Y(GC&I)	Y(Z&H)	Y(G&H)	?	?	?	Y<i>	?	?	?		Wtrcrse, Stbck(Z), Herb/Pest Regs(H)
Boxborough	Y(Z)	N/A	Y(Z)	Y(G&Z)	Y(Z)	Y(Z)	Y(G)	?	?	?	?	?	?	Y<w>	
Boxford	N	N/A	Y(Z)	Y(Z)	Y	Y(H)	Y	Y	N	N	Y<Pre>	N	?	Y<s>	2 Acre Zoning
Boylston	Y(Z)	N	Y(Z)	?	?	Y(G)	Y(G)	Y	?	Y<i>	?	?	Y		
Braintree	N/A	Y(Z)	Y(Z)	Y(Z)	Y(G),f	Y(Z)	?	N	Y(G)	?	?	Y(Z)	?	N	Y<s>
Brewster(S)	Y(Z)	N/A	Y(Z)	Y(GZ&C)	N	Y(H)	N	Y	Y	Y<i>	Y	Y	Y	Y<w>	
Bridgewater	Y(Z)	N/A	Y(Z)	Y	N	N	N	N	N	?	Y	N	Y		Mandatory Sewer Hookup
Brimfield	?	N/A	Y	?	?	?	?	?	?	?	?	?	?		
Brockton	N	N	Y(Z)	Y(Z)	N	N	N	N	N	?	?	?	?		
Brookfield	N	N/A	Y(Z)	N	N	N	N	N	N	N	N	N	?		
Brookline	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Buckland(P)	?	N/A	Y(Z)	?	N	N	Y	?	Y	?	Y	Y	N		
Burlington	Y(G&Z)	Y(Z)	Y(H&Z)	Y(G,I,Z)F	Y(G&H)	Y(G)	Y(G)	?	?	?	?	?	?		Pesticide Use Regulations(Z)
Cambridge	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Canton	?	Y	?	Y(G)	Y(G),fF	Y(G)f	?	?	Y(G)	?	?	?	?	Y<s&wp>	
Carlisle(P)	?	N/A	Y(Z)	Y(Z)	?	?	Y(G)	?	?	?	?	?	Y		
Carver(S)	N	N/A	Y(Z)	Y(G&Z)	?	?	Y(Z)	?	?	Y<i>	Y<'86>	N	?	Y<w>	

TABLE D.1 - Water Supply Protection Matrix for the Commonwealth of Massachusetts (Updated to December 10, 1991)

TOWN NAME	Groundwater Protection District	Watershed Protection District	Floodplain District Bylaw	Wetlands Protection District	Toxic & Hazardous Materials	Underground Storage Tanks	Earth Removal/Erosion Control	Env. Impact Analysis for Major Dev.	Spill Response Plan	Contingency Plan / Water Emergencies	Open Space Plan	Regional Protection Committee	Title 5 Revisions/ Amendment	Private Well/ Water Sup. Regulations	Other Regulations
Charlemont	?	?	?	?	?	?	?	?	?	?	?	?	?		
Charlton	N	N/A	Y	Y	Y(G)	Y	Y(G)fF	Y	?	Y<i>	?	?	Y		
Chatham(S)	N	N/A	Y(Z)	Y(Z,C,I)	Y	Y(H)	N	?	Y	N	Y	Y	?	Y<w>	Herbi/Pesticide Regulations(H)
Chelmsford	N	N/A	Y(Z)	Y(G)	Y(G)	Y(G)f	Y(G)	Y	N	Y<i>	Y<Pre>	N	?		
Chelsea	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Cheshire	?	N	Y(Z)	N	Y(Z)	?	Y	N	?	?	N	Y	?		
Chester	?	?	?	?	?	?	?	?	?	?	?	?	N		
Chesterfield(P)	Y	Y	Y	?	?	?	Y	?	?	?	?	?	?		Westfield River Prot. Dist. (Z)
Chicopee	N	N	Y	?	?	?	Y	?	?	?	?	?	N		
Chilmark(S)	N	N	N	Y(Z&C)f	N	Y	N	Y	Y	N	Y	N	?		Dist. of Critical Planning Concern (Z)
Clarksburg	N	N/A	Y	N	N	N	Y	N	?	Y<i>	N	N	?		
Clinton	N/A	?	Y(Z)	?	Y	N	Y(Z)	N	?	?	?	?	?		
Cohasset	Y	Y(H&Z)	Y(H&Z)	Y(C)	?	Y(H)fF	?	?	?	?	?	?	Y(H)		
Colrain	?	?	Y(Z)	?	?	?	Y(Z)	?	Y	?	Y	?	?		
Concord	Y(G&Z)	Y(G)	Y(Z)	Y(Z)	Y(H)F	?	Y(Z)	?	?	?	?	?	?		
Conway(P)	?	?	Y(Z)	?	?	?	?	?	?	?	?	?	?	Y	Road Salt Policy Statement
Cummington	Y	N/A	Y	?	Y	Y	N	?	?	?	?	?	?		
Dalton	N/A	N	Y(Z)	N	Y(G&Z)	?	Y(Z)	N	?	Y<i>	N	N	Y	Y<w>	
Danvers	?	Y(Z)	Y(Z)	Y(G),f	Y(G)	Y(G)f	?	?	?	?	?	?	?	Y<w>	
Dartmouth	Y(G&Z)	Y(G&G)	Y(G&Z)	Y(G,Z,I)	Y	Y(Z)f	Y(G)	?	Y	?	N	N	?		
Dedham	Y(G)	Y(G)	Y(Z)	Y(G&I)	?	?	?	?	?	?	?	?	N		
Deerfield	?	Y(Z)	Y	Y	Y	?	?	?	Y	Y<i>	Y	?	Y		Herbi/Pesticide Regulations(H)
Dennis(S)	Y(Z&H)	N/A	N	Y(G&C)	Y(H)F	Y(H)	Y(G)F	Y	Y	N	Y	Y	?		
Dighton	N	N	Y(Z)	N	N	?	Y	?	?	Y<i>	N	N	N		Deoilants Regulation (H)
Douglas	Y(G)	N/A	Y(G)	Y(G)	?	?	Y(Z)	Y	?	?	?	?	Y	Y<a>	
Dover(S)	Y(Z)	N/A	?	Y(C)	N	Y(H)	?	?	?	Y<i>	Y<Pre>	Y	?	Y<w>	
Dracut	Y(Z)	N/A	Y(Z)	Y(Z)	?	N	Y(Z)	Y	N	N	N	N	?		Pub. Water Sup. Hookup Moratorium
Dudley	N	N/A	Y(Z)	Y	?	?	?	?	Y	?	?	?	Y	Y<w>	
Dunstable	N	N/A	Y	Y(G)	Y	N	Y	N	N	N	Y	N	Y		
Duxbury	Y(G&Z)	N/A	?	Y(G&C)	?	?	Y(G)	?	?	?	?	?	Y	?	
East Bridgewater	Y(Z)	N/A	Y(Z)	Y(Z)	N	?	Y(G)	N	N	?	?	?	Y		
East Brookfield	N	N/A	Y(Z)	?	?	?	Y	?	?	?	?	?	?		
East Longmeadow	N/A	N	Y(Z)	N	Y	N	Y(Z)	?	?	Y<i>	?	?	?		Road Salt Limit Bylaw (G)
Easthampton	Y(Z)	N/A	Y(Z)	N	?	Y	?	?	?	Y<i>	?	Y	?		Herbi/Pesticide Regulations(H)
Eastham(P&S)	Y(G)	N/A	Y(Z)	Y(C&I)	Y(G&H)	Y(H)	Y	Y	Y	N	Y	Y	?	Y<w>	Road Salt Restrictions
Easton	Y(Z)	N/A	Y(Z)	Y(G)	Y	Y(Z)	N	Y	Y	?	?	Y	Y		Zoning for Crit. Plan. Concern
Edgartown(S)	Y(H)	Y(Z)	Y(Z)	Y(G&C)	Y(H)	Y(H)	N	Y	Y	N	N	N	?	Y<w&wp>	Stream & Pond Protection
Egremont	N/A	N	Y(Z)	N	N	N	Y	N	N	N	N	N	?	Y<w>	
Erving(P)	N	N/A	?	?	Y(G),fF	Y	?	?	?	?	?	Y	Y	Y<w>	
Essex	Y(Z)	N/A	Y(Z)	Y(C)	?	?	Y(G)	?	?	?	?	Y	Y		
Everett	N/A	?	?	?	?	?	?	?	?	?	?	?	N		Pesticide Regulations(H)
Fairhaven	Y	N/A	Y(Z)	Y(G)	Y	Y(G)f	Y(Z)	?	?	Y	Y<'89>	Y	?		
Fall River	N/A	Y	N	N	N	N	N	?	?	Y<i>	Y	N	?		Density Limit(Z), Areas of Env. Concern
Falmouth(S)	Y(Z)	Y(Z)	Y(Z)	Y(G,Z,C),f	?	Y(Z&H)	?	?	?	?	?	?	Y		
Fitchburg	N/A	Y(Z&H)	?	?	N	N	?	Y	Y	?	?	?	Y	?	
Florida(P)	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Foxborough(S)	Y(Z)	N/A	Y(G)	Y(G&I)	Y(G)F	Y(G)F	Y(G&Z)F	?	?	Y<i>	?	Y	Y		Vinyl Chloride Storage Controls (G)
Framingham	?	?	Y(Z)	?	?	?	?	?	Y	Y<i>	?	?	Y		
Franklin	Y(Z)	N/A	Y(Z)	?	Y(H&Z)	?	?	?	?	?	?	?	Y	Y<w>	
Freetown	N	Y(Z)	Y(Z)	Y(G)	Y	N	Y	?	?	?	N	N	?		
Gardner	N/A	?	?	?	N	N	?	Y	?	Y<i>	?	?	?		
Gay Head(P)	N	N	Y(Z)	Y(C)	N	N	Y	Y	Y	N	N	N	N		Road Salt Limitations
Georgetown	Y	N/A	Y(Z)	Y(G&I)	Y(G)F	Y(G&H)	Y(G)	Y	N	N	Y<Pre>	N	?	Y<w>	

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Gill	?	N/A	Y(Z)	?	Y	Y	?	?	Y	?	?	?	Y	Y<w>	
Gloucester	N/A	?	?	?	?	?	?	?	?	?	?	?	Y	Y<w>	Road Salt Policy Statement
Goshen(P)	N	N	N	N	N	N	?	?	?	?	?	?	?	Y<w>	
Gosnold	?	N/A	Y(Z)	?	?	?	?	?	?	?	?	?	N	Y<w>	
Grafton	Y(Z)	N/A	Y(Z)	N	Y	?	Y(G)	Y	?	?	?	?	Y	Y<w>	Road Salt Policy Statement
Granby	Y	N/A	Y(Z)	Y(Z)	?	?	Y(Z)	?	?	Y<i>	?	?	Y	Y<w>	
Granville	N	N	N	N	N	N	N	?	?	Y<i>	?	?	?	Y<s>	
Great Barrington	Y	N	Y(Z)	Y(Z)	?	N	Y	N	Y	Y	N	Y	Y	Y<s>	
Greenfield	Y(Z)	Y(Z)	Y(Z)	?	Y(H)F	Y(H)F	Y	?	Y	Y	Y	?	N		Herbicide Regulations(H)
Groton	Y(Z)	N/A	Y(Z)	Y(G)	Y(G&H)F	Y(G,Z,H)F	?	Y	?	?	?	?	?	Y<w>	
Groveland	Y(Z)	N/A	Y(Z)	N	Y(H)	Y(H)	Y(G)	Y	N	N	Y<'74>	Y	?		
Hadley	Y(Z)	N	Y(Z)	?	?	Y(G)f	Y	?	?	Y<i>	?	?	?		Watershed Building Moratorium
Halifax	N	N/A	Y(Z)	Y	N	N	N	N	N	?	?	?	Y	Y	
Hamilton	Y(Z)	N/A	Y(G)	Y(G)	?	?	?	?	?	?	?	Y	?	?	
Hampden	N	N/A	Y(Z)	Y(Z)	N	N	Y(Z)	?	?	?	?	?	?	?	
Hancock	?	N/A	?	?	?	?	?	Y	?	?	?	?	?	?	
Hanover	Y(G&Z)	N/A	Y(Z)	Y(G,Z,C)	?	Y(G,Z,H)	Y(G)	?	?	?	?	?	?	Y(Z)<wp>	Herbi/Pesticide Regulations(G)
Hanson	Y(Z)	N/A	Y(Z)	Y	Y	?	Y	?	?	Y<i>	?	?	Y	Y(Z)<wp>	
Hardwick	N	N/A	Y(Z)	?	?	Y	?	?	?	Y<i>	?	?	?	?	
Harvard	Y(Z)	N/A	Y(Z)	Y(Z&I)	Y	Y(H),fF	?	N	Y	Y<i>	?	?	?		Herbi/Pesticide Regulations(H)
Harwich(S)	Y(Z)	N/A	N	Y(G&I),F	N	Y(H)	N	Y	Y	Y<i>	?	N	Y	Y<w>	
Hatfield	Y	Y(Z)	Y(Z)	N	Y	Y	N	?	?	?	?	Y	?	?	
Haverhill	N/A	?	Y(Z)	?	Y(G)	Y(G)	?	Y	N	Y<i>	?	?	N	?	
Hawley(P)	?	?	?	?	Y(Z)	?	?	?	?	?	?	?	?	?	
Heath(P)	?	?	?	Y	?	?	Y(Z)	?	?	?	?	?	?	?	
Hingham	Y(G)	Y(Z)	Y(Z)	Y(G&I)	?	?	Y(Z)	?	?	Y<i>	?	Y	Y	?	
Hinsdale	N/A	N	N	N	N	N	Y	N	?	Y	N	N	?	?	
Holbrook	N/A	N	Y(G)	?	Y(G)fF	Y(G)f	?	N	?	?	N	?	?	Y<w>	
Holden	Y(Z&G)	N	Y(Z)	Y	Y(G)fF	Y(G)fF	Y(G)	Y	?	?	?	?	Y	?	
Holland(P)	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Holliston	Y(G&Z)	N/A	Y(Z)	Y(G,Z,I),F	N	Y(Z)	Y(G)	?	?	?	Y<Pre>	N	?	Y<s>	
Holyoke	Y(Z)	Y(Z)	Y(Z)	N	?	?	Y	?	?	Y<i>	?	?	?	?	
Hopedale	N	N	Y(Z)	?	?	?	Y(G)	?	?	Y<i>	?	?	?	?	
Hopkinton	Y(Z)	N/A	Y(Z)	Y(Z)	?	?	Y(G)	?	?	Y<i>	?	?	Y	Y<nw>	
Hubbardston	Y	N/A	?	?	Y(G)	N	?	Y	?	?	?	?	Y	?	
Hudson	Y	Y(Z)	Y(Z)	Y(Z)	Y(G)	Y(G)	Y	?	?	?	?	Y	N	?	
Hull(P)	?	?	Y(Z)	?	?	?	?	?	?	?	?	?	?	?	Conservancy Buffer District
Huntington	Y	Y	Y	?	?	?	Y(Z)	?	?	?	?	?	?	?	
Ipswich	Y(Z)	Y(Z)	Y(Z)	Y(Z&C)	Y(G&Z)	Y(G)	Y(Z)	?	?	?	?	?	Y	Y<e>	Watershed Building Moratorium
Kingston	Y(Z)	N/A	Y(Z)	Y(G&I)	N	?	Y	N	N	?	?	N	Y	Y<s>	
Lakeville	Y(Z)	N/A	Y(Z)	N	Y	Y	Y	?	?	Y<i>	N	N	?	Y<w>	River Protection Regulations (Z)
Lancaster	Y(Z)	N/A	Y(Z)	?	?	?	?	N	?	Y<i>	?	?	?	?	
Lanesboro	?	N/A	Y(Z)	Y	Y(Z)	Y(H)fF	Y	N	?	Y<i>	N	?	?	Y<w>	
Lawrence	N/A	?	?	?	N	N	?	N	N	Y<i>	?	?	N/A		Stream & Pond Protection
Lee	N/A	N	Y(Z)	N	?	N	Y(Z)	N	?	Y<i>	N	N	Y	Y<w>	
Leicester	Y(Z)	Y(Z)	Y	Y(G&I)	?	?	?	?	?	Y<i>	?	?	?	?	
Lenox	N/A	Y	Y(Z)	N	?	N	Y(G)	N	?	Y<i>	N	N	?	?	
Leominster	Y(Z&H)	Y(H)	?	?	Y	Y(Z)	?	Y	?	?	?	?	?	Y<w>	Stream & Lake Protection District(Z)
Leverett(P)	Y(Z)	Y	Y(Z)	?	Y	Y	Y(Z)	Y	Y	?	?	?	Y	Y<w>	Herbi/Pesticide Regulations(H)
Lexington	N/A	?	Y(Z)	Y(G&Z)	?	?	Y(G)	?	?	?	?	?	?	?	
Leyden(P)	?	?	?	?	?	?	?	Y	Y	?	Y	?	N	?	
Lincoln	Y(Z)	Y(Z)	Y(Z)	Y(G&Z)	?	Y(G)f	?	?	?	?	?	?	?	?	
Littleton	Y(Z)	N/A	Y(Z)	Y(Z)	Y(G)	Y(G,Z,H)	?	?	?	?	?	?	Y	Y<w>	

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Longmeadow	N/A	N	Y(Z)	Y(G)	?	?	Y(Z)	?	?	?	?	?	N		
Lowell	N/A	N	Y	Y(Z)	N	N<ii>	Y	N	N	Y<i>	Y<Pre>	N	N		Mandatory Sewer Hookup (H)
Ludlow	N/A	N	Y(Z)	N	N	Y(G)f	Y	?	?	?	?	?	?		2 Acre Zoning
Lunenburg	Y(Z)	N/A	Y(Z)	Y(G)	N	N	Y(G)	Y	?	Y<i>	?	?	Y	Y<w>	
Lynn	N/A	?	?	?	?	?	?	?	?	?	?	?	Y		
Lynnfield	?	?	Y(Z)	?	?	Y(G)f	Y(Z)	?	?	Y<i>	?	?	?		
Malden	N/A	?	?	?	?	?	?	?	?	?	?	?	N		
Manchester	Y(Z)	Y(Z)	Y(Z)	?	Y(H)	Y(Z)	Y(G&Z)	?	?	?	?	Y	Y		Waterbody Setback
Mansfield	Y(Z)	Y(Z)	Y	Y(Z&I)	Y	Y(Z)	Y(Z)	?	?	Y<i>	Y	Y	?		
Marblehead	N/A	?	Y(Z)	?	?	?	Y(G)	?	?	?	?	?	N		
Marion	Y(Z)	N/A	Y(Z)	Y(C)	Y	Y	Y	?	?	Y<i>	Y<'88>	Y	?		
Marlboro	N/A	?	Y(Z)	Y(Z&I)	?	?	Y	?	?	Y<i>	?	?	?		
Marshfield	Y(Z)	N/A	Y(Z)	Y(G,Z,I)	?	Y(G)	Y(G)	?	?	?	?	Y	?	Y<w>	Herbi/Pesticide Regulations(H)
Mashpee(S)	Y(Z&H)	N/A	Y(Z)	Y(G&Z)	Y(H)	Y(H)	?	?	?	Y<i>	?	?	?	Y<e>	Building in Wetlands Regs. (H)
Mattapoisett	Y(Z)	N/A	Y(Z)	N	Y	Y(H)	Y(G)	?	?	?	Y<'88>	Y	?		
Maynard	?	?	?	?	Y(G),fF	Y(G),fF	?	?	?	?	?	?	?		
Medfield(S)	Y(Z)	N/A	Y(Z)	Y(G&I)	?	Y(G)	Y(Z)	?	?	?	?	?	?	Y<s>	
Medford	N/A	?	?	?	?	?	?	?	?	Y<i>	?	?	N		
Medway	N	N/A	Y(Z)	Y(Z)	N	Y(G)	?	?	?	Y<i>	N	N	?		
Melrose	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Mendon	?	N/A	Y(Z)	Y(G),f	?	?	Y(G)F	?	?	Y<i>	?	?	Y		
Merrimac	Y(Z)	N/A	Y	N	N	N	Y(Z)	?	N	N	N	N	?		
Methuen	N/A	Y	Y(Z)	?	?	Y	?	?	?	?	?	?	N		
Middleborough(S)	Y(Z)	N/A	Y(Z&H)	Y(Z&I)	N	Y(G)F	Y(G)	Y	?	Y<i>	N	N	?	Y<w>	
Middlefield(P)	N	Y	Y	?	?	?	Y	?	?	?	?	?	?		
Middleton	Y(Z)	N/A	Y(Z)	?	?	?	?	?	?	?	?	?	?	Y<s>	
Milford	N	N	Y(Z)	N	Y(H)	Y(G)F	?	?	?	?	Y<Pre>	U	?		Radioactive Wastes Reg (G)
Millbury	Y(Z)	N/A	Y	Y	?	Y(G)F	Y	Y	?	Y<i>	?	?	Y		
Millis	Y(Z)	Y(Z)	Y(Z)	Y(I)	Y(G&H)	Y(G)fF	Y(H)	?	?	?	Y<Pre>	Y	Y	Y<w&s>	
Millville(P)	N/A	N/A	Y	?	?	?	?	?	?	?	?	?	?		
Milton	N/A	?	Y(G)	Y(G)	?	?	?	?	?	Y<i>	?	?	N		
Monroe	N/A	?	?	?	?	?	?	?	?	?	?	?	N		
Monson	Y	N	Y(I)Z	?	Y(Z)	?	Y	?	?	?	?	?	Y		Groundwater Regulations (H)
Montague	N	?	Y(Z)	?	N	N	Y(Z)	Y(Z)	?	Y<i>	?	Y	?	Y<w&e>	Stream & Pond Protection
Monterey	N	N	N	N	N	N	N	N	?	N	N	N	?	Y<w>	
Montgomery	N	N/A	N	N	N	N	N	?	?	?	?	?	?		
Mt. Washington(P)	?	?	?	?	?	?	?	?	?	?	?	?	?		
Nahant	N/A	?	Y(Z)	?	?	?	?	?	?	?	?	?	?		
Nantucket(S)	Y(Z)	N/A	Y(Z)	Y(Z&C)	?	Y(Z&H)	?	?	?	Y<i>	?	?	?		Water Conservation Bylaw
Natick	Y(Z)	N/A	Y(Z)	?	Y(H)	Y(G)	?	Y	?	?	?	Y	Y	Y<w>	
Needham	Y(Z&H)	Y(Z&H)	Y(Z)	Y(G&I)	Y	Y(G,Z&H)f	Y(A)	?	?	?	?	?	?		
New Ashford(P)	?	?	?	?	?	?	?	?	?	?	?	?	?		
New Bedford	N/A	N	N	N	N	N	N	?	?	?	Y<'88>	N	?		
New Braintree(P)	N/A	N/A	?	?	N	N	Y	?	?	?	?	?	?		
New Marlboro	N	N	N	N	N	N	N	N	?	N	N	N	?		
New Salem(P)	?	?	?	?	?	?	?	?	?	?	?	?	?	Y<w>	
Newbury	N	N	Y(Z)	Y(C)	N	Y	?	Y	N	N	N	N	?		
Newburyport	N	?	?	Y(C)	N	?	?	N	N	?	?	?	N		
Newton	N/A	Y(Z)	Y(Z)	Y(I)	?	?	?	?	?	?	?	?	?	Y<w>	
Norfolk	Y(H)	N/A	Y(Z)	Y(Z,G,I)	?	Y(G&H)	Y(G)	?	?	Y<i>	?	Y	Y	Y<w&s>	
North Adams	N/A	N	Y	N	N	N	Y	N	Y	Y	N	N	?	Y<w>	
North Andover	Y(Z)	Y(Z&H)	Y(Z)	Y(Z),f	Y(G)	Y(G)	Y(Z)	N	N	?	?	?	?		
North Attleboro	Y(Z)	N/A	Y	N	Y	N	Y(Z)	?	?	Y<i>	Y<'85>	N	?		

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North Brookfield	N/A	N	N	?	N	N	?	?	?	Y<i>	?	?	Y		
North Reading	Y(Z)	N/A	Y(Z)	Y(Z&I)	Y(G)	Y(H)	Y(G)	?	?	Y<i>	?	?	?		Mineral Removal Controls
Northampton	Y(Z)	Y	Y(Z)	N	?	Y	Y	?	?	?	?	Y	?		
Northborough	Y	N	Y	Y(G&I)	?	?	Y(G)	?	?	Y<i>	?	?	Y		Herbi/Pesticide Regulations (H)
Northbridge	N	N/A	Y	Y(G)	?	?	?	?	?	?	?	?	Y		
Northfield	Y	?	Y(G)	?	Y	?	Y(G)	?	Y	Y<i>	?	Y	?		
Norton	Y(Z)	N/A	Y(Z)	Y(Z)	Y	Y(Z)	Y(Z)	?	?	?	N	Y	?	Y<w>	
Norwell	Y(Z)	N/A	Y(Z)	Y(G,Z,C)	?	Y	?	?	?	?	?	Y	Y		Salt Use Controls
Norwood(S)	Y(Z)	Y(Z)	Y(Z&H)	?	?	?	Y(Z)	?	?	?	?	?	Y	Y<w>	
Oak Bluffs(S)	Y	N/A	Y(Z)	Y(G&C)	Y	Y(G&Z)	N	Y	Y	?	N	N	?		Dist. of Critical Planning Concern (H)
Oakham(P)	N/A	N/A	Y	?	?	?	Y	Y	?	?	?	?	N		
Orange	Y(G)	Y(G)	Y(Z)	?	Y(Z)	Y	Y(Z)	Y	Y	N	Y	?	Y	Y<w>	Herbicide Reg(H), Rest. Grdwtr Use(H)
Orleans(S)	Y(Z)	N/A	Y(Z)	Y(I)	Y(G)	Y(Z&H)	N	N	N	N	Y	N	Y		
Otis(P)	?	N/A	Y(Z)	?	?	?	?	?	?	?	?	?	?		
Oxford	N	N/A	Y(Z)	N	?	?	Y(G)	Y	?	?	?	?	?	Y<w>	
Palmer	Y(Z)	Y(Z)	Y(Z)	Y	?	?	?	?	?	?	?	?	Y		
Paxton	N/A	Y	N	?	?	?	Y	Y	?	Y<i>	?	?	Y		
Peabody	?	?	?	?	?	?	?	?	?	?	?	?	N		Road Salt Policy Statement
Pelham(P)	Y(Z)	Y(Z)	N	Y(G)	?	Y(Z)	Y(G)	?	?	?	?	Y	?	Y<w>	
Pembroke	Y(Z)	N/A	Y(Z)	Y(C)	N	Y(G)f	Y	N	N	?	?	Y	Y		
Pepperell	Y(Z)	N/A	Y(Z)	Y	N	Y	Y(Z)	N	N	N	Y	N	Y		
Peru(P)	N/A	?	?	?	?	?	?	?	?	?	?	?	Y		
Petersham	N	N/A	?	?	N	N	?	Y	?	Y<i>	?	?	?		
Phillipston(P)	N	?	?	?	N	N	Y(Z)	N	?	?	?	?	?		
Pittsfield	N/A	N	Y	N	N	N	Y	N	Y	Y	N	N	N		
Plainfield(P)	N	N/A	N	N	?	?	?	?	?	?	?	?	N		
Plainville	Y(Z&H)	Y(Z&H)	Y	Y(G,Z,C)	Y	Y(H)	Y	?	?	Y	?	N	?	Y<w>	Watershed Building Moratorium
Plymouth(S)	Y(Z)	N	Y	Y(G,Z,C)	N	Y(Z)f	Y	N	N	Y<i>	?	?	Y		Herbi/Pesticide Regulations(H)
Plympton(P&S)	Y(Z)	?	Y(Z)	?	N	N	N	N	N	?	?	N	Y	Y<w>	
Princeton	N/A	N/A	N	?	N	N	?	?	?	?	?	?	Y		Salt Use Controls
Provincetown(S)	?	N/A	?	Y(G&C)	Y(H)	Y(H)	?	?	?	Y<i>	?	?	Y		
Quincy	?	?	?	Y(C)	?	?	?	?	?	?	?	?	?		Herbi/Pesticide Regulations(H)
Randolf	N	Y(Z)	Y(Z)	Y(Z)	?	Y	?	N	?	?	N	?	?		
Raynham	Y	N/A	Y(Z)	Y(G&Z)	Y	Y(G)	Y(Z)	?	?	?	Y<'89>	N	Y		
Reading	Y(Z)	N/A	Y(Z)	Y(Z&I)	?	?	?	?	?	Y<i>	?	?	?	Y<w>	
Rehoboth(P)	Y	N/A	Y	N	N	N	Y	?	?	?	Y	N	?	Y<w&s>	
Revere	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Richmond	?	N/A	Y(Z)	Y(Z)	?	?	?	Y	?	?	?	?	Y		Stippican Riverfront Protection Bylaw
Rochester(P)	N	N/A	Y(Z)	N	N	N	Y(G)	?	?	?	Y<'88>	Y	?		
Rockland(P)	Y(Z)	Y(Z)	?	?	?	?	Y(Z)	?	?	Y<i>	?	?	?		
Rockport	Y(Z)	Y(Z)	Y(Z)	Y(Z)	?	?	Y(Z)	?	?	?	?	?	Y	Y<w>	
Rowe(P)	?	N/A	?	?	?	?	Y(G)	Y	?	?	?	?	?		
Rowley	Y(Z)	N/A	Y(Z)	Y(Z)	N	Y	Y(Z)	Y	N	N	Y<Pre>	N	?	Y<s>	
Royalston	N	N/A	Y(Z)	?	N	N	?	?	?	?	?	N	N		
Russell	?	?	N	N	?	?	Y	?	?	Y<i>	?	Y	N		
Rutland	N/A	Y(Z)	N	N	N	N	Y	?	?	?	?	?	Y		
Salem	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Salisbury	Y(Z)	N/A	Y(Z)	Y(C)	N	N	Y(G)	?	N	?	N	N	?		
Sandisfield	?	?	Y(Z)	?	?	?	?	?	?	?	?	?	Y		Herbi/Pesticide Regulations(H)
Sandwich(S)	Y(Z)	N/A	Y(Z)	Y(G)	Y(Z&H)	Y(Z&H)	Y(Z)	?	?	?	?	?	Y	Y<w&e>	
Saugus	N/A	?	Y(Z)	Y(G)	?	?	?	?	?	?	?	?	?		
Savoy(P)	?	?	?	?	?	?	?	Y	?	?	?	?	Y		Waterways Protection Bylaw (G)
Scituate	Y(Z)	Y(Z)	Y(Z&H)	Y(G&H)	Y(H)	?	?	?	Y	Y<i>	?	?	Y	Y<e>	

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TOWN NAME	Groundwater Protection District	Watershed Protection District	Floodplain District Bylaw	Wetlands Protection District	Toxic & Hazardous Materials	Underground Storage Tanks	Earth Removal/Erosion Control	Env. Impact Analysis for Major Dev.	Spill Response Plan	Contingency Plan / Water Emergencies	Open Space Plan	Regional Protection Committee	Title 5 Revisions/ Amendment	Private Well/ Water Sup. Regulations	Other Regulations
Seekonk	Y(Z)	N/A	Y(Z)	Y(G&Z)	Y	N	Y	?	?	Y<i>	N	N	?		
Sharon(S)	Y(Z)	N/A	Y(Z)	Y(G&Z)	Y(G)	Y(Z&G)	Y(Z&H)	Y	Y	?	?	?	?		
Sheffield	Y(Z)	Y(Z)	Y	N	N	N	N	N	?	Y<i>	N	Y	N		
Shelburne	?	?	Y(Z)	?	?	?	Y(Z)	?	Y	Y<i>	Y	?	Y		
Sherborn	N	N/A	Y(Z)	Y(G)	N	N	Y(Z)	N	N	N	Y<Pre>	Y	?	Y<s>	
Shirley	Y(Z)	N/A	Y(Z)	?	Y(G)	Y(G)	Y(G&Z)	?	?	?	?	Y	?	Y<w&s>	
Shrewsbury	Y	N/A	Y	?	?	Y	Y	Y	?	?	?	?	Y		
Shutesbury(P)	?	N	?	Y	?	?	?	Y	?	?	Y	?	Y	Y<w>	
Somerset	Y	Y	Y(Z)	N	Y	Y	N	?	?	Y<i>	N	N	N		
Somerville	N/A	?	?	?	?	?	?	?	?	?	?	?	N		
South Hadley	N/A	Y	Y	N	Y(H)	N	Y(Z)	?	?	Y<i>	?	Y	?		Road Salting Controls
Southampton	N/A	Y	Y(Z)	Y,f	?	Y	Y(Z)	?	?	?	?	Y	Y	Y<w>	
Southborough	N/A	Y(Z)	Y	Y	Y	?	Y(G)	?	?	?	?	?	Y	Y<s>	
Southbridge	N/A	?	Y	?	?	?	?	?	?	?	?	?	?		
Southwick	N/A	Y	Y	Y(G)	?	?	Y(Z)	?	?	Y<i>	?	?	?	Y<w>	
Spencer	N	N	N	?	?	?	N	?	?	?	?	?	Y		
Springfield	N/A	N	Y	N	?	?	Y	?	?	?	?	?	N		
Sterling	N	N/A	Y(Z)	?	N	N	Y(G)	?	?	?	?	N	?	Y<w>	Stream & Pond Protection
Stockbridge	Y(Z)	Y(Z)	Y(Z)	Y(G&Z)	Y(G)F	N	Y	Y	?	Y<i>	N	N	?		
Stoneham	N/A	?	?	?	?	?	Y(Z)	?	?	?	?	?	N		Mandatory Sewer Hookup
Stoughton	Y(G&H)	N/A	Y(Z)	Y(Z)	Y(G&H)	?	N	Y	Y	Y<i>	?	N	Y	Y<w&s>	Min. Depth to Water Table Reg(H)
Stow	Y(Z)	N/A	Y(Z&H)	Y(Z)	Y(G)f	Y(G)f	Y	?	?	?	?	?	?	Y<w>	
Sturbridge	N	N/A	Y	?	?	Y(H)F	Y	Y(G)	?	Y<i>	?	?	Y		Critical Resources District
Sudbury	Y(Z)	N/A	Y(Z)	?	?	?	Y(Z)	Y(G)	?	?	?	?	Y	Y<s>	
Sunderland	Y(Z)	Y(Z)	Y(Z)	Y(G)	N	N	Y(Z)	Y	Y	Y<i>	Y	?	Y	Y	
Sutton	N	N/A	Y	Y(G&I),f	?	?	Y(Z)	Y	?	?	?	?	Y		
Swampscott	N/A	?	Y(Z)	Y(Z)	?	?	?	?	?	?	?	?	?		
Swansea	Y(G)	N/A	N	Y(G)	Y(G)	N	Y	?	?	Y<i>	Y<'89>	N	?	Y<w&s>	
Taunton	N	N	Y	N	N	N	Y	?	?	?	N	N	?		
Templeton	N	N/A	Y(Z)	?	N	N	Y(G)	?	?	?	?	N	Y		Waterway Pollution Controls(G),F
Tewksbury	Y(Z)	N/A	Y(Z)	Y(Z)	Y(G&H)	Y(G)	Y	N	N	Y<i>	N	N	?		
Tisbury(S)	Y	N	Y	Y(G&C)	Y(Z&H)F	Y(G)	Y(Z)	Y	Y	N	Y	N	?		
Tolland(P)	N	N	N	N	N	N	N	?	?	?	?	?	?	Y<w>	
Topsfield	?	?	Y(Z)	Y(G)	?	Y(G)	?	?	?	?	?	?	Y	Y<s>	Herbicide Regulations (H)
Townsend	Y(Z)	N/A	Y(Z)	Y(G&Z)	Y(G)	Y(G)F	Y(Z)	Y	?	?	?	N	?	Y<w&s>	
Truro(S)	Y(Z)	N/A	Y(Z)	Y(C)	?	Y(H)	?	?	?	?	?	?	?		
Tyngsborough	N	N/A	Y(Z)	Y(Z)	Y(G)	Y(G)F	Y(Z)	Y	N	Y<i>	Y	N	?	Y<w>	
Tyringham(P)	?	?	?	?	?	?	Y(Z)	?	?	?	?	?	N		
Upton	N	N/A	Y	?	?	?	?	?	?	?	?	?	Y		
Uxbridge	N	N/A	Y	?	?	Y(G)	Y(G)	?	?	Y<i>	?	?	Y		
Wakefield	?	?	?	?	?	?	?	?	?	Y<i>	?	?	?	Y<w>	Herbi/Pesticide Regulations (H)
Wales	N	N/A	Y	N	N	N	?	?	?	?	?	?	?		
Walpole(S)	Y(Z)	N/A	Y(Z)	Y(G&I)	Y(H)	Y(G&H)	Y(Z)	?	?	?	?	?	Y	Y<w>	
Waltham	N/A	?	?	Y(I)	?	?	?	?	?	?	?	?	?		
Ware	Y	N/A	Y(Z)	Y	?	?	Y(G)	?	?	Y<i>	?	?	?		
Wareham(S)	Y(Z)	N/A	Y(Z)	Y(G&I)	Y(Z)	Y	Y(G)	?	?	Y<i>	Y<'86>	N	?		
Warren	N	N/A	Y(Z)	N	N	N	Y(G)	?	?	?	?	?	?		
Warwick	?	?	?	?	?	?	?	Y	?	?	?	?	?	Y<w>	
Washington	?	?	?	?	?	?	?	?	?	?	?	?	Y		Herbi/Pesticide Regulations (H)
Watertown	N/A	?	?	?	?	?	?	?	?	?	?	?	?		1990 Building Moratorium
Wayland	Y(Z)	N/A	Y(Z)	?	?	?	?	Y	Y	?	?	?	Y	Y<s>	
Webster	N	N/A	Y	N	N	N	N	?	?	Y<i>	?	?	?		Herbi/Pesticide Regulations (H)
Wellesley	Y(Z)	N/A	Y(Z)	Y(I)	?	Y(H)F	?	?	Y	?	?	Y	N		Pesticide Bylaw(G)

TABLE D.1 - Water Supply Protection Matrix for the Commonwealth of Massachusetts (Updated to December 10, 1991)

TOWN NAME	Groundwater Protection District	Watershed Protection District	Floodplain District Bylaw	Wetlands Protection District	Toxic & Hazardous Materials	Underground Storage Tanks	Earth Removal/Erosion Control	Env. Impact Analysis for Major Dev.	Spill Response Plan	Contingency Plan / Water Emergencies	Open Space Plan	Regional Protection Committee	Title 5 Revisions/ Amendment	Private Well/ Water Sup. Regulations	Other Regulations
Wellfleet(S)	?	N/A	Y(Z)	Y(C)	Y	Y(Z&H)	?	?	?	?	?	?	Y		
Wendell(P)	Y	?	?	?	Y	?	?	Y	?	?	?	?	?		
Wenham	Y(G)	N/A	?	Y	?	?	?	?	?	Y<i>	?	Y	?	Y<s>	
West Boylston	Y(Z)	N	Y	?	?	?	Y	?	?	Y<i>	?	?	Y		
West Bridgewater	N	N/A	Y(Z)	Y	N	N	Y	N	N	?	?	N	Y		
West Brookfield	N	N/A	Y(Z)	Y	?	?	?	Y	?	Y	?	?	?		
West Newbury	N/A	N	Y(Z)	N	Y	N	Y	N	N	?	?	?	N		
West Springfield	N	Y	Y(Z)	N	?	?	?	?	?	?	?	?	?		
West Stockbridge	N	N	Y	Y	?	N	Y	N	?	N	N	N	Y	Y<s>	
WestTisbury(P&S)	N	N	Y(Z)	Y(C)	Y	Y(H)	Y	Y	Y	N	Y	N	?		
Westborough	Y(Z)	N	Y(G&H)	Y	Y	?	Y	Y	?	?	?	?	Y	Y<w>	
Westfield	Y(Z)	Y(Z)	Y	N	Y(G)	Y(G&H)	N	?	?	Y<i>	?	Y	?		Groundwater Monitoring (H)
Westford	Y(G)	N/A	Y(Z)	Y(Z)	Y	Y	Y(G)	N	N	N	Y	N	Y		
Westhampton	N/A	N	Y	N	Y(Z)	?	N	?	?	?	?	?	Y		
Westminster	N/A	?	Y(Z)	Y(Z)	N	N	?	?	?	?	?	N	?		
Weston	Y(Z)	?	Y(Z)	Y(Z)	?	?	?	?	?	?	?	Y	Y		Pesticide Regulations (H)
Westport	N	N/A	Y(Z)	Y(C)	N	N	Y	?	?	Y<i>	Y	N	?		
Westwood(S)	Y(Z)	N/A	?	Y(I)	Y(G)	?	?	?	?	?	?	?	?		
Weymouth	Y	Y	Y(Z)	Y(G)	?	Y(G)	?	?	?	?	?	Y	N		
Whately	Y(Z)	N/A	Y(Z)	?	Y(G),fF	Y	Y	Y	Y	?	?	Y	Y	Y<w>	
Whitman	N	Y(Z)	Y(Z)	Y	N	N	N	Y	N	?	?	N	Y		
Wilbraham	N/A	Y(Z)	Y(Z)	Y	?	Y(Z)	Y	?	?	?	?	?	N		
Williamsburg	Y(Z)	Y(Z)	Y(Z)	?	Y(Z)	?	Y	?	?	?	?	?	N		
Williamstown	Y(Z)	Y(Z)	Y(Z)	Y	Y(G)	Y	Y(Z)	Y	?	Y<i>	N	Y	?	Y(Z)<w>	
Wilmington	Y(Z)	N/A	Y(Z)	Y(G)	?	Y(G)	Y(G)	?	?	?	?	?	Y		
Winchendon	N	N	Y(Z)	N	N	N	Y	N	N	?	?	Y	?		
Winchester	N/A	?	Y(Z)	?	?	?	?	?	?	Y<i>	?	?	?		
Windsor(P)	N/A	?	?	?	?	?	?	?	?	?	?	?	Y		
Winthrop	N/A	?	Y	Y(Z)	Y(Z)	?	?	?	?	?	?	?	N		
Woburn	N/A	?	?	?	?	?	?	?	?	?	?	?	?		
Worcester	Y	N	Y	Y	?	?	Y	?	?	Y<i>	?	?	Y		
Worthington	Y	?	Y(Z)	?	?	?	?	?	?	?	?	?	?	Y<w>	
Wrentham	Y(Z)	N/A	Y(Z)	Y(G)	N	Y(Z)	Y(G)	?	?	Y<i>	Y<Pres>	?	Y	Y<s>	
Yarmouth(S)	Y(Z)	N/A	Y(Z)	Y(Z&C)	Y(G&H)	Y(G,Z,H)fF	N	?	Y	N	Y	Y	Y		

MODEL FLOOR DRAIN REGULATION

[town] Board of Health

[date of issuance]

(Source: DEP, Division of Water Supply, 1992)

Notes:

1. This regulation has been designed to meet the requirements of the Massachusetts Department of Environmental Protection's Wellhead Protection "Source Approval" Regulations 310 CMR 22.21(2)(a)8 within designated Zone II areas. Refer to 310 CMR 22 if your community is in the source approval process for a public drinking water supply.
2. Though the regulations cited above only require that the regulation cover the Zone II of the public water supply in the Source Approval process, this model regulation applies to the entire town. The Department recommends, however, that the regulation cover the entire town so as to be consistent with the state regulations (310 CMR 27.00) prohibiting discharges of the nature discussed in this regulation. In the event that the town chooses not to have a town-wide regulation, the Department recommends that the regulation cover at minimum the Zone II or Interim Wellhead Protection Area for all of the town's wells.
3. The Department recommends that all towns, not just those in the Source Approval process, adopt and implement these regulations as a water source protection tool.
4. Portions of this model regulation within {} are more stringent than the Department regulations and are therefore optional; it is not required that they be in the regulation.

Section I. PURPOSE OF REGULATION

Whereas;

- floor drains in industrial and commercial facilities are often tied to a system leading to a leaching structure (e.g. dry well, cesspool, leach field) or a septic system; and
- poor management practices and accidental and/or intentional discharges may lead petroleum and other toxic or hazardous materials into these drainage systems in facilities managing these products; and
- improper maintenance or inappropriate use of these systems may allow the passage of contaminants or pollutants entering the drain to discharge from the leaching structure or septic system to the ground; and
- discharges of hazardous wastes and other pollutants to floor drains leading to leaching structures and septic systems have repeatedly threatened surface and ground water quality throughout Massachusetts; and
- surface and ground water resources in the Town of [town] contribute to the town's drinking water supplies;

the Town of [town] adopts the following regulation, under its authority as specified in Section II, as a preventative measure for the purposes of:

- preserving and protecting the Town of [town]'s drinking water resources from discharges of pollutants to the ground via floor drains, and
- minimizing the threat of economic losses to the Town due to such discharges.

Section II. SCOPE OF AUTHORITY

The Town of [town] Board of Health adopts the following regulation pursuant to authorization granted by M.G.L. c.111 s.31 and s.122. The regulation shall apply, as specified herein, to all applicable facilities, **existing and new**, within the Town of [town].

Section III. DEFINITIONS

For the purposes of this regulation, the following words and phrases shall have the following meanings:

Commercial and Industrial Facility: A public or private establishment where the principal use is the supply, sale, and/or manufacture of services, products, or information, including but not limited to: manufacturing, processing, or other industrial operations; service or retail establishments; printing or publishing establishments; research and development facilities; small or large quantity generators of hazardous waste; laboratories; hospitals.

Department: the Massachusetts Department of Environmental Protection.

Discharge: The accidental or intentional disposal, deposit, injection, dumping, spilling, leaking, incineration, or placing of toxic or hazardous material or waste upon or into any land or water so that such hazardous waste or any constituent thereof may enter the land or waters of the Commonwealth. Discharge includes, without limitation, leakage of such materials from failed or discarded containers or storage systems and disposal of such materials into any on-site leaching structure or sewage disposal system.



Floor Drain: An intended drainage point on a floor constructed to be otherwise impervious which serves as the point of entry into any subsurface drainage, treatment, disposal, containment, or other plumbing system.

Leaching Structure: Any subsurface structure through which a fluid that is introduced will pass and enter the environment, including, but not limited to, drywells, leaching catch basins, cesspools, leach fields, and oil/water separators that are not water-tight.

Oil/Water Separator: A device designed and installed so as to separate and retain petroleum based oil or grease, flammable wastes as well as sand and particles from normal wastes while permitting normal sewage or liquid wastes to discharge into the drainage system by gravity. Other common names for such systems include MDC traps, gasoline and sand traps, grit and oil separators, grease traps, and interceptors.

Toxic and Hazardous Materials: Any substance or mixture of physical, chemical, or infectious characteristics posing a significant, actual, or potential hazard to water supplies or other hazards to human health if such substance or mixture were discharged to land or water of the Town of [town]. Toxic or hazardous materials include, without limitation, synthetic organic chemicals, petroleum products, heavy metals, radioactive or infectious wastes, acids and alkalis, and all substances defined as Toxic or Hazardous under Massachusetts General Laws (MGL) Chapter 21C and 21E or Massachusetts Hazardous Waste regulations (310 CMR 30.000), and also include such products as solvents, thinners, and pesticides in quantities greater than normal household use.

Use of Toxic or Hazardous Material: The handling, generation, treatment, storage, or management of toxic or hazardous materials.

Section IV. PROHIBITIONS

With the exception of discharges that have received (or have applied and will receive) a Department issued permit prior to the effective date of this regulation, no floor drain(s) shall be allowed to discharge, with or without pretreatment (such as an oil/water separator), to the ground, a leaching structure, or septic system in any industrial or commercial facility if such floor drain is located in either:

- A. an industrial or commercial process area,
- B: a petroleum, toxic, or hazardous materials and/or waste storage area, or
- {C: a leased facility without either A or B of this section, but in which the potential for a change of use of the property to a use which does have either A or B is, in the opinion of the Board of Health or its agent, sufficient to warrant the elimination of the ground discharge at the present.}

Section V. REQUIREMENTS FOR EXISTING FACILITIES

- A. The owner of a facility in operation prior to the effective date of this regulation with a prohibited (as defined under Section IV) floor drain system shall:
 - 1. disconnect and plug all applicable inlets to and outlets from (where possible) applicable leaching structures, oil/water separators, and/or septic systems;
 - 2. remove all existing sludge in oil/water separators, septic systems, and where accessible, leaching structures. Any sludge determined to be a hazardous waste shall be disposed of in accordance with state hazardous waste regulations (310 CMR 30.000). Remedial activity involving any excavation and/or soil or groundwater sampling must be performed in accordance with appropriate Department policies;
 - 3. Alter the floor drain system so that the floor drain shall be either:
 - a. connected to a holding tank that meets all applicable requirements of Department policies and regulations, with hauling records submitted to the [town] Board of Health at the time of hauling;
 - b. connected to a municipal sanitary sewer line, if available, with all applicable Department or local permits; or
 - c. permanently sealed. {Any facility sealing a drain shall be required to submit for approval to the Board of Health a hazardous waste management plan detailing the means of collecting, storing, and disposing any hazardous waste generated by the facility, including any spill or other discharge of hazardous materials or wastes.}
- {B. Any oil/water separator remaining in use shall be monitored weekly, cleaned not less than every 90 days, and restored to proper conditions after cleaning so as to ensure proper functioning. Records of the hauling of the removed contents of the separator shall be submitted to the Board of Health at the time of hauling.}

- C. Compliance with all provisions of this regulation must be accomplished in a manner consistent with Massachusetts Plumbing, Building, and Fire code requirements.
- D. Upon complying with one of the options listed under Section V.A.3., the owner/operator of the facility shall notify the Department of closure of said system by filing the Department's UIC Notification Form (which may be obtained by calling 617/292-5770) with the Department, and sending a copy to the [town] Board of Health.

Section VI. EFFECTIVE DATES FOR ALL FACILITIES.

The effective date of this regulation is the date posted on the front page of the regulation, which shall be identical to the date of adoption of the regulation.

- A. Existing Facilities:
 - 1. Owners/Operators of a facility affected by this regulation shall comply with all of its provisions within {120} days of the effective date;
 - 2. All applicable discharges to the leaching structures and septic systems shall be discontinued immediately through temporary isolation or sealing of the floor drain.
- B; New Facilities:
 - 1. As of the effective date of the regulation, all new construction and/or applicable change of use within the Town of [town] shall comply with the provisions of this regulation.
 - 2. Certification of conformance with the provisions of this regulation by the Board of Health shall be required prior to issuance of construction and occupancy permits.
 - {3. The use of any new oil/water separator shall comply with the same requirements as for existing systems, as specified above in Section V.B.}

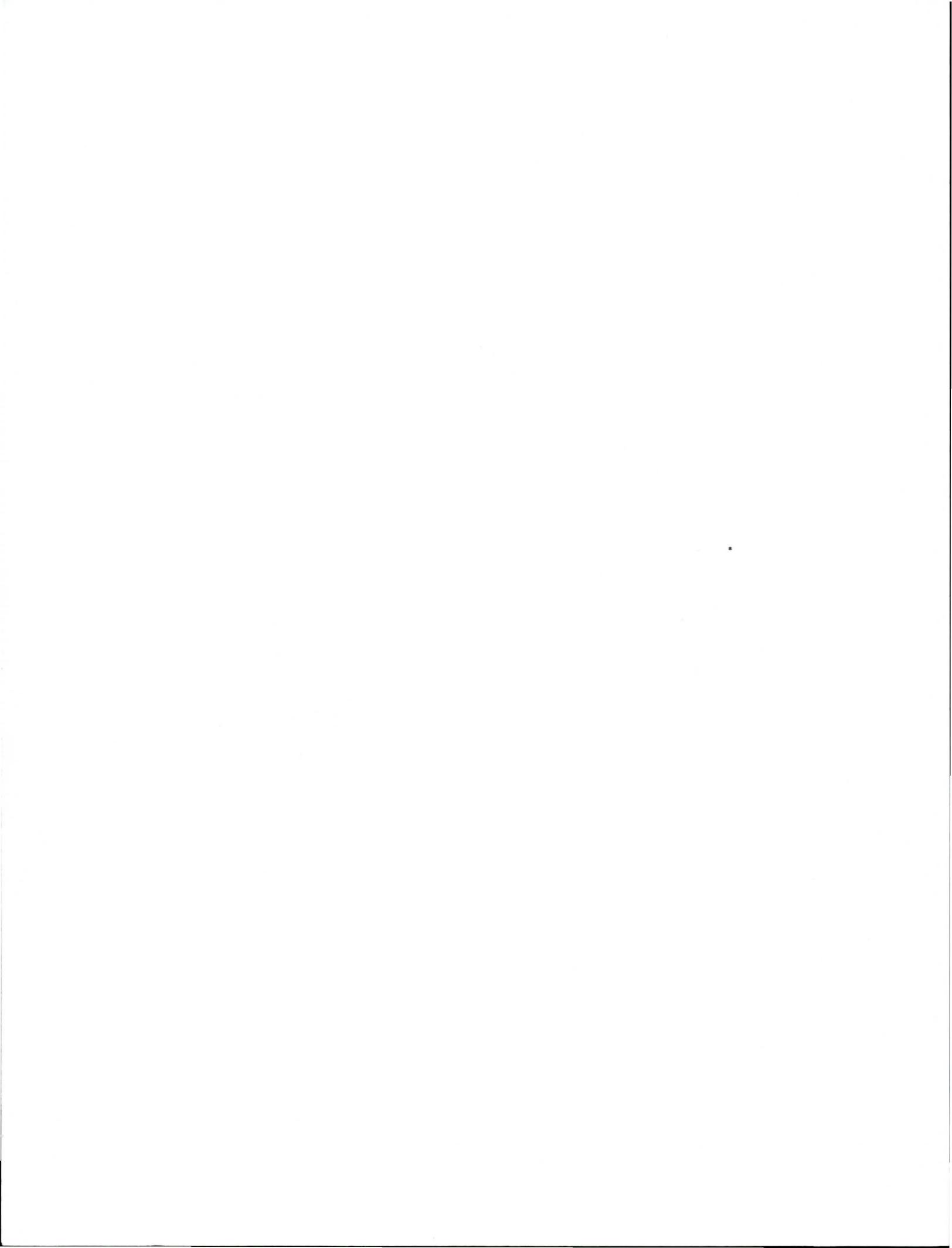
Section VII. PENALTIES

Failure to comply with provisions of this regulation will result in the levy of fines of not less than \${200.00}, but not more than \$1000.00. Each day's failure to comply with the provisions of this regulation shall constitute a separate violation.

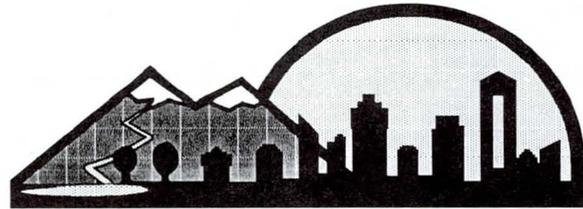
Note: Effective 1992, maximum fines for health violations increased. Under Chapter 111: Section 31 (violation of health regulation) maximum increased from \$500 to \$1000 and Section 122 (violation of nuisance regulations) maximum increased from \$100 to \$1000.

Section VIII. SEVERABILITY

Each provision of this regulation shall be construed as separate to the end that, if any provision, or sentence, clause or phrase thereof, shall be held invalid for any reason, the remainder of that section and all other sections shall continue in full force and effect.



APPENDIX E



GLOSSARY

ABSORPTION: The process of taking up one substance into the body of another, such as a sponge absorbing water.

ACCESS ROAD (Woods Road): A road passable to log trucks, between a publicly maintained road and the landing, over which log trucks pass carrying forest products that have been gathered at the landing.

ACID RAIN: Precipitation that has a low pH (less than pH 5.6, which is normal for "natural" precipitation); the precipitation becomes acidic when moisture in the air reacts with sulfur and nitrogen pollutants in the atmosphere; because of its low pH, acid rain has a harmful effect on some plants, soils and surface waters, buildings and, indirectly, on some organisms that live in surface waters.

ADSORPTION: Attraction and holding of one substance on the surface of another; this often involves the attraction of molecules in gases and liquids to the surface of a solid.

AEROBIC: Living or active only in the presence of oxygen.

AEROBIC DECOMPOSITION: To decay by aerobic microorganisms.

AGROCHEMICAL: Synthetic chemicals (pesticides and fertilizers) used in agricultural production.

ALGAE: Nonvascular plants, usually aquatic and capable of using carbon dioxide by photosynthesis.

ALGAL BLOOM: Large, readily visible, masses of algae found in bodies of water (usually ponds and lakes) during warm weather.

ALGICIDE: Any substance that will kill or control algal growth.

ALKALINITY: The capacity of water to neutralize acids by its contents of bicarbonates, carbonates or hydroxides (alkaline substances).

ANAEROBIC: Living or active in the absence of oxygen.

ANAEROBIC DECOMPOSITION: Reduction of organic matter by anaerobic microorganisms in an oxygen free environment.



AQUACULTURE: The controlled cultivation and harvest of aquatic plants or animals (i.e., edible marine algae, clams, oysters, etc.).

AQUATIC: Plants or animal life living in, growing in, or adapted to water.

AQUIFER: A geologic formation that can hold, and provide, large quantities of water readily. Aquifers can be classified as confined or unconfined.

AREA OF INFLUENCE: The land surface overlying the cone of depression created by well pumping.

ARTESIAN AQUIFER: see **CONFINED AQUIFER**

ARTESIAN WELL: A well that penetrates an aquifer containing water under pressure. Water in the well will rise above the water level in the aquifer; if the pressure is great enough, the well will overflow.

BACTERIA: Microscopic one-celled organisms that have no chlorophyll, are aerobic or, for very brief periods anaerobic, and multiply by simple cell division. Bacteria exists essentially everywhere and perform a variety of functions; not always useful to people. While decomposing organic matter in water, bacteria can greatly reduce the quantity of oxygen in water.

BANK: The portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a bordering vegetated wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland. The upper boundary of a bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of a bank is the mean annual low flow level.

BASAL AREA: The area in square feet of the cross section of a tree taken at breast height (4.5 feet above the ground).

BASE FLOW: The portion of streamflow derived from groundwater discharge.

BEDROCK: Solid rock, commonly called "ledge", that forms the earth's crust. It is locally exposed at the surface but more commonly is buried beneath a few inches to more than 300 feet of overburden.

BEST MANAGEMENT PRACTICES (BMPs): Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to prevent and reduce nonpoint source pollutants. Best management practices should be compatible with the productive use of the resource to which they are applied and should be cost effective.

BIOCHEMICAL OXYGEN DEMAND (BOD): A laboratory measurement of the "strength" or potency of an organic or inorganic waste; the test determines the amount of oxygen used by microorganisms as they biochemically degrade (reduce to simple by-products) the waste. BOD values provide a somewhat standard measure of how much oxygen will be required to degrade a waste, and therefore reflect the effect the waste may have on fish or other aquatic organisms that require oxygen to live.

BIODEGRADABLE: Capable of being broken down (decomposed) by microorganisms.

BLACK WATER: Liquid and solid human body waste and the carriage water generated through toilet usage.

BORDERING VEGETATED WETLAND: A freshwater wetland which borders on creeks, rivers, streams, ponds, and lakes, such as wet meadows, marshes, swamps, and bogs. The boundary of a bordering vegetated wetland is the line within which fifty percent (50%) of the vegetational community consists of the plant species identified in the Wetlands Protection Act.

BUFFER STRIPS: Strips of grass or other close growing vegetation that separates a waterway (ditch, stream, brook) from an intensive land use area (subdivision, farm); also referred to as filter strips, vegetated filter strips, and grassed buffers.

BUFFER STRIPS (Forest): Is a forest area of light cutting where 50% or less of the basal area is removed at any one time. The purpose is to provide a forested appearance along roads, water courses, and other water bodies to help maintain an attractive recreation landscape in these scenically sensitive areas.

BYLAW: A town law.

CHEMICAL OXYGEN DEMAND (COD): An indirect measurement of the amount of oxygen used by organic and inorganic matter in water. The measurement is a laboratory test based on a chemical oxidant and therefore does not necessarily correlate with the biochemical oxygen demand.

CHISEL PLOWING: Cropland preparation by a special implement (chisel) that avoids complete inversion of the soil. Chisel plowing can leave a protective cover of crop residues on the soil surface that helps prevent erosion and improve infiltration.

CHLORINATED HYDROCARBONS: Synthetic compounds that contain chlorine, hydrogen, and carbon; often a main ingredient in pesticides.

CHLORINATION: One method of disinfecting water (either drinking water or waste water). There is some concern that chlorine used in waste water disinfection may be harmful to sensitive aquatic organisms inhabiting the waters that receive the treated wastewater.

CLAY SOIL: A soil containing more than 40 percent clay, but less than 45 percent sand, and less than 40 percent silt.

COLIFORM BACTERIA: A special kind of bacteria that produces acid and gas when decomposing lactose (a carbohydrate also known as milk sugar) under anaerobic conditions. Coliform bacteria typically inhabit the intestines of warm blooded animals, as well as the surfaces of plants and soil.

COMBINED SEWER: A sewer that transports surface water runoff and human domestic wastes (sewage), and sometimes industrial wastes.

COMBINED SEWER OVERFLOW: Flow of wastewater and runoff in a combined sewer in excess of the sewer capacity. It represents the flow that cannot be treated immediately and is frequently discharged directly to a receiving stream without treatment, or to a holding basin for subsequent treatment and disposal.



COMPOSTING: A controlled microbial degradation of organic waste yielding an environmentally sound, nuisance free product of potential value as a soil conditioner.

CONE OF DEPRESSION: A roughly circular area around a well where the groundwater level is lowered by pumping.

CONFINED AQUIFER: An aquifer whose upper, and perhaps lower, boundary is defined by a (confining) layer of natural material that does not transmit water readily. Groundwater trapped within this type of aquifer is under pressure.

CONTOUR FARMING: A conservation based method of farming in which all farming operations are performed across (rather than up and down) the slope.

CONTOUR STRIP CROPPING: A kind of contour farming in which row crops are planted in strips, between alternating strips of close-growing, erosion resistant forage (grass, grain, or hay) crops.

CONTRIBUTION ZONE: The natural drainage area (or recharge area) that is the source of water for a well. Also known as the **CATCHMENT AREA**.

CONVENTIONAL TILLAGE: The traditional method of farming in which soil is prepared for planting by completely inverting it with a moldboard plow. Subsequent working of the soil with other implements is usually performed to smooth the soil surface. Bare soil is exposed to the weather for some varying length of time depending on soil and climatic conditions.

COST EFFECTIVENESS: A measure used to compare alternatives on the basis of cost inputs per unit of resulting benefits.

COST SHARING: A publicly financed program through which society, as the beneficiary of environment protection, shares part of the cost of pollution control with those who must actually install the controls.

COVER CROP: A crop that provides temporary protection for delicate seedlings and/or provides a canopy for seasonal soil protection and improvement between normal crop production periods.

CROP ROTATION: A system of farming in which a regular succession of different crops are planted on the same land area.

DEEP PERCOLATION: Downward movement of water through the soil profile to ground water.

DISCHARGE POINT: Places where groundwater flows out of an aquifer. Springs are visible discharge points. Discharge points also occur as seepage into wetlands, lakes, and streams.

DISSOLVED OXYGEN (DO): Oxygen dissolved in water and readily available to fish and other aquatic organisms.

DIVERSION: A structural conveyance (or ditch) constructed across a slope to intercept runoff flowing down a hillside, and divert it to some convenient discharge point.



DRAWDOWN: The lowering of the water table caused by the withdrawal of water from an aquifer by pumping. Also, a best management practice used to control some types of aquatic plants in lakes and ponds, performed by lowering the waterlevel and exposing plant roots or rhizomes to freezing and thawing.

ECOLOGY: The study of the relationships of plants and animals with each other and with their environment.

EFFLUENT: Wastewater as it leaves some type of treatment system, such as septic tank effluent or municipal wastewater treatment plant effluent.

EROSION: Wearing away of soil by running water, wind, or ice.

EUTROPHICATION: The natural aging process of surface waters (such as rivers, streams, reservoirs) through enrichment by nutrients. Eutrophication is accelerated by people's activities; in the end, eutrophication results in the complete filling in and drying up of a water body.

EVAPOTRANSPIRATION: Loss of water to the atmosphere from the earth's surface by evaporation and by transpiration through plants.

FAUNA: The animal life characteristic of a region or environment.

FECAL COLIFORM: Coliform bacteria that originate in the intestinal tract of humans and other warm-blooded animals; fecal coliform are not harmful to humans by themselves, but are used to indicate the potential presence of other harmful bacteria.

FILTER STRIP (Forest): Is an area of forest land, adjoining the bank of a water body, where no more than 50% of the basal area is cut at any one time.

FLOODPLAIN: The flat or nearly flat land on the floor of a stream valley or tidal area that is covered by water during floods.

FLORA: Plants and microorganisms present in a given environment

GAINING STREAM: A stream that receives groundwater discharges. The level of water in the stream is at the water table level for the adjacent aquifer.

GEOGRAPHIC INFORMATION SYSTEM (GIS): A computerized database which allows for the graphic display of map information together with other related, non-spatial information in the database, such as population, income, traffic counts, etc.

GLACIAL TILL: A mixture of clay, sand, gravel, boulders and sediment deposited by melting glacial ice, intermingled in any proportion; usually resistant to groundwater movement.



GRASSED WATERWAY: A natural or constructed conveyance for surface runoff, lined with an erosion-resistant grass, that transports runoff to a suitable discharge point at a non-erosive rate.

GREY WATER: Wastewater other than sewage, such as sink drainage or washing machine discharge.

GROUNDWATER: Water beneath the earth's surface, found at varying depths, where every space between soil or rock particles is filled with water (the saturated zone).

GULLY: A deep channel cut into the soil surface by accelerated erosion; a gully is so deep and/or wide that it cannot be smoothed out by tillage operations.

HABITAT: The natural environment of an organism.

HARDNESS: Condition of water, caused mostly by naturally occurring impurities, that prevents suds formation by soap.

HAZARDOUS WASTE: Any waste material that is potentially dangerous, including, but not limited to, explosives, radioactive materials, and chemicals.

HERBICIDES: Agrochemicals (pesticides) used to control undesirable plants.

HOUSEHOLD HAZARDOUS WASTE: Any number of commonly used household cleaning products, workshop and outdoor chemicals, automotive fluids and personal care products that are potentially dangerous to the environment.

HYDRIC SOIL: A hydric soil is a soil that is saturated, flooded, or ponded for a period of at least two weeks during the growing season; soils which are indicators of the existence of wetlands.

HYDROCARBON: An organic compound composed of carbon and hydrogen; they occur in all living creatures. They are also found in petroleum products, natural gas, and coal.

HYDROLOGIC CYCLE: A term used by scientists to describe the constant movement of water in and on the earth and atmosphere: numerous processes (such as precipitation, evaporation, runoff) comprise the hydrologic cycle.

IMPERMEABLE: Soil or rock that does not allow water to pass through it.

INDUCED RECHARGE: When a cone of depression from a pumping well extends to a nearby surface waterbody, lowering the water table and causing the surface waterbody to lose water to the adjacent groundwater aquifer.

INFILTRATION: The entry of water (from precipitation, irrigation, or runoff) into the soil profile.

INFILTRATION RATE: The quantity of water that can enter the soil surface in a specified time interval.

INORGANIC CHEMICALS: Naturally occurring or synthetic chemical compounds that contain no carbon.

INSECTICIDES: Agrochemicals (pesticides) used to control undesirable insects.

LANDFILL: Facility in which solid waste from municipal and/or industrial sources is disposed; sanitary landfills are those landfills that are operated in accordance with environmental protection standards.

LANDING (Forest): The location on a piece of forested property currently being harvested, where forest products such as logs are collected.

LEACHATE: Water containing dissolved substances that moves downward through some specified material, such as landfill leachate - subsurface drainage from a landfill.

LEACHING: The removal of soluble materials from a substance as water moves through it.

LOADING: The quantity of a substance entering the environment (soil, water, or air).

LOSING STREAM: A stream that loses water to the adjacent groundwater aquifer. The adjacent groundwater table is below the stream level.

MICROBIAL: Relating to microbes (microorganisms).

MICROORGANISM: A simple form of life with microscopic dimensions; microbes.

MUNICIPAL SEWAGE: Wastes (mostly liquid) originating from a community; may be composed of domestic wastewaters and/or industrial wastewaters.

MULCH: Any substance spread or allowed to remain on the soil surface to conserve soil moisture and shield soil particles from the erosive forces of raindrops and runoff.

NITRIFICATION: The biochemical transformation of ammonium nitrogen to nitrate nitrogen.

NONPOINT SOURCE (NPS) POLLUTION: Pollution of surface or ground water supplies originating from land-use activities and/or the atmosphere, having no well-defined point of entry.

NO-TILLAGE: A method of crop production in which seedbed preparation involves only opening a small slit in the soil (when plowing is eliminated) for seed and agrochemical placement; pest control is subsequently achieved through the use of agrochemicals, rather than tillage; also referred to as "no-till" or "zero till".

NUTRIENTS: Chemical elements or substances, such as nitrogen and phosphorus, that are essential for plant and animal growth.



NUTRIENT POLLUTION: Contamination of water resources by excessive inputs of nutrients; in surface waters, excess algal or aquatic plant production is a result of elevated nutrient concentrations. In Massachusetts, nitrogen and/or phosphorus are most often the problematic nutrients that cause "eutrophication" of surface water bodies.

ORDINANCE: A city law.

OVERLAND FLOW: See **SURFACE RUNOFF**.

OXIDATION: The process of combining with oxygen.

PATHOGENIC: Capable of causing diseases.

PATHOGENS: Disease causing microorganisms.

PERCOLATION: Downward movement of water through the soil profile or other substance.

PERCOLATION RATE: The rate at which water moves through saturated granular material, such as soil.

PERMEABILITY: The capacity for water movement through soil or rock. In porous, permeable surface material that water readily seeps through, such as sand or gravel, 40 to 50 percent of the rain and snowmelt may seep into the ground (Raymond, 1988b).

PESTICIDES: Chemical compounds used to control specific pests (plants or animals). Insecticides control insects; herbicides control plants.

pH: A measure to indicate an acid or an alkaline condition; pH values can range from zero (extremely acid) to 14 (extremely basic or alkaline); pH near 7 (neutrality) is preferred by many aquatic organisms; pH measurements use a non-linear scale such that pH 6 is 10 times more acidic than pH 7, and pH 5 is 100 times more acidic than pH 7; seawater has a pH of approximately 7.5 to 8.5, coffee has a pH of slightly above 5.

POINT SOURCE POLLUTION: Pollution of ground or surface water supplies at well-defined, usually manufactured, "points" or locations; discharges of treated wastewater from municipal and industrial treatment plants are common point sources of pollution.

POLLUTANT: Any substance of such character and in such quantities that upon reaching the environment (soil, water, or air), is degrading in effect so as to impair the environment's usefulness or render it offensive.

POLLUTION: The occurrence of contaminating materials in the environment (water, soil, or atmosphere) above natural, background levels.

POROSITY: The capacity of soil or rock to hold water. Saturated sand contains about 20% water, gravel 25%, and clay, 48% (Raymond, 1988b).

POTABLE: Suitable for drinking.



RECEIVING WATERS: All distinct bodies of water that receive runoff or wastewater discharges, such as streams rivers, ponds, lakes, and estuaries.

RECHARGE: The replenishment of groundwater by infiltration or seepage from precipitation or surface runoff.

RECHARGE AREA: Land area over which precipitation infiltrates into the soil and percolates downward to replenish an aquifer; for unconfined aquifers, essentially the entire land surface overlaying the aquifers is a recharge area; for confined aquifers, recharge areas may be only a small part of the overlaying area.

RILL: A small channel eroded into the soil surface by runoff; rills easily can be smoothed out by normal tillage.

RUNOFF: The portion of precipitation, snow melt, or irrigation that flows over and through the soil, eventually making its way to surface water supplies (such as streams, rivers, ponds); runoff includes surface runoff, interflow and groundwater flow.

SALINITY: The quality of water based on its salt content; seawater contains approximately 18,000 parts of salt in each million parts of water.

SAND: Soil particles between 0.05 and 2 mm in diameter.

SANITARY SEWER: A sewer that transports only wastewaters (from domestic residences and/or industries) to a wastewater treatment plant.

SATURATED ZONE: A subsurface zone in which all openings in a soil or rock formation are filled with water. Also known as the **Zone of Saturation**.

SEDIMENT: Eroded soil and rock material, and plant debris, transported and deposited by runoff.

SEDIMENTATION: The deposition of transported soil particles due to a reduction in the rate of flow of water carrying these particles.

SEPTAGE: The liquid and semi-solid contents removed by pumping from a septic tank.

SEPTIC SYSTEM: An on-site system designed to treat and dispose of domestic sewage; a typical septic system consists of a tank that receives wastes from a residence or business, a distribution box, and a leach field.

SEWAGE: Liquid and solid wastes carried in sewers.

SEWER: An underground system of conduits (pipes and/or tunnels) that collect and transport wastewaters and/or runoff; gravity sewers carry free-flowing water and wastes; pressurized sewers carry pumped wastewaters under pressure.

SEWERAGE SYSTEM: The network of sewers that carries sewage from point of origin to point of treatment.

SILT: Soil particles between 0.05 and 0.02 mm in approximate diameter.



SKID ROAD and TRAIL (Forest): The main road in the forest, including its branches, which will be used repeatedly by a skidder or forwarder to remove the forest floor, make ruts, compact the soil, and otherwise create conditions that can cause erosion.

SLUDGE: In wastewater treatment, the semi-solid part of sewage and bacterial mass that has been acted upon by bacteria and settled and/or been removed from the treated wastewater.

SOIL ERODIBILITY: A measure of the soil's susceptibility to raindrop impact, runoff and other erosional processes.

SOIL PROFILE: A vertical section of the earth's highly weathered upper surface often showing several distinct layers, or horizons.

SPECIFIC YIELD: The amount of water that will drain out of a soil or rock formation by gravity flow.

SPRING: The emergence of groundwater at the land surface (discharge point), usually at a clearly defined point; it may flow strongly or just ooze or seep out.

STORM SEWER: A sewer that collects and transports surface runoff to a discharge point (infiltration basin, receiving waterbody, treatment plant).

STREAM: A body of running water, including brooks which move in a definite channel in the ground.

STRIP CROPPING: A crop production system that involves planting alternating strips of row crops and close-growing forage crops; the forage strips intercept and slow runoff from the less protected row crop strips.

SURFACE RUNOFF: Precipitation, snow melt, or irrigation in excess of what can infiltrate the soil surface and be stored in small surface depressions; runoff is a major transporter of nonpoint source pollutants.

TERRACE: A broad channel, bench or embankment constructed across the slope to intercept runoff and detain or channel it to protected outlets, thereby reducing erosion from agricultural areas.

TOXICITY: Refers to the capacity of a substance to produce injury to the human body or other biological system.

TRANSPIRATION: The loss of water vapor to the atmosphere from plants through pores in the leaf surface.

TREATED WASTEWATER: Wastewater that has been subjected to one or more physical, chemical and biological processes to reduce its pollution and/or health hazard.

TURBIDITY: A condition in water or wastewater caused by the presence of suspended material resulting in scattering and absorption of light rays.



UNCONFINED AQUIFER: An aquifer whose upper boundary (the water table) is made up of relatively loose, unconsolidated natural material that transmits water readily; unconfined aquifers also are often referred to as water table aquifers. Water within these aquifers is not under pressure.

UNDERGROUND STORAGE TANK (UST): A container buried in the soil designed to store various liquids, especially fuels; USTs are prevalent in rural areas (for example, home heating oil tanks) and in urban areas (for example, gasoline storage tanks); USTs can pose as a hazard to the environment if their contents leak.

UNSATURATED ZONE: A soil or rock zone above the water table, extending to the land surface, in which the pore spaces are only partially filled with water. Also known as the **Zone of Aeration**.

URBAN RUNOFF: Surface runoff from urban areas (such as streets, parking lots, residential developments).

VALLEY AQUIFERS: Aquifers located in flat-bottomed valleys, usually with a stream running through them.

VEGETATIVE CONTROLS: Nonpoint source pollution control practices that involve plants (vegetative cover) to reduce erosion and minimize the loss of pollutants.

WASTEWATER: Literally, water that has been used for some purpose and discarded, or wasted; typically liquid discharged from some domestic residential, business and industrial sources that contains a variety of wastes (fecal matter, by-products).

WASTEWATER TREATMENT PLANT: A facility that receives wastewaters (and sometimes runoff) from domestic and/or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful by-products; known by the acronyms WWTP, STP (sewage treatment plant), and POTW (publicly owned treatment works).

WATER BAR (Forest): A ditch cut across a dirt road or skid trail for the purpose of diverting the overland flow of water from the surface of the road to the adjacent forest floor thereby preventing erosion.

WATER BODY: Includes the ocean and estuaries, ponds, lakes, rivers, and streams.

WATERS OF THE COMMONWEALTH: Are broadly defined to include all waters within the jurisdiction of the Commonwealth, including, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and groundwater.

WATERSHED: An area of land that contributes runoff to one specific delivery point; large watersheds may be composed of several smaller "sub-watersheds", each of which contributes runoff to different locations that ultimately combine at a common delivery point.



WATER TABLE: The upper level of a saturated zone below the soil surface, often the upper boundary of a water table aquifer. The water table rises and falls according to the season, and the amount of rain and snowmelt that occurs.

WATER TABLE AQUIFER: See **UNCONFINED AQUIFER**.

WASTE STORAGE POND: An impoundment for containing liquid wastes.

WASTE TREATMENT LAGOON: An Impoundment for liquid wastes, so designed as to accomplish some degree of biochemical treatment of the wastes.

WETLAND BUFFER ZONE: That area of land extending one hundred (100) feet horizontally outward from the boundary of any resource area defined under Wetland Protection Act Regulations with the exceptions of land under water bodies, land subject to tidal action, land subject to coastal storm flowage and land subject to flooding.

WETLANDS: Any of a number of tidal and non-tidal areas characterized by saturated or nearly saturated soils most of the year that form an interface between terrestrial (land-based) and aquatic (water based) environments; includes freshwater marshes around ponds and channels (rivers and streams), brackish and salt marshes; other common names include swamps and bogs.