

Supplement A

Developing a Groundwater Protection Plan

This supplement guides you through the process of learning about your community's groundwater resources and using this information to develop a protection plan. Part 1 of Supplement A tells you where to find the information you will need, shows you how to display it on maps in order to compare data from different sources, and discusses some of the ways you can use this information in your groundwater management plan. Part 2 shows you how to evaluate the information to identify problems and issues. Parts 3 and 4 show you how to use the data you have collected to determine what your community's goals should be and how to select solutions.

The information in this section is designed to be usable by persons with little formal training in natural resource planning or hydrogeology. It is based on evaluation of readily available information, and includes step-by-step examples. Professional planning staff or a planning consultant may not need to work through all of the steps shown here. If your town does not have professional planning assistance, DEP's Water Management Bureau or your regional planning agency can help you. It will still be helpful, however, to read this section carefully in order to understand the information provided by your planning staff and better use it in local planning.

Part 1: How to Inventory, Map and Interpret Groundwater Information

The following pages tell you where you can obtain information related to your town's groundwater resources, and how to display it on maps for use in the planning process. Sample mapping for key resource maps are provided. Detailed instructions are included for mapping the following information:

Topography

Topographic Base Map

Natural Features

Map 1: Hydrologic System

Map 2: Groundwater Resources (Aquifers)

Water Use and Quality

Map 3: Water Supply Sources and Service Areas

Map 4: Water Quality Classification and Known Pollution Sources

Land Use

Map 5: Existing Land Use Risks

Map 6: Zoning

Other Considerations

Sewer Service Areas

Future Land Use Plans

Much of the information you will collect is already in the form of maps, but these maps may be at many different scales, making relationships hard to see. The best way to display this data is to prepare a topographic base map of your town at a convenient scale or use an existing town base map, and then map the other information at the same scale on acetate overlays. Transferring map information from one scale to another can be laborious; it is easiest if your base map is at a fairly small scale, such as 1:24,000 (1"=2000'), the scale of a standard topographic quadrangle map.

You may find that you want to make additional overlay maps. It may be easier, for instance, to use separate overlays to map some of the information grouped on the example maps, or you may need to map data from different sources separately to identify any conflicts between them. There also may be other kinds of information available about your town that you will want to add to your map set; some of these optional maps are discussed briefly.

In Connecticut, most of the basic information needed for water resource planning is available from DEP through the Natural Resource Center publications office or the Water Management Bureau. A matrix showing information sources for specific data needs can be found at the end of this section. Supplement D tells you how to contact state and regional agencies for groundwater information.



Geographic Information Systems

The use of GIS computer technology allows you to easily view and evaluate mapped information. Much of the mapped information discussed is now available in digital form and will greatly improve your analysis of the data.

Topographic Base Map

A topographic base map provides a good foundation for your overlays. Prepared by the U.S. Geological Survey (USGS) for the entire country, topographic maps show the lay of the land in intricate and accurate detail. Planners, engineers, naturalists and sportsmen all make frequent use of topographic maps.

■ What It Shows:

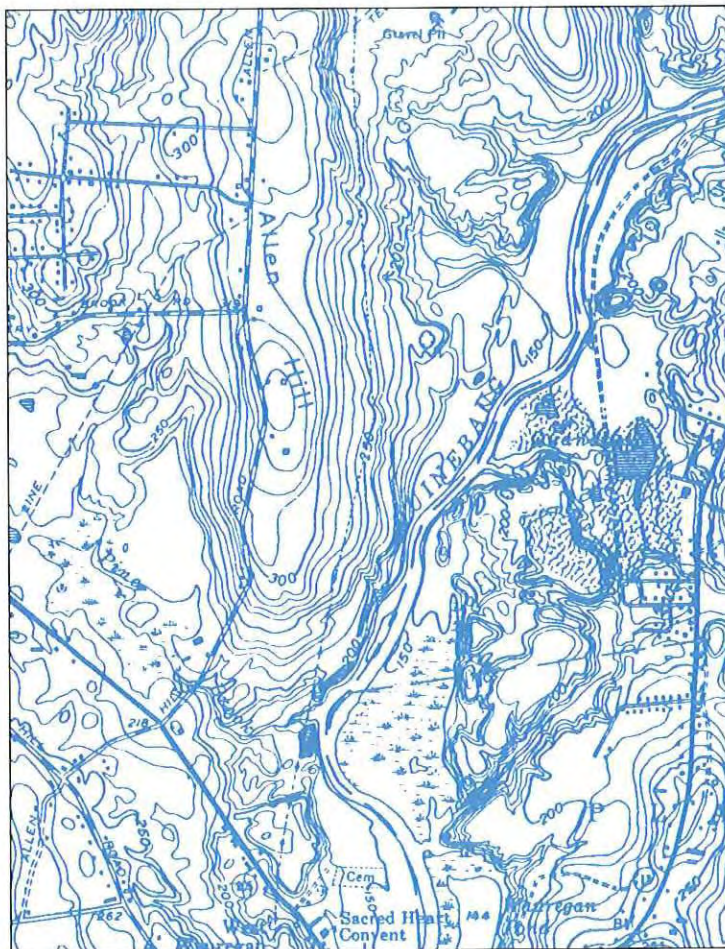
Contour lines on the USGS maps show elevation in 10-foot intervals, indicating the location of peaks, valleys, ridges and other topographic features, essentially providing a three-dimensional view of the town. The closer together these lines are, the steeper the slope. These maps also show many other natural features, such as rivers, streams, major wetlands and forests, which, in tandem with the contours, help you understand water flow patterns.

Major cultural or man-made structures are also indicated on these maps. Roads, railroads, pipelines, built-up areas and individual buildings, as well as the locations of town boundaries, are shown. The maps are updated with the aid of aerial photography every several years.

■ Where to Get It:

USGS topographic maps at a scale of 1:24,000 (1" = 2000') are available in the 7.5-minute quadrangle series. They can be obtained from the DEP Natural Resources Center publications office or from many sporting goods stores. You may need more than one quadrangle to cover your entire town.

You may want to supplement your base map with a set of aerial photographs of your town, which provide much more detailed information on natural features and land use (they may be more current than the last revision of the topographic maps, as well). Aerial photos of all Connecticut towns are taken every five years, and are available from the DEP Natural Resources Center publications office.



Map 1: HYDROLOGIC SYSTEM

■ What It Shows:

This map will show where the surface waters in your town are located, the direction in which they are flowing, and the land areas that drain to them. It will also show the wetlands and floodprone areas that are part of the hydrologic system; you may find it more convenient to map wetlands and floodprone areas as a separate overlay.

Drainage basins, also called watersheds, are the basic surface water hydrologic units on the landscape. These basins' boundaries run along ridge tops, or watershed divides. All rain falling into a basin travels downhill to its streams, leaving the basin at its lowest point — the outlet. In most areas, groundwater flow follows essentially the same downhill flow path as the surface water; exceptions are rare in Connecticut, but they can occur where bedrock and surface contours slope in different directions. You can determine direction of flow by looking at the contour lines, which form V's that point upstream. For ease in seeing the flow pattern, it helps to use arrows to indicate the direction of flow.

Wetlands and floodprone areas are other critical features of the drainage system. Wetlands, which include swamps, marshes and bogs, are natural filters that help protect water quality. Floodprone areas are commonly identified as 100-year flood zones. Wetlands and floodprone areas are often associated with stratified drift formations that have the potential to yield large volumes of water to wells.

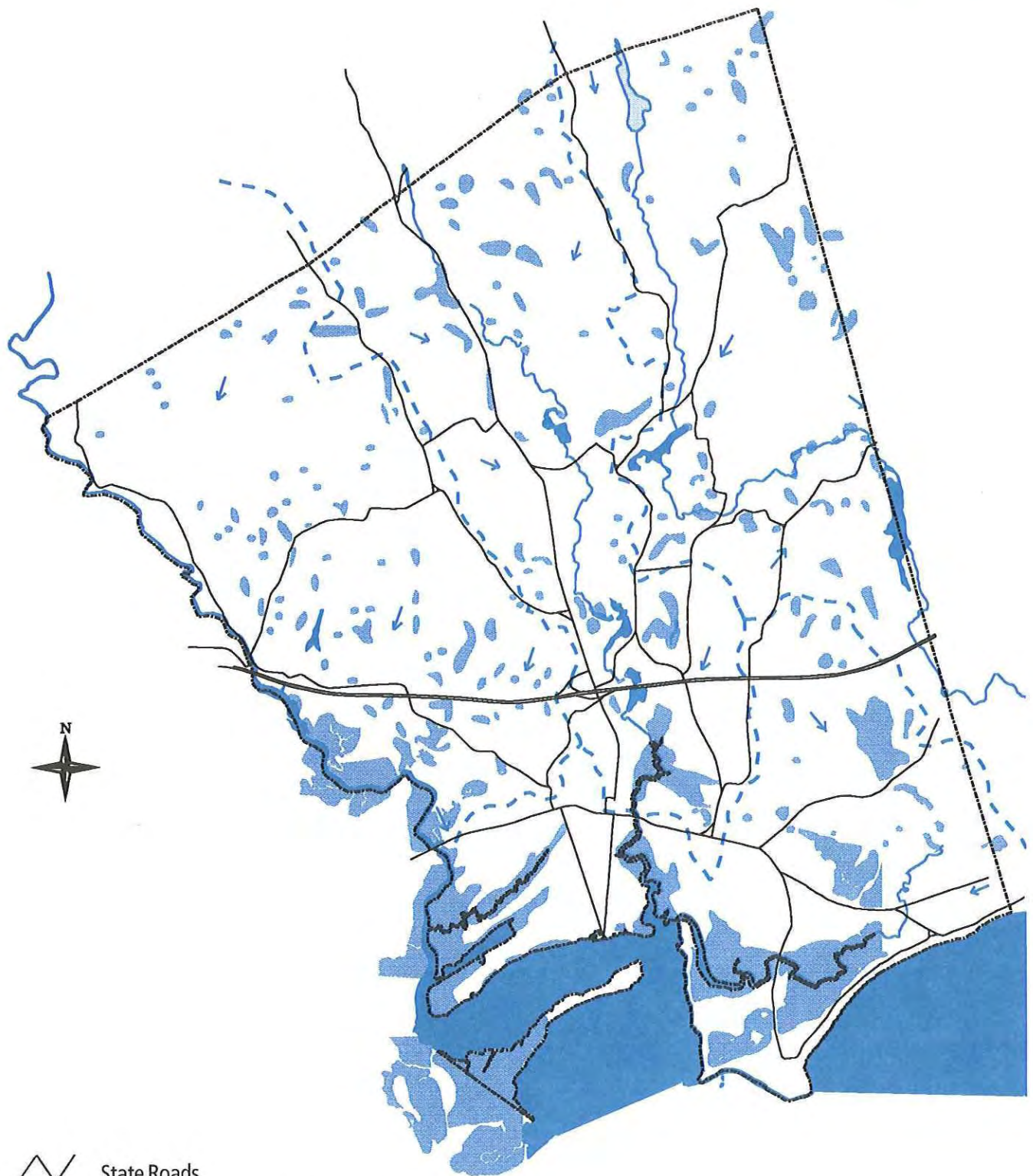
It is important to note that your town will share hydrologic features with adjacent towns and communities further upstream. Political boundaries and land uses wander across the landscape, largely ignoring what is uphill or downhill. Mapping the hydrologic system helps to underline the relationship between political and natural boundaries in your area.

■ Where to Get It:

Boundaries of major drainage basins and subbasins in Connecticut are available from the DEP Natural Resources Center publications office at 1:24,000 scale. In practice, you can determine the drainage basin for any area of interest with a contour map. Though this is a laborious task, you may find that you want to examine the watershed area for a specific site — the point where one stream runs into another, where water flows out of a reservoir, where a public well is located, or where a river leaves your town, for instance. Start by marking the outlet of the drainage basin you are interested in. Then draw a line from the outlet to the nearest high point, crossing the contour lines at right angles. Proceed to the next high point, continuing in this manner.

Watercourses and Wetlands information can be taken directly from the topographic base map, which shows most of the larger wet areas, or use your town wetlands and watercourses map. Used as a basis for regulating wetlands, the town maps are usually at a larger scale than the USGS maps, providing more detailed and more accurate information, including many small wetlands that may be difficult to display on your smaller map.

Flood prone areas may be shown on your town zoning or wetlands maps. For most areas, Flood Insurance Rate Maps are also available, on which the Federal Emergency Management Agency (FEMA) has delineated flood zones for the 100-year and 500-year floods. You can obtain these directly from FEMA, or from your town or regional planning office.



-  State Roads
-  Subregional Drainage Basin Boundary
-  Streams
-  Waterbody
-  Reservoir
-  Marsh
-  General Flow Direction

Hydrologic System

Map 2: GROUNDWATER RESOURCES (AQUIFERS)

■ What It Shows:

This map shows the location of geologic features that affect water yield and will tell you where your town's most significant aquifers are located. Basically, this map indicates whether areas are underlain by till or stratified drift, and which specific stratified drift deposits are likely to yield large amounts of water.

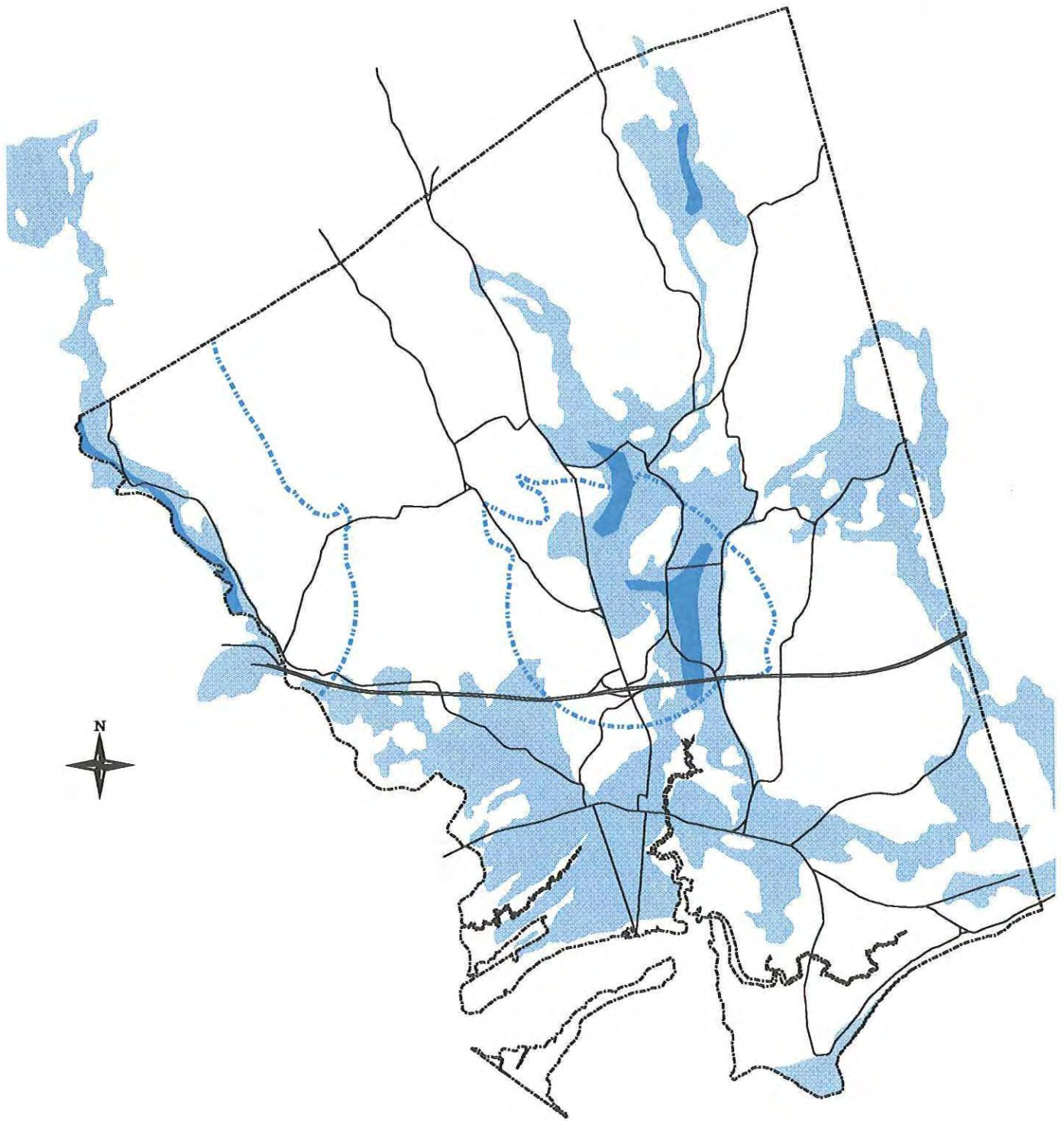
The yield from a stratified drift aquifer depends on its hydrogeologic characteristics: the depth of the saturated stratified drift deposit, as well as its hydraulic connection to a stream or river, and the texture or coarseness of the material. To keep your map simple, you may want to show two categories of stratified drift: coarse-grained deposits with a saturated depth of 40 feet or more, capable of producing high water yields (you could also use 10 feet or more for locally important aquifers); and other stratified drift deposits (shallow and/or fine-grained), which have limited yields.

The remainder of the town will ordinarily be till over bedrock aquifers capable of producing only low yields. If your town includes bedrock aquifers that may have higher yields, such as limestone, you may want to show these geologic formations on your map. Bedrock aquifers of relatively high yield may be important for small public wells, especially if your town does not have high-yield stratified drift aquifers.

■ Where to Get It:

The DEP Water Management Bureau has compiled maps showing both the texture and depth of stratified drift aquifers at a scale of 1:24,000. Connecticut Water Resource Bulletins, available from the DEP Natural Resources Center publications office, provide the primary source of technical information about the source, occurrence and availability of groundwater and include a hydrogeologic map. These bulletins are available for each of the state's major river basins.

Surficial and bedrock geology maps are available for most USGS quadrangles in Connecticut at the same scale as topographic maps (1"=2000'). Also available for some quads: bedrock contour maps, which may be useful in determining groundwater flow in geologically unusual areas. These are available from the Natural Resources Center.



-  State Roads
-  Preliminary State Aquifer Protection Areas
-  Till/Bedrock (low-yield aquifer)
-  Stratified Drift
-  Coarse Stratified Drift, over 40 feet saturated thickness (potential high-yield aquifer)

Groundwater Resources (Aquifers)

Map 3: WATER SUPPLY SOURCES AND SERVICE AREAS

■ What It Shows:

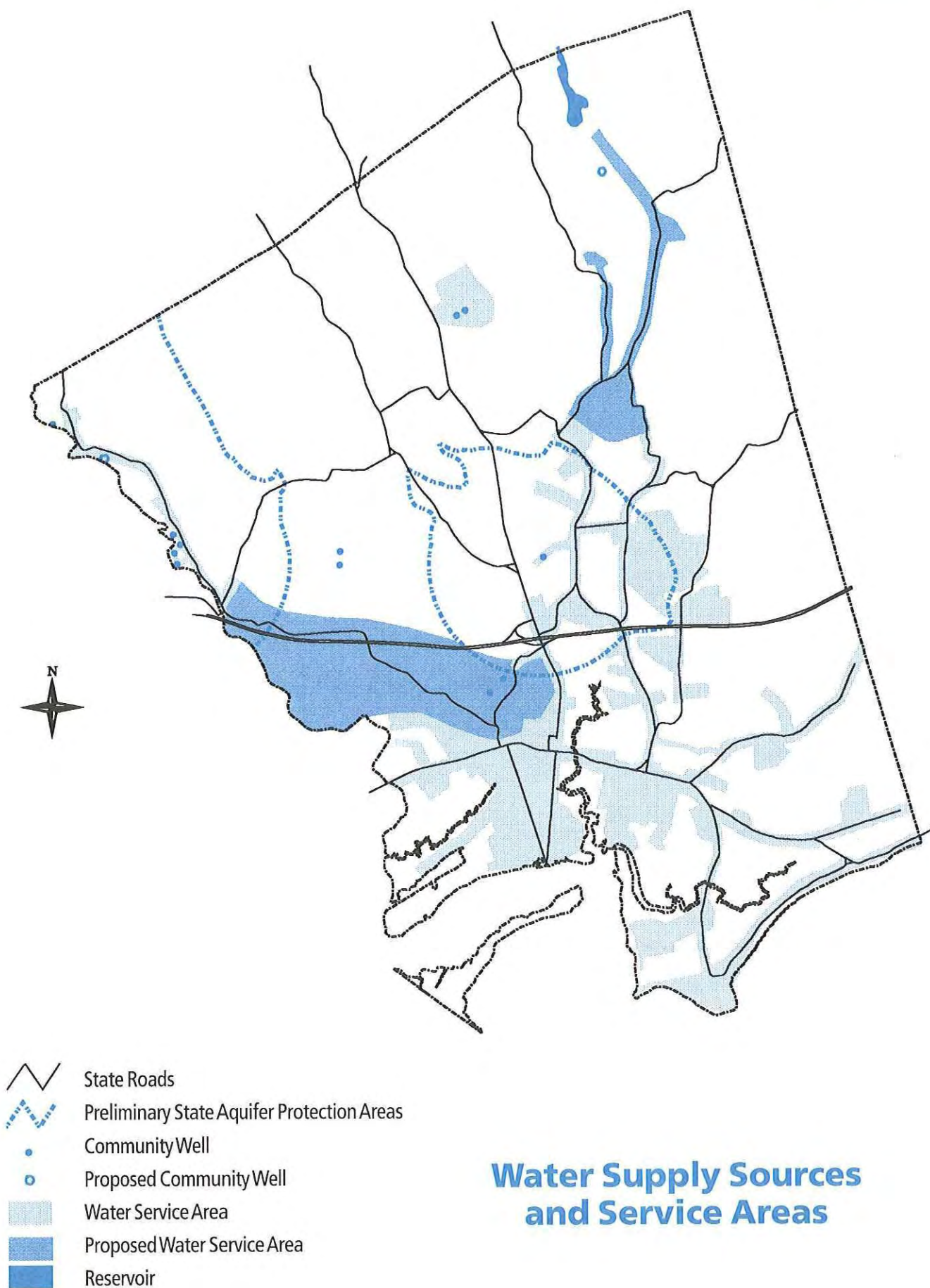
This map indicates the existing and future sources of public drinking water that have been identified in your town as part of Connecticut's water supply planning process. It also shows you what areas of your town are dependent on private wells and likely to remain so for the foreseeable future. Any surface water reservoirs in your town should be included on this map, along with their watershed areas. Public groundwater supplies should be indicated by noting the location of public wells, large or small, and as much information as possible about their recharge areas. Remember that even if there are no reservoirs or public wells in your town, there may be areas of land that provide recharge to water supplies in neighboring towns. The actual area of town presently served by a public water supply, and any future areas proposed for service, should also be mapped. Locations that do not fall within these existing and proposed service areas will depend on private wells to meet their water needs.

■ Where To Get It:

The locations of public water supply service areas and public wells, as well as surface supplies and drainage basins, are shown on DEP's map, "Community Water Systems in Connecticut" (1984), at a scale of 1:125,000.

Water utilities that own land or provide water service in your town can provide you with maps of these facilities. Utilities serving over 1,000 people must also prepare Water Supply Plans showing existing and proposed (future) sources and service areas. If there are public wells in your town operated by water utilities that serve more than 1,000 people, the utilities will be able to provide maps showing the recharge areas of their stratified drift wells. If this information is unavailable for other public wells in your town, you may want to start by drawing a circle (radius) around each well, or obtain technical assistance to delineate, at least roughly, the area that is likely to provide recharge to the well.

Your local health department should have information on the locations of noncommunity wells. Such wells are probably in use at schools, public buildings, and workplaces in areas of your town not served by public water. For each site, you may want to list the owner, type of supply, any known quality information, number of people served and any plans for expansion.



Map 4: WATER QUALITY CLASSIFICATION AND KNOWN POLLUTION SOURCES

■ What It Shows:

Connecticut's Water Quality Standards and Water Quality Classifications guide DEP's water management and permit programs. The Classification maps show the existing and proposed quality of surface and ground waters and their designated uses. These maps are an important resource for planning by local communities. They indicate where groundwater is clean enough for drinking, where contaminated waters are, and the location of areas that should be restored to drinking water standards. They may also help identify areas that may be suitable for siting high-risk industries that are not suitable for drinking water supplies.

Based on hydrogeologic and other data, these surface and ground water quality classifications balance the competitive demands of water supply, waste disposal and a healthy aquatic environment. By mapping groundwater classifications on an overlay, you can identify areas of a public water supply source (these areas appear as GAA) or areas of private well supplies (GA areas on the maps). They also identify areas where groundwater is likely to be already impacted (GB on the maps). In some of these areas, groundwater quality is degraded but needs to be restored to drinking water standards (GB/GA or GB/GAA), while in other areas (e.g., urban centers) restoration is neither feasible nor necessary. A limited number of locations are identified as suitable for waste disposal because of favorable hydrogeologic conditions, while having little or no water supply potential (GC). The table on page 39 summarizes the groundwater quality classifications, uses, and discharges allowed.

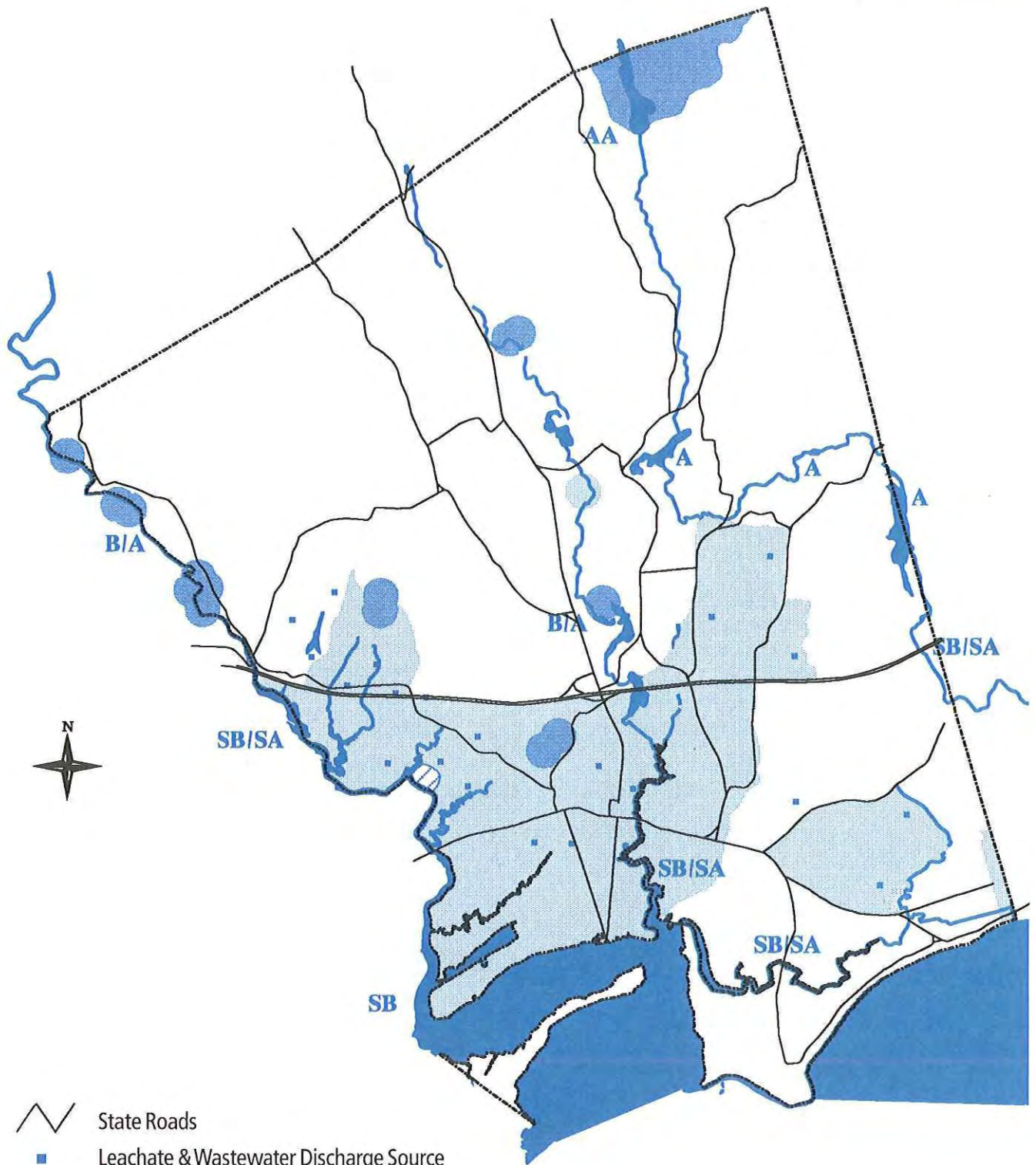
Known Pollution Sources: In most communities, there are sites where wastes of various kinds may leach into groundwater. Mapping the known pollution sources in your community will show where water quality degradation exists or can reasonably be expected. The type and degree of impairment will depend on the nature, extent and duration of the waste disposal activity. Major waste disposal activities, like landfills or industrial wastewater discharges, are now effectively regulated by the state and are not permitted in areas used for drinking water. Inactive waste disposal sites (such as former industrial locations or illegal dumping areas) or sites where spills or leaks of chemicals or oil have occurred may remain sources of possible contamination unless they have been cleaned up and monitored to DEP specifications. Smaller waste disposal activities, including underground injection wells, drywells, pits, lagoons, or septic systems where chemicals may be illegally or accidentally disposed of, are often poorly regulated because they can be very numerous and difficult to locate and inspect. Small-lot areas with a high density of septic systems can also be a source of groundwater contamination, especially if there are known incidents of septic system failure or well contamination.

■ Where To Get It:

Water Quality Classifications maps for each major drainage basin in Connecticut, at a scale of 1:50,000, can be obtained from the DEP Natural Resources Center publications office. A five-color map showing water quality classifications for the entire state, at a scale of 1:125,000 (1"= about 2 miles) is also available. The most recent revision of the *Connecticut Water Quality Standards* sets forth the state's policies for surface water and groundwater, describes the designated uses and allowable discharges for each of the water quality classifications, and provides detailed quality criteria parameters and standards.

Known Pollution Sources: DEP Leachate and Wastewater Discharge maps are available from DEP's Natural Resources Center publications office. These maps show major sites and sources of water pollution at a scale of 1:50,000 (1"= approximately 4,000'), such as sanitary landfills, septage lagoons, industrial waste lagoons, sewage treatment plants, industrial waste discharges, and chemical spills. Each map includes an inventory which describes the owner or operator of the facility and the specific type of discharge. Additional information on waste disposal sites, chemical leaks and spills, and remediation activities at contaminated sites can be obtained from the DEP Waste Management Bureau, Water Management Bureau, or your local health department.

Local officials can help supplement the information available from the state for those areas of your community that provide critical groundwater supplies. The town sanitarian, building inspector, health director, fire marshal or planner may have some information on smaller sites and septic system failures.



State Roads
 Leachate & Wastewater Discharge Source

Groundwater Quality —

GB/GA
 GAA
 GB or GC
 GA (white)

Surface Water Quality —

AA, A, B, etc.

Water Quality Classification and Known Pollution Sources

Map 5: EXISTING LAND USE RISKS

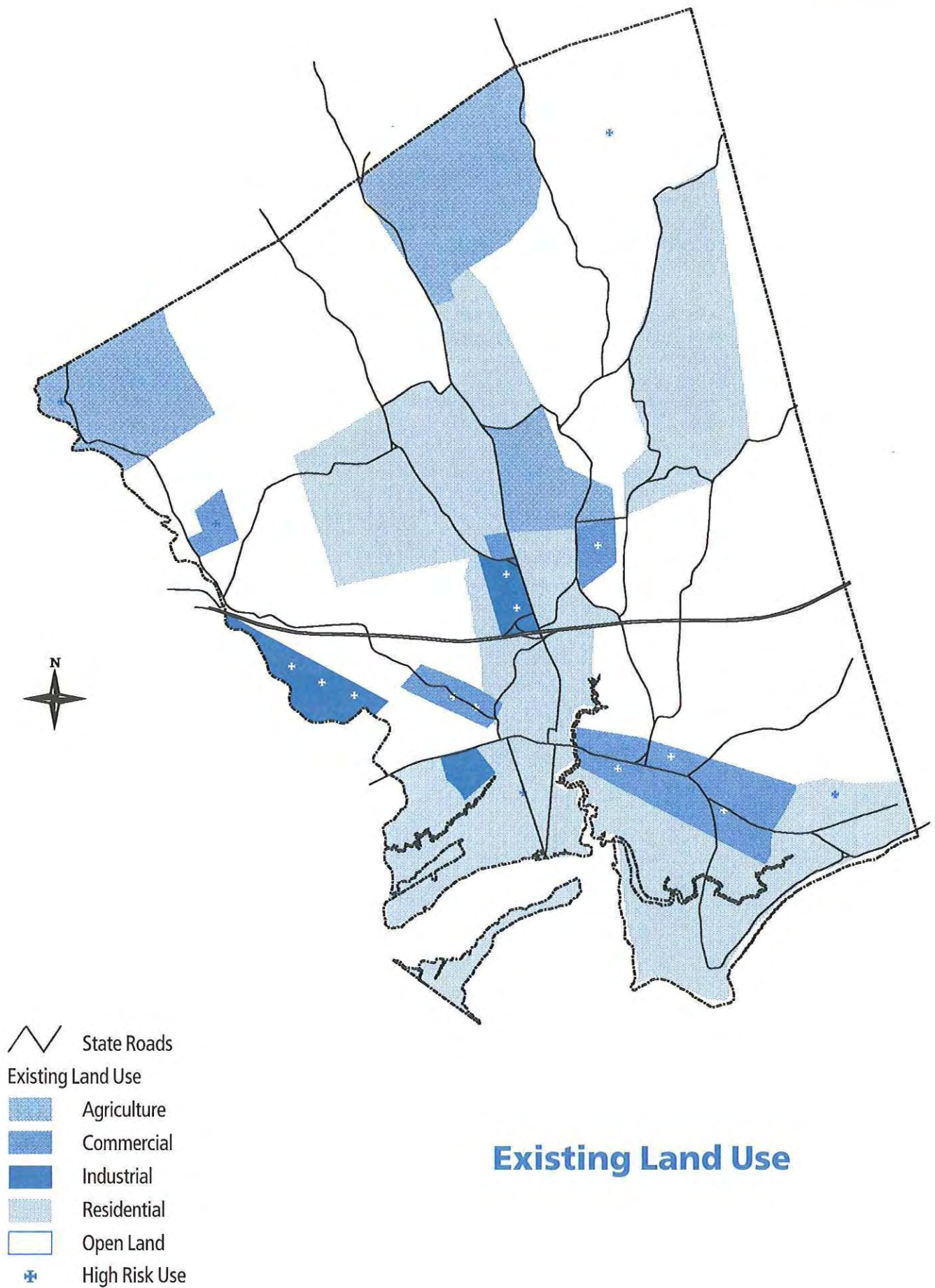
■ What It Shows:

Existing land uses in your community can be mapped and ranked by the degree of risk they pose to groundwater, using the ranking of land uses shown in Part II of this guide or guidance in Supplement B. On this map, the community can be divided into areas based on the general category of land use, such as industrial, residential or commercial. Where more specific information is desirable, the sites of individual high-risk uses can be indicated, with points and an inventory describing each. This map will help you to recognize land use risks so that they can be inspected or carefully monitored in sensitive areas. It is important to also identify conservation land such as open space, parks, and water company land since these areas are usually committed to restricted uses and provide good resource protection.

■ Where To Get It:

This map should show existing land use in your community, rather than what is permitted by zoning. If your town's plan of development has recently been updated, it probably includes a map of existing land uses. A recent land use map may also be available from your town planning office or regional planning agency. If a land use map is not available, you can generate one. If constructing a land use map, start with a map of zoning districts and modify it to reflect the land uses evidenced by aerial photos, tax assessor's records and field surveys.

If your town includes state-designated Aquifer Protection Areas, you will need to develop a detailed land use inventory for these areas, locating each high-risk site and developing information about it. DEP guidelines for performing this land use inventory are included in Supplement B. You may want to conduct a similar inventory for your other sensitive aquifer areas.



Map 6: ZONING

■ What It Shows:

Zoning is a tool to allocate a town's land for various types of uses, to separate incompatible uses, and to set standards for those land uses. The town's zoning map shows the boundaries of the districts allocated for general categories of use, such as industrial, commercial and residential. Frequently a town has more than one district in each use category, and these districts may differ in the specific types of uses permitted, as well as in the allowable density or other standards required. For example, there may be separate districts for "heavy industry" and "light industry" or high and low density residential use.

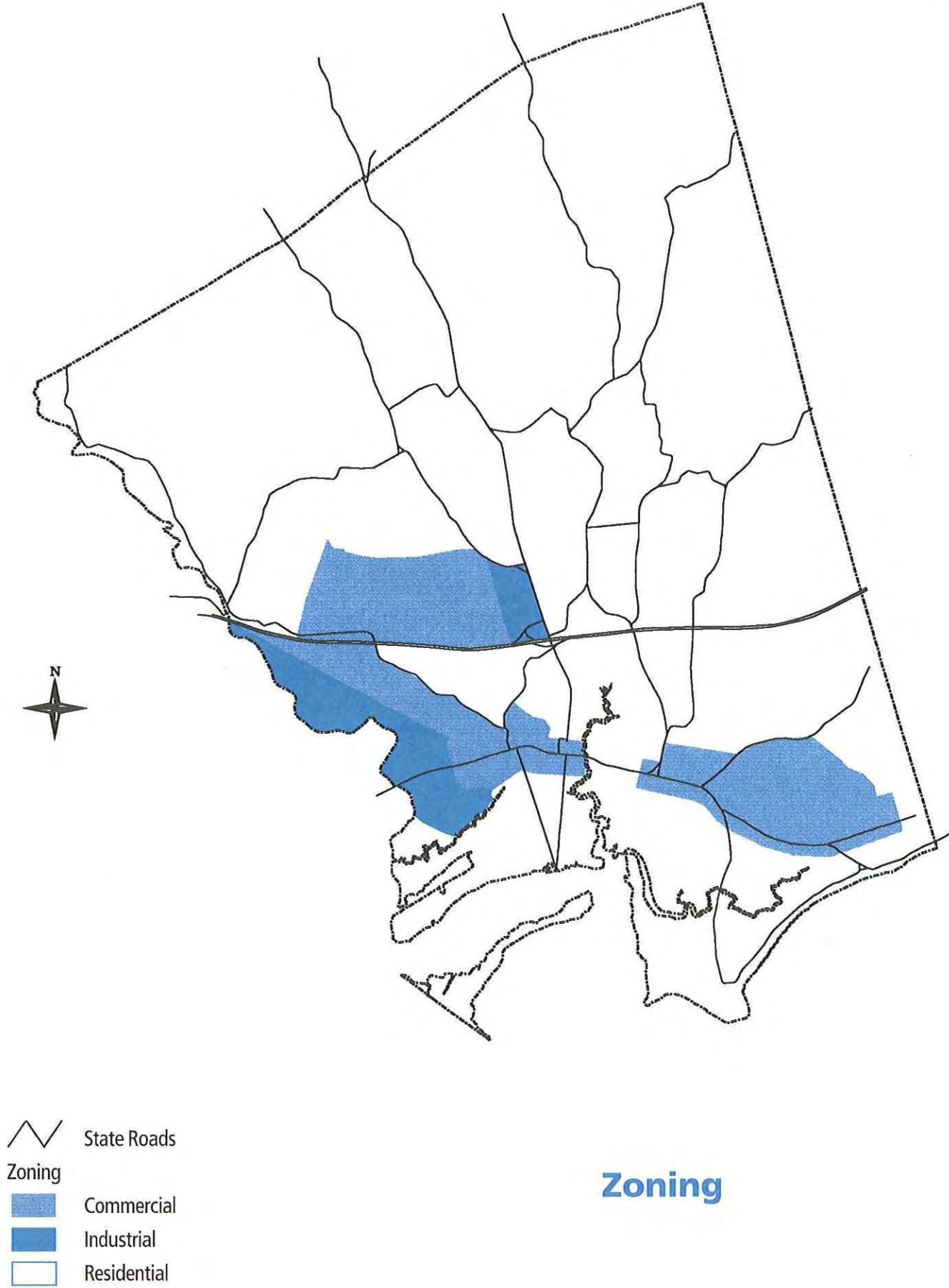
Your zoning map and regulations for permitted uses and building standards for each district will help determine areas of your community where high-risk uses may be constructed in the future or where existing buildings may be converted to higher risk uses.

Many towns discover that they have dedicated critical water supply areas to high-risk land uses. Often, for example, commercial and industrial uses are located on land along major highways or railroad tracks, transportation lines laid out along level valley bottoms to follow the easiest path. Industrial areas were also historically located along rivers because they were a source of power and transportation. But river valleys are often the location of high-yield water supply formations, as well. Such zoning patterns are common because the impact of high-risk uses on groundwater was rarely recognized or considered when most towns laid out their basic zoning patterns years ago.

The zoning map will also help determine where water supply sources are protected from high-risk uses. For example, your town may have special zones intended for water supply protection, such as an Aquifer Protection District, usually as an "overlay" zone that places restrictions on uses in the underlying district. Or there may be restricted zones intended for other objectives, like prevention of flood damage or protection of streambelts, that also coincide with important aquifers.

■ Where To Get It:

A copy of your town's zoning map and zoning regulations can be obtained from the town planning office or town clerk.



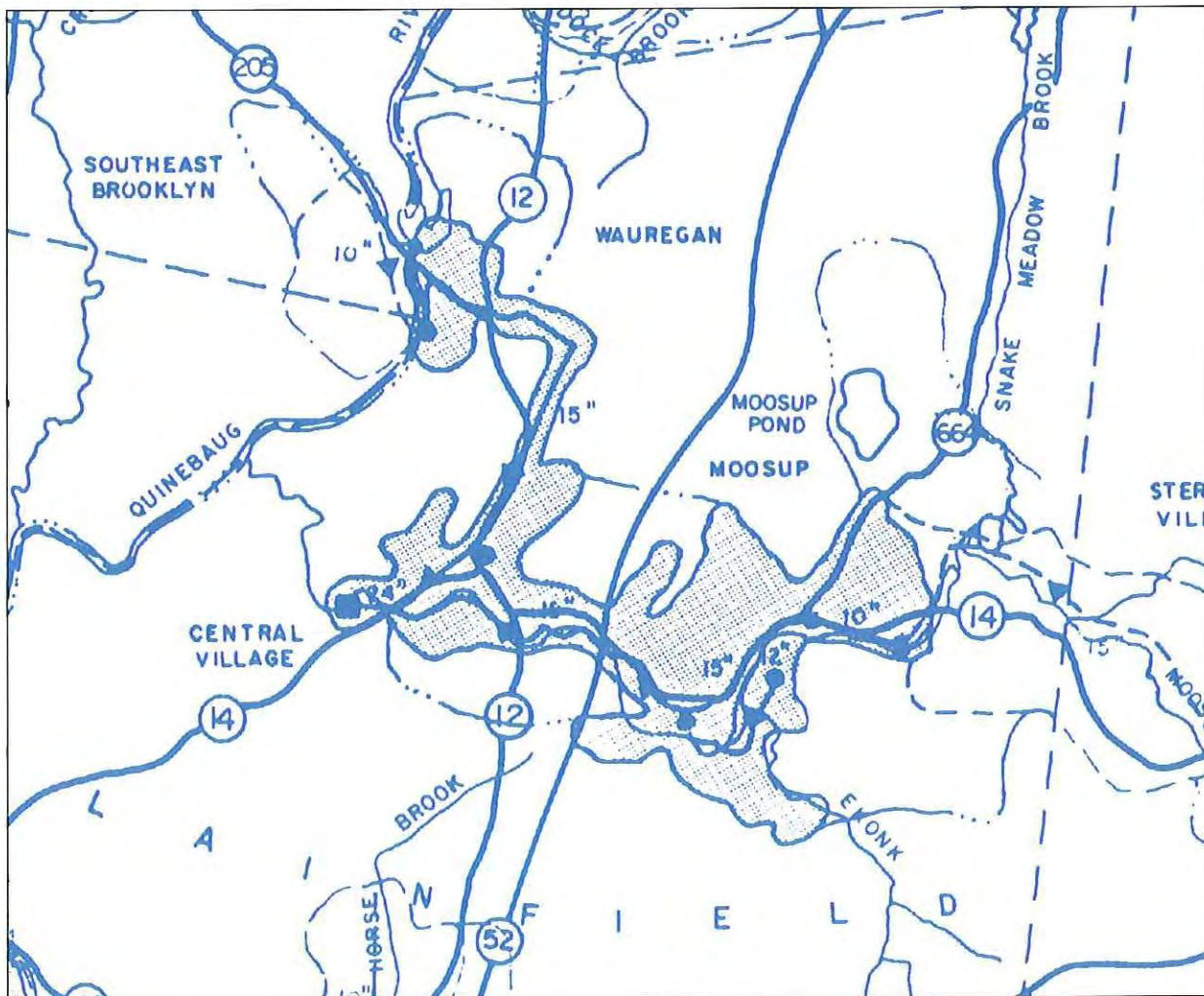
OTHER CONSIDERATIONS:

Sewer Service Areas

Groundwater risks from many types of land uses, such as commercial/industrial activity and high-density residential development, can be substantially reduced in areas served by public sewers. To help evaluate the degree of risk from these land uses, both existing and future sewer service areas should be mapped.

Municipal sewer systems capture and transport raw sewage to a central facility for treatment and disposal. Sewage treatment plants can process some types of wastes not removed by septic systems, including industrial wastes that have been pretreated as required under the DEP discharge permit program. Sanitary sewers may thus be regarded as an opportunity for reducing the risks of groundwater contamination from industrial land uses. Sewers cannot, however, eliminate all risk from these land uses: groundwater can still be contaminated through improper storage of chemicals, spills and leaks at industrial sites, and other non-point pollution sources.

Your local water pollution control commission or town engineer's office can provide maps of existing and proposed sewer service areas.



Future Land Use Plans

Connecticut law requires that towns prepare a plan of development and that they review and update it at 10-year intervals. Once a plan has been formally adopted by the town, however, it helps to provide a compelling argument for amending any inconsistent sections of the zoning code.

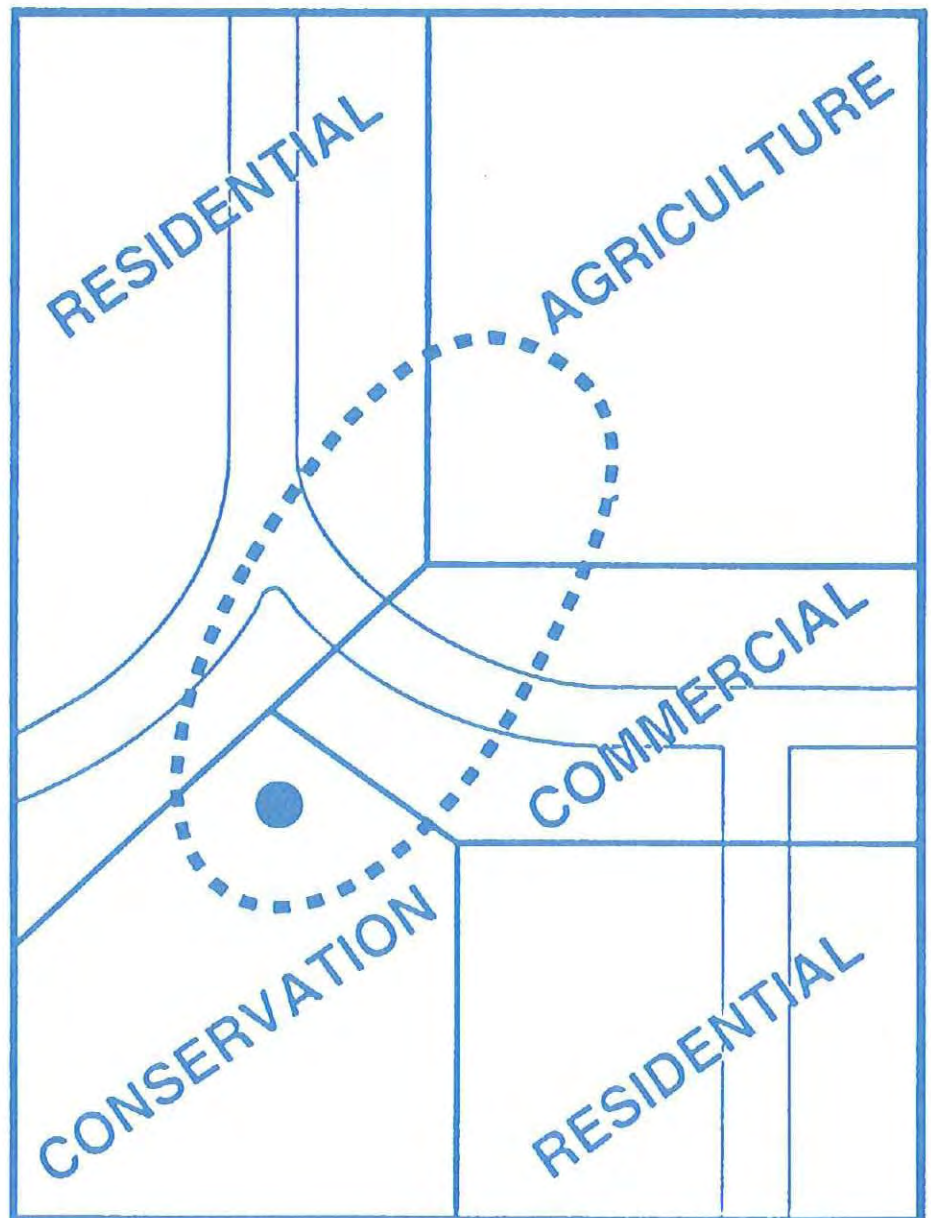
The plan of development represents the community's vision of its future. Generally it includes plans for general land use (which may not coincide with the zoning map); infrastructure, such as transportation routes, utilities, fire service and schools; and recreation and open space. A recently revised plan of development will probably also give some consideration to water supply, especially if there are public water supply sources in the town. This does not necessarily mean, however, that it takes into account all of the factors important in groundwater management. It is critical that groundwater protection planning efforts be coordinated with, and included in, revisions to the plan of development.

Your overlay map should show the general land use categories indicated in the current plan of development. You may also want to include certain other features from the plan, such as recommended open space acquisitions or proposed extensions of water and sewer services, but you may find it more convenient to add this information to one of your other overlays.

Other plans can also affect the community's future. You may want to obtain and map on separate overlays the state Conservation and Development Policies Plan and any regional plans (such as transportation or open space plans) that have been prepared for your area.

The plan of development can be obtained from the town planner or town clerk. If it has not been updated for several years, talk to the town planner or planning and zoning commission to find out when the next revision is scheduled and how you can ensure that water supply protection will be part of the process.

The Connecticut Conservation and Development Policies Plan, revised every five years, is available from the state Office of Policy and Management; your town or regional planning agency will also have a copy, as well as any regional plans that may affect your town.



Information Sources Matrix

Type (Subject) of Resource Information

P = Primary Source

S = Secondary Source

[illegible]

Sources of Information

Part 2: Evaluating the Information — Identifying Groundwater Problems and Issues

Once you have collected and mapped relevant information, you will have to assess what it shows. The use of map overlays (or GIS if available) is very helpful to identify potential problems and opportunities by easily comparing things. Below is an outline to help you evaluate groundwater information, step by step. An alternative is to simply overlay the maps one at a time, and note what it shows you. Basically, evaluating information is answering questions about the situation presented. The following questions should be answered by the assessment:

- what important aquifer resources exist, and where are they located?
- are aquifers now used for water supply, or needed for future supply?
- is the water quality currently good or degraded?
- does existing or future land use threaten water quality?
- do current programs, land use regulations and plans adequately consider and protect the resources?

They can be answered by following the steps below which build upon each other. In some cases you may find you need more information to make a decision, or need technical advice from DEP Water Management Bureau, or others.

■ Step 1: Identify and Characterize Groundwater Resources and Their Uses

Overlay Hydrology, Groundwater Resources, and Water Supply Sources/Service Areas mapping (example maps 1, 2, 3). The key question you want to answer here are what type of aquifers exist in town, and what is their use and value.

- a. Identify high or moderate yielding stratified drift aquifers.
 - identify existing community wells drawing from the aquifer, and proposed future wellfield sites.
 - note potential community supply aquifers. Note their importance, are they reasonably located near water service lines or planned growth areas, and what is their future need.
 - note if recharge areas are known or further delineation is needed.
- b. Identify bedrock/till aquifer areas.
 - note areas of on-site private and smaller public wells, and areas located outside proposed water service areas.
- c. Note the relationship of identified groundwater resources to adjacent watershed areas and general direction of water flow. Note the relationship of groundwater resources to adjacent surface waters (streams, lakes, reservoirs, and major wetland/flood zones). This will give you a general idea of the recharge and discharge areas of the groundwater resources, and relationship to other water resources.

Summarize your resource information on the following page, and assign *tentative priorities* to target resource areas for further consideration.

RESOURCE DESCRIPTION & USE CHECKLIST

GROUNDWATER RESOURCE	USE/VALUE			PRIORITY
	Present Supply	Future Supply	Surface Water Flow	High - Low
1. Stratified Drift Aquifers <ul style="list-style-type: none"> • Community Wellfields • State Aquifer Prot. Areas • Regionally Sign. Aquifers (high yield) • Locally Sign. Aquifers (moderate yield) 				
2. Bedrock/Till & Other Low-Yield Aquifers <ul style="list-style-type: none"> • Community Wells • Private Well Areas 				

Water Supply Information

Present Water Supply

Public Water

total population served _____

% of total pop. _____

groundwater _____ %

surface water _____ %

Private Wells

_____ % population served

Water Supply Plan Information:

Future Sources: _____

Other Supply Needs (treatment, storage, distribution, etc.): _____

■ Step 2: Assess The Current Water Quality Conditions of Identified Resources

Overlay Groundwater Resources, Water Supply Sources/Service Areas, Water Quality (example maps 2, 3, 4,) and Sewer Service Areas mapping. Although some groundwater resources are used for supply or have good yield potential, they may already have historic water quality problems from old landfills, unauthorized discharges, spills, historic urban lands, etc. The key task here is to sort out clean areas, areas with existing water quality problems, and their use. Aquifers may be undesirable for drinking water supply because of existing water quality.

For identified resources in Step 1 answer the following:

a. Is groundwater quality currently considered good?

YES _____

NO _____ If no:

- describe the type and extent of pollution, and known sources and severity.
- describe impacts to existing water supply use or surface waters.
- note existing measures to monitor or mitigate problems, or to abandon water supply sources.
- do public sewers help reduce pollution sources?
- note other relevant information.

Based on the above assessment review previous priorities.

■ Step 3: Identify Existing Land Use Conditions

Overlay Groundwater Resources, Water Supply Sources/Service Areas, Existing Land Use (example maps 2,3,5) and Sewer Services Area mapping. Based on existing land use conditions and the infrastructure in place, are identified resources threatened? Should the resources be monitored, or potential supplies eliminated?

For identified resources in Step 1 answer the following:

a. Do existing land use conditions protect water quality?

YES _____

NO _____ If no:

- identify the degree to which areas are threatened by land use and potential pollution sources.
- identify any measures in place to help reduce these threats.
- note other relevant information.

Based on the above assessment, review previous priorities.

■ Step 4: Determine How Future Land Use Will Affect Resources

Overlay Groundwater Resources, Water Supply Sources/Service Areas, Zoning (example maps 2, 3, 6), Future Land Use, and Sewer Service Areas mapping. You now need to determine what the future threats may be by examining the “built-out” condition as suggested in your current Zoning and Plan of Development. Will it protect the resources and be within their capacity to support proposed development?

For identified resources in Step 1 answer the following:

- a. Do existing zoning map designations protect resources by allowing compatible land uses?

YES _____

NO _____ If no:

- identify areas potentially zoned inappropriately.
- identify existing zoning regulations which address threats.

- b. Do land use designations in the Plan of Development indicate compatible land uses that will protect resources?

YES _____

NO _____ If no:

- identify potentially inappropriate land use designations.
- identify plan goals and policies which address the resources.

- c. Note areas in town where high risk development (industrial, commercial) may be better suited.

- d. Note if future water sources are reasonably located near projected development and growth areas or existing service lines.

The checklist on the following page can be used to summarize your findings for each groundwater resource area (wellfield, aquifer).

Part 3: Establishing Goals — A Statement of What Is To Be Achieved

A plan should be based on goals, a general statement of what the community wants to achieve. To help identify goals that should be considered by towns, examples are listed below. Not all will apply to every town, since they will be based on identified resource issues. You may have identified some preliminary goals as part of your purpose for considering an aquifer protection plan or study, and now you can refine those based on your evaluation. Ideally, many of these goals, along with the supporting resource information, will be included in the town Plan of Development so they are utilized in town land use and environmental decisions.

1. Resource Management/Protection

- Recognize groundwater as an important source of water by incorporating groundwater resource information in town conservation and development plans.

POTENTIAL PROBLEMS & ISSUES CHECKLIST

Groundwater Resource (wellfield, aquifer, etc.) _____

POTENTIAL PROBLEM/ISSUE	YES	No	COMMENT
Existing Water Quality			
Land Use			
• existing uses			
• zoning			
• plan of development			
Infrastructure			
• water service extension			
• sewer service extension			
• sewer avoidance			
Other Resource Concerns (list)			

- Identify and protect important existing and future public water supply aquifers, and private well areas.
- Ensure local implementation of the State Aquifer Protection Area Program for applicable public wellfields.
- Seek further hydrogeological evaluation of specific aquifers and wellfields to delineate critical recharge areas.
- Inform and educate the public and business community about groundwater, its importance, and pollution prevention actions.

2. Land Use & Development

- Revise the town Plan of Development to recognize important groundwater resources, identify compatible land use designations on the future land use plan, and incorporate policies to properly site high-risk land use and prevent pollution.
- Identify critical groundwater resources for protection in open space and land acquisition programs.
- Manage existing high risk land uses which threaten groundwater quality.
- Revise zoning map designations and regulations to protect important groundwater resources.
- Minimize groundwater pollution by properly siting and controlling land use activities.
- Promote interagency coordination of land use decisions with water companies and state environmental and health officials.
- Ensure proper waste disposal and hazardous material storage and handling at existing business and town facilities.

3. Infrastructure Improvement or Avoidance

- Avoid extending public sewers into sensitive groundwater areas, which may encourage intensive land use and cause secondary impacts.
- Establish a sewer avoidance program to manage onsite sewage disposal systems and avoid sewerage areas.
- Plan public water service in areas impacted by long-term groundwater supply pollution and areas suitable for planned urban development.
- Extend public sewers into areas to solve existing pollution problems and to serve areas suitable for planned growth.

4. Municipal Programs

- Review town operations and procedures which can affect water quality.
- Insure water supply wells are adequately monitored and tested for drinking water quality.
- Inform and educate the community about groundwater, private well protection, and pollution prevention measures.
- Coordinate protection efforts with adjacent towns which share resources.

Part 4: Selecting Solutions

After you have identified problems/issues and stated general goals, you must select specific measures to address them. The checklist on the next page will help you identify the regulatory and non-regulatory tools already in place in your town, as well as those that might need to be amended or added to ensure local groundwater protection. When determining the best course of action, be sure to take into consideration your resources of staff, time and budget. If a measure cannot be implemented or enforced, it will not be helpful to prescribe it.

Following the checklist is an action plan worksheet which can be used to organize identified problems/issues, goals, recommended actions and implementation. This worksheet is particularly useful for demonstrating *why* you are proposing certain actions be taken.

See Part IV of this manual for an in-depth discussion of the regulatory and non-regulatory tools available to towns. See also the selected model ordinances in Supplement C.

CHECKLIST OF GROUNDWATER PROTECTION MEASURES

IMPLEMENTATION MEASURES	EXIST	AMEND	NEED	COMMENT
<p>■ Regulatory</p> <p>1. LAND USE CONTROLS</p> <p>A. Plan of Development</p> <ul style="list-style-type: none"> • policies & goals • future land use designation <p>B. Zoning</p> <ul style="list-style-type: none"> • rezone areas (change zones) • special aquifer/wellhead zone • special permits • performance/design standards • impact assessment provisions • cluster zoning • buildable land criteria • other <p>C. Subdivision</p> <ul style="list-style-type: none"> • design standards • impact assessment provisions • open space provisions <p>D. Ordinance/Regulation</p> <ul style="list-style-type: none"> • underground fuel storage • hazardous material storage/handling • septic system maintenance 				

IMPLEMENTATION MEASURES	EXIST	AMEND	NEED	COMMENT
<ul style="list-style-type: none"> • stormwater management • health code (well construction/testing) 				
<p>■ Non-Regulatory</p> <p>2. MUNICIPAL PROGRAMS</p> <ul style="list-style-type: none"> • business inspection/monitoring • sewer avoidance • sewer service extension • water service extension • household hazardous waste collection • business pollution prevention education • water quality/well monitoring • open space/land acquisition plan • public information/education <ul style="list-style-type: none"> - household hazardous waste - underground fuel storage - septic systems - private wells - water conservation <p>3. INSTITUTIONAL ACTIVITIES</p> <ul style="list-style-type: none"> • town agency coordination • permanent water quality work group • road salt storage/use practices • intertown coordination • other 				

ACTION PLAN

This worksheet can be used to summarize and organize your recommendations. Recommended measures should be based upon identified problems or issues impacting the town, and address your stated goals. Recommendations also should identify the party responsible for carrying out each measure (town official/agency), especially if the tasks are newly created. Finally, the action plan should include an implementation timeframe and assign priority to each recommendation.

Use multiple copies of this worksheet to summarize all your proposed measures.

Problem/Issue:

Goal:

Recommendation/Measure:

Responsible Agency/Person:

Timeframe:

Priority:

Supplement B

Assessing Land Use Risks

Part 1: Guidelines to Inventory Land Use Risks

An inventory of existing land use is a good way to identify existing threats to water quality and help determine activities that should be further examined. The inventory can include two layers of information, or you can use one or the other. The first method is to map general land use areas by typical planning categories (open space to industrial). The other is to map the particular high risk use or activity as a numbered points and list basic information about it on an index. If you have existing general land use mapping you may want to use it and add high risk points information. Below is guidance on how to do each type of mapping, and suggested methods and sources of information.

General Land Use Categories To Be Mapped

Land use categories can be mapped as: open space, residential, agricultural, commercial, institutions, industrial, utilities, transportation, and waste disposal. These land use types are listed in general order of increasing risk to groundwater quality. Every land use type can however, encompass both high and low risk activities.

Land use categories should be mapped to at least a five-acre level of detail and down to a two-acre level of detail. Municipalities may also map some or all of the subcategories indicated; however, such detail is optional. Different land use categories should be indicated on the map by color and/or letter codes.

■ Open Space

1. Water utility-owned land, dedicated natural areas, state parks and forests.
2. Landscaped parks or open spaces (including cemeteries, golf courses, playing fields, public gardens, and city parks).
3. Undeveloped, vacant land.

■ Residential

1. Low density (1 or fewer dwelling units per acre).
2. Medium density (2 to 8 dwelling units per acre).
3. High density (more than 8 dwelling units per acre).

■ Agricultural

Permanent pastureland, hayfields, row crops, orchards, nurseries, Christmas tree plantations, greenhouses, animal husbandry (livestock, dairy, poultry, etc.).

■ Commercial

Retail, trades, and services; includes most offices and stores, as well as service businesses.

■ Institutional

Public buildings and facilities, government offices including the municipal hall, libraries, churches, schools, prisons, hospitals, fire stations, public works garages, etc.

■ Industrial

1. Lower risk industry (no materials processing, just assembly; no bulk storage of chemicals or scrap, or onsite disposal).
2. Resource extraction (rock quarrying, sand and gravel excavation).
3. Higher risk industry (any industry involving materials processing or primary manufacturing; especially chemical, metal plating, finishing, or other processing).

■ Utilities

Power stations, water supply treatment facilities, etc.

■ Transportation

Airports, highway maintenance facilities and municipal garages, rail stations, rail stations and yards, bus terminals.

■ Waste Disposal, Treatment or Handling

- Landfills, transfer stations
- Bulky wastes
- Sewage treatment and sewage sludge disposal
- Special waste, such as septage and industrial waste
- Hazardous waste
- Recycling processing area
- Junk or salvage yards
- Historic and closed waste sites of all kinds
- Resource recovery facilities

Higher Risk Activities And Facilities

The activities listed below can be mapped as numbered points on the base map, with business name, type, and address shown in an attached index. Use an "X" to show the location of the high risk use, with the center of the X on the center of the use. The listing by land use category below is intended to provide a general guide; any use related to or similar to those listed should also be identified. Where known, former high risk sites (such as gas stations, mills, and factories) should be mapped as high risk points and labeled as vacant in the index.

■ Open Space – higher risk activities include:

- golf courses
- cemeteries

■ **Residential – higher risk activities include:**

- unsewered high and moderate density residential development.
- certain home occupations (see higher risk commercial uses listed below).

■ **Agricultural – higher risk activities include:**

- nurseries and greenhouses, row crops, orchards, tree plantations, intensive livestock areas.

■ **Commercial – higher risk activities include:**

- all automotive sales or services (any car, truck, bus, recreational vehicle, marine, or heavy equipment facility) including gas and service stations, body and general repair shops, dealerships, rental or leasing operations, washes, etc.
- machine shops
- junk or salvage yards
- certain retail trades including: fuel oil distributors or dealers, lumber yards, hardware stores, auto and home supply stores, garden centers, department stores, heavy construction businesses
- personal and repair services including: dry cleaners; launderers and laundromats; lawn care businesses; photo processors; equipment rental; pharmacies; printers; funeral parlors and crematories; medical, dental, and veterinary offices; furniture strippers and finishers; reupholsterers; electrical, radio, and television repair; appliance, lawnmower, and small engine repair; heating and cooling equipment service; pesticide applicators and exterminators; etc.
- research or testing laboratories
- large uncovered parking areas (more than 100 spaces), parking garages with open roofs
- underground fuel and chemical storage

■ **Institutional – higher risk activities include:**

- garages and vehicle or equipment service areas
- fuel storage and dispensing facilities
- salt storage areas
- hospitals
- secondary schools and colleges with workshops or laboratories
- prisons with workshops or laboratories

■ **Manufacturing & Industrial – higher risk activities include:**

- All manufacturing and processing facilities except: simple assembly involving no processing, and warehousing of durable goods (no chemicals).
- warehousing, storage, or distribution of: chemicals; fertilizers; pesticides and allied products; petroleum, coal, and other fuels; and hazardous materials.
- mining (rock quarries and sand and gravel excavation)

■ **Utilities – higher risk activities include:**

- electric power generation
- oil or chemical pipelines

■ **Transportation – higher risk activities include:**

- airports
- highway maintenance facilities, including road salt storage
- truck, rail, or bus terminals, stations, or maintenance facilities

■ **Waste – all waste disposal, treatment or handling sites should be identified as higher risk activities, including:**

- mixed waste landfills
- solid waste transfer stations
- bulky waste landfills
- sewage treatment plants, sewage sludge disposal
- special waste, such as septage and industrial waste
- hazardous waste
- recycling processing center
- junk and salvage yards
- resource recovery facilities
- historic and closed waste sites of all kinds

This list contains the more common higher risk uses. Any activity involving the handling, use, storage, or disposal of large quantities of solvents, petroleum products, pesticides, or hazardous chemicals constitutes a higher risk activity.

Suggested Information Sources And Inventory Methodologies

There are several possible ways for determining the locations of higher risk activities. Communities are urged to combine several approaches, rather than relying completely on one source or method.

- Windshield survey — Although driving through town and visually noting higher risk uses is fairly time-consuming, this technique is generally acknowledged to be the most reliable and complete method for identifying land uses.
- Municipal officials, especially sanitarians or health inspectors, building inspectors, fire marshals, planners, and zoning enforcement officials — can help identify or confirm land use variances and higher risk activities.
- Water utility or municipal water department inspectors and managers — are often aware of higher risk uses threatening water supplies.
- Emergency Response Plan — Under the Federal Superfund Amendments and Reauthorization Act (SARA Title 3), facilities that manufacture, use, and/or store hazardous materials are required to report to the local Emergency Planning Committee and local fire department. Reporting is required to aid municipalities in emergency response planning for the possibility of fires or spills involving such materials. The businesses identified in these Emergency Response Plans will almost all prove to be higher risk activities.
- DEP's Leachate and Wastewater maps and reports — The Natural Resources Center of DEP maintains maps showing known sources of leachate and wastewater in the State. These maps are arranged by major drainage basin and are available from the Natural Resources Center.
- Underground Storage Tank Inventory — The Waste Management Bureau, Underground Storage Program in DEP maintains a statewide inventory of non-residential underground fuel, petrochemical, and waste oil tanks (all gas tanks and other tanks containing more than 2,000 gallons). Data sheets showing addresses of each unknown underground storage tank are available from the DEP. Such underground storage tanks constitute a

threat to the aquifer in themselves and are often also indicators of businesses posing other threats to groundwater.

- Aerial photographs — Aerial photos are most helpful when interpreted by people with air photo experience.
- Yellow pages.
- Chamber of Commerce industry and commerce listings.
- Regional planning organizations — may have information from previously conducted inventories.

Part 2: Table of Land Uses and Activities of Concern to Groundwater Supplies

The table on the following pages lists activities which are known or suspected risks to groundwater quality. The potential risk is related to waste generation or the use and handling of hazardous materials associated with the use. Certain wastes or chemicals are a particular concern because they may be toxic, persistent, or mobile and can pollute groundwater in very small amounts.

The table is organized into two major categories: activities or practices; and traditional land uses. The land use categories are organized by type and Standard Industrial Code (SIC) where applicable. The recommended controls relates to typical zoning mechanisms. **Recommended control is based on application to a specific sensitive resource area — i.e., a significant public water supply aquifer or wellfield area. Extra protection is based on its water supply value, environmental sensitivity, and social and economic value to a town or region. Some of these controls may be applicable throughout town, but none should be applied on an absolute basis.** Even though many land uses present risks, they may be necessary or acceptable. The idea is to site them, or plan for them to be sited, where they can do the least harm and where infrastructure can help support them.

Additional information about land use and its impacts to groundwater is available from the DEP Water Management Bureau.

TABLE OF ACTIVITIES AND LAND USES OF CONCERN TO GROUNDWATER SUPPLIES

ACTIVITY/LAND USE

CRITICAL ACTIVITY AND MATERIAL

RECOMMENDED CONTROL COMMENT

■ Section 1: Activity or Practice – Not A Specific Land Use (or can occur incidental to various land uses)

1. WASTE DISPOSAL <ul style="list-style-type: none"> • SANITARY LANDFILLS • SEPTAGE LAGOONS • HAZARDOUS WASTE DISPOSAL • BULKY AND SPECIAL WASTE DISPOSAL • SLUDGE DISPOSAL • WATER SOFTENER BRINES • STUMP DUMPS 	<p>Activity – Leachate generation from waste disposal.</p> <p>Material – Numerous chemical constituents.</p>	Prohibit. Very high risk, controlled at state level.
2. SEPTIC SYSTEM DISCHARGE OF NON-DOMESTIC WASTE	<p>Salt contamination from treatment backwash.</p> <p>Material – Modest natural organic leachate.</p>	Prohibit salt discharges to ground or to septic system.
3. UNDERGROUND LEACHING SYSTEMS FOR STORMWATER FROM PAVED HIGHWAYS, PARKING AND DEVELOPED AREAS	<p>Activity – Discharge of non-biodegradable wastes to groundwater.</p> <p>Material – Persistent organics and inorganics.</p>	Restrict during site development review to property needs and clean material.
4. FLOOR DRAINS	<p>Activity – Pavement runoff to leaching systems for stormwater runoff management.</p> <p>Material – Sodium chlorides metals, solvents, pesticides, petroleum chemicals, transportation spills.</p> <p>Activity – Illegal or inadvertent disposal of various pollutants through dry wells or septic systems.</p> <p>Material – Organics and inorganic chemical contaminants.</p>	Prohibit. Very difficult to control or adequately treat. Run off from clean roofs and undeveloped areas may be acceptable.
		Prohibit discharge except where connected to public sewer with DEP approval and treatment where required.

Activity/Land Use	Critical Activity and Material	Recommended Control Comment
5. WASTE PROCESSING SYSTEMS <ul style="list-style-type: none"> • RESOURCE RECOVERY FACILITIES FOR MUNICIPAL SANITARY WASTES • SOLID WASTE TRANSFER STATION • RECYCLING PROCESSING CENTERS • SEWAGE TREATMENT PLANTS • SALVAGE, JUNK YARD 	<p>Activity – Spills, leaks and possible leachate from storage and processing wastes.</p> <p>Material – Potential organic and inorganic contaminants.</p>	Prohibit. Nature of business is difficult to control.
6. UNDERGROUND STORAGE OR TRANSMISSION OF LIQUID FUELS AND HAZARDOUS CHEMICALS <ul style="list-style-type: none"> • UNDERGROUND STORAGE TANKS • UNDERGROUND DISTRIBUTION SYSTEMS • LIQUID FUEL PIPELINES 	<p>Activity – Tank, pipeline or joint leaks or breaks.</p> <p>Material – Liquid fuels, hazardous chemicals.</p>	Prohibit. High risk, difficult to detect leak or failure.
7. OUTDOOR, UNPROTECTED STORAGE OF CHEMICAL PRODUCTS AND WASTES ABOVE GROUND	<p>Activity – Exposure of materials to precipitation, and subsequent generation of leachate: spills; leaks; accidents.</p> <p>Material – Various organic and inorganic contaminants.</p>	Prohibit. Require indoor and special storage standards for chemicals and wastes if of small quantity.
8. ROAD SALT STORAGE	<p>Activity – Stockpiling and handling for de-icing roads and parking lots.</p> <p>Material – Sodium chloride, de-caking chemicals.</p> <p>Activity – Leaking pipes, failures.</p> <p>Material – Various organic wastes and chemical contaminants.</p>	Prohibit. Stockpiles and mixing areas often ignored.
9. PUBLIC SEWERAGE SYSTEMS, PIPELINES AND PUMP STATIONS	<p>Activity – Fuel, petroleum product storage, equipment maintenance and unauthorized waste disposal.</p> <p>Material – Hydrocarbons, petrochemicals, solvents.</p>	Conditional. Require low exfiltration pipe specifications (Reservoir Equivalent), special spill and failure protection for manholes and pump stations.
10. MINING, SAND AND GRAVEL EXCAVATION.		Special permit. Management standards for hazardous material storage and use, security against waste disposal, proper site restoration.

ACTIVITY/LAND USE

CRITICAL ACTIVITY AND MATERIAL

RECOMMENDED CONTROL COMMENT

Section 2: Land Uses

1. RESIDENTIAL
 - DENSITY GREATER THAN ONE UNIT PER ACRE; LOT SIZE LESS THAN ONE ACRE
 - HOME OCCUPATIONS
2. AGRICULTURE (SIC 01XX-07XX)
 - ROW CROPS, ORCHARDS, LIVESTOCK, NURSERIES
3. INSTITUTIONAL (SIC 82XX)
 - A. EDUCATIONAL FACILITIES
 - ELEMENTARY AND SECONDARY SCHOOLS
 - COLLEGE AND UNIVERSITIES
 - VOCATIONAL SCHOOLS
 - B. PRISONS
 - C. MUNICIPAL AND STATE GARAGES FOR HIGHWAY AND PUBLIC WORKS DEPARTMENTS

Activity – Large domestic sewage volumes, household hazardous waste, underground fuel storage.

Material – Nitrates, pesticides, petroleum.

Activity – Similar commercial or industrial uses but on smaller scale.

Material – Various chemicals depending on type of use.

Activity – Pesticide, fertilizer storage and application, animal waste management, fuel, vehicle maintenance.

Material – Chemical pesticides, nitrates, petrochemicals.

Activity – Chemistry/physics/biology labs, automotive repair shops, industrial arts, hazardous material storage and use, school, lab and shop wastes, underground fuel storage.

Material – Petrochemicals, laboratory chemicals and waste, cleaning solvents.

Similar to educational facilities see above.

Activity – Road maintenance related equipment storage, equipment maintenance, and fuel storage.

Material – Cleaning solvents, hydrocarbons, pesticides, any other organic chemicals.

Conditional. Low to moderate risk, at greater density it is difficult to meet water quality goal for conventional pollutants. Recommend connection to public sewer, no underground fuel storage, education program. Recommended minimum density/lot size in unsewered areas is 1 unit/2 acres (exclusive of wetlands).

Regulate particular use as listed for the commercial or industrial use.

Conditional. Require a management plan for operation using best management practices for critical materials and activities. Town should require that farmer develop plan in accordance with existing state and federal agricultural agency guidance.

Special permit. Connection to public sewer desirable.

Prohibit

ACTIVITY/LAND USE	CRITICAL ACTIVITY AND MATERIAL	RECOMMENDED CONTROL COMMENT
D. ROADS, TRANSPORTATION CORRIDORS. INSTITUTIONAL, COMMERCIAL OR INDUSTRIAL PARKING AREAS	Activity – De-icing highway runoff, transportation spills and accidents. Material – Sodium chloride, hydrocarbons, various hazardous materials.	Restrict sodium chloride use. Review per site plan and municipal improvement project review for stormwater disposal and spill containment.
E. AIRPORTS	Activity – De-icing, aircraft and equipment maintenance, fuel storage and distribution. Material – Hydrocarbons, solvents, waste oils, de-icing chemicals, and other wastes.	Prohibit.
F. HOSPITALS	Activity – Non-domestic wastes, large fuel storage. Material – Laboratory chemicals and pathogens, liquid fuel.	Special permit. Require connection to public sewer.
4. COMMERCIAL A. RETAIL TRADE (SIC 52XX-59XX) • NEW OR USED CAR DEALERS • GASOLINE SERVICE STATIONS • BOAT DEALERS • RECREATIONAL VEHICLE DEALERS • MOTORCYCLE DEALERS • OTHER AUTOMOTIVE DEALERS • FUEL OIL DEALERS • LUMBER HARDWARE AND OTHER BUILDING MATERIALS • PAINT, GLASS AND WALLPAPER STORES • RETAIL NURSERIES AND GARDENS • MOBILE HOME DEALERS • DEPARTMENT STORES • AUTO AND HOME SUPPLY STORES	Activity – Fuel and chemical storage, vehicle maintenance and repair, use of solvents, lubricants, paints, brake and transmission fluids, generation of waste oils, hazardous and non-hazardous wastes. Material – Petrochemicals, solvents, waste oil and other organic chemicals. Activity – Storage of various chemicals and hazardous material. Material – Petrochemicals, solvents and pesticides.	Prohibit. Special permit.

ACTIVITY/LAND USE

CRITICAL ACTIVITY AND MATERIAL

RECOMMENDED CONTROL COMMENT

- B. PERSONAL OR BUSINESS SERVICES (SIC 70XX - 89XX)
 - DRY CLEANING
 - INDUSTRIAL LAUNDERERS
 - LAWN CARE BUSINESS
 - HEAVY CONSTRUCTION EQUIPMENT RENTAL
 - POWER LAUNDRIES (FAMILY OR COMMERCIAL)
 - BEAUTY SHOPS
 - FUNERAL SERVICE AND CREMATORIES
 - PHOTOFINISHING LABORATORIES
 - PRINT SHOPS
 - PHARMACIES
- C. AUTOMOTIVE SERVICES: (SIC 75XX)
 - TOP AND BODY REPAIR/PAINT SHOPS
 - AUTO EXHAUST SYSTEM REPAIR
 - TIRE RETREADING AND REPAIR
 - AUTOMOTIVE TRANSMISSION REPAIR
 - GENERAL AUTOMOTIVE REPAIR
 - OTHER AUTOMOTIVE REPAIR
 - RADIATOR REPAIR
- D. OTHER AUTOMOTIVE SERVICES: (SIC 75XX)
 - TRUCK RENTAL AND LEASING, NO SERVICE.
 - PASSENGER CAR RENTAL
 - PASSENGER CAR LEASING
 - UTILITY TRAILER RENTAL
 - AUTOMOTIVE GLASS REPLACEMENT
 - CAR WASHES

Activity – Cleaning solvents, chemical storage and use, industrial strength cleaning, heavy equipment fueling and maintenance.

Material – Chemicals and wastes associated with service, e.g. chlorinated solvents, hydrocarbons, and heavy metals.

Special permit. Require connection to public sewer.

Prohibit.

Activity – Fuel storage, use and storage of oils, paints, thinners, various solvents and fluids.

Material – Hydrocarbons, solvents, and benzene.

Activity – Similar to above.

Material – Similar to above.

Special permit. No vehicle maintenance or engine repair allowed.

Activity – Non-domestic wastewater.

Material – Detergents, petrochemicals.

Special permit. Require connection to public sewer.

ACTIVITY/LAND USE	CRITICAL ACTIVITY AND MATERIAL	RECOMMENDED CONTROL COMMENT
E. MISCELLANEOUS REPAIR SERVICES (SIC 76XX) • FURNITURE STRIPPING • ARMATURE REWINDING SHOPS • MARINE SERVICE AND REPAIR • SMALL ENGINE REPAIR • RADIO AND TELEVISION REPAIR • REFRIGERATION SERVICE AND REPAIR • OTHER ELECTRICAL REPAIR SHOPS • REUPHOLSTERY AND FURNITURE REPAIR	Activity – General use of cleaning solvents, cleaning, lubricating parts. Material – Solvents, oils, methylene chloride, other hazardous substances.	Prohibit. Special permit.
F. HEALTH SERVICES: (SIC 80XX, 074X) • MEDICAL, DENTAL OFFICES • VETERINARY SERVICES • MEDICAL, DENTAL LABS • HOSPITALS, CLINICS • NURSING AND PERSONAL CARE	Activity – Non-domestic wastewater, medical waste, hazardous material use and storage. Material – Various laboratory chemicals and chemical waste. Can have large fuel storage, pharmaceutical chemicals.	Special permit. Require connection to public sewer.
G. MISCELLANEOUS: • CHEMICAL OR BIOLOGICAL LABORATORIES	Activity – Chemical use and storage, non-domestic wastewater.	Prohibit.
• GOLF COURSES	Material – Various chemicals and waste.	Prohibit or Special permit.
5. INDUSTRIAL A. CONSTRUCTION (SIC 15XX-17X8) • HIGHWAY AND STREET CONSTRUCTION • BRIDGE, TUNNEL, ELEVATED HIGHWAY • WATER, SEWER, AND UTILITY LINES • HEAVY CONSTRUCTION	Activity – Intense lawn care pesticide storage and application, equipment maintenance. Material – Pesticides, nitrates, waste oils, hydrocarbons. Activity – Fuel, vehicle storage and maintenance. Material – Hydrocarbons, cleaning agents.	Special permit.

ACTIVITY/LAND USE

CRITICAL ACTIVITY AND MATERIAL

RECOMMENDED CONTROL COMMENT

B. MINING ACTIVITIES (SIC 10XX-14XX)

Activity – Fuel, vehicle storage and maintenance.

Special permit.

Material – Hydrocarbons, cleaning solvents

C. FOOD AND KINDRED PRODUCTS (SIC 20XX)

Activity – Raw material storage, processing wastes.

Special permit.

Material – Nitrogenous wastes, preservatives

D. TEXTILE MILL PRODUCTION (SIC 22XX)

Activity – Storage and use of hazardous materials, equipment cleaning and hazardous wastes.

Prohibit.

- DYEING

- TANNING

- TEXTILE COATING

- FABRIC PRINTING

Material – Strong acids and alkalis, solvents, metals and hydrocarbons.

- ALL OTHER TEXTILES

Special permit.

E. APPAREL AND OTHER (SIC 23XX)

Activity – Storage and use of hazardous materials, equipment cleaning and hazardous wastes.

Prohibit.

- TEXTILE PRODUCTS

- DYEING

- TANNING

- TEXTILE/APPAREL COATING

- FABRIC/APPAREL PRINTING

Material – Strong acids and alkalis, solvents, metals and hydrocarbons.

- ALL OTHER APPAREL PRODUCTION

Special permit.

F. LUMBER AND WOOD PRODUCTION (SIC 24XX)

Activity – Chemical treatment of wood, chemical storage.

Prohibit.

- HARDWOOD VENEER AND PLYWOOD

- SOFTWOOD VENEER AND PLYWOOD

- WOOD PRESERVING

- RECONSTITUTED WOOD PRODUCTS

Material – Creosotes, tars trichlorophenol, pentachlorophenol, metals solvents, and oils.

- ALL OTHER ACTIVITIES

Special permit.

G. FURNITURE AND FIXTURES (SIC 25XX)

Activity – Painting and finishing.

Prohibit painting and finishing. Special permit, if assembly only.

Material – Solvents, preservatives, paint wastes.

Activity/Land Use	Critical Activity and Material	Recommended Control Comment
H. PAPER AND ALLIED PRODUCTS (SIC 26XX) • PULP & PAPER MANUFACTURING	Activity – Storage and use of hazardous and non-hazardous materials, large quantities of waste generation. Material – Toxic organic and inorganic chemicals, metals, and chlorinated hydrocarbons.	Prohibit.
I. PRINTING AND PUBLISHING (SIC 27XX) INCLUDING PLATE MAKING, COMMERCIAL LITHOGRAPHIC, ENGRAVING, PRINTING, GRAVURE	Activity – Storage and use of organic chemicals, equipment cleaning, engraving.	Prohibit.
J. CHEMICALS AND ALLIED (SIC 28XX)	Material – Chlorinated solvents, phenols hydrocarbon. Activity – Storage, use and production of chemicals, equipment cleaning and maintenance, hazardous waste generation.	Prohibit. Very high risk.
K. PETROLEUM AND COAL PRODUCTS (SIC 29XX)	Material – Organic and inorganic chemicals. Activity – Storage and use of fossil fuels, machine shops, equipment cleaning and maintenance.	Prohibit. Very high risk.
L. RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS (SIC 30XX) • RUBBER MANUFACTURING, e.g., FABRIC COATING, ELASTOMER AND RESIN CEMENTS, TIRES AND TUBES • ALL OTHER ACTIVITIES	Material – Hydrocarbons, solvents. Activity – Raw material storage, process, hazardous waste generation, machine shops. Material – Waste oils, solvents, phenols, strong organic and inorganic wastes.	Prohibit.
M. LEATHER AND LEATHER PRODUCTS (SIC 31XX) • LEATHER TANNING AND FINISHING • ALL OTHER ACTIVITIES	Activity – Storage and use of toxic chemicals. Material – Strong acids and alkalis.	Special permit, if assembly or fabrication only.
		Prohibit.
		Special permit, if assembly or fabrication only.

ACTIVITY/LAND USE

CRITICAL ACTIVITY AND MATERIAL

RECOMMENDED CONTROL COMMENT

N. STONE, CLAY AND GLASS PRODUCTS (SIC 32XX)

- GLASS MIRRORS, COATING

- ALL OTHER ACTIVITIES

O. PRIMARY METAL INDUSTRIES (SIC 33XX)

P. FABRICATED METAL PRODUCTS (SIC 34XX)

- METAL PLATING OR CLEANING, ETCHING, AND DEGREASING

- ALL OTHER ACTIVITIES

Q. INDUSTRIAL MACHINERY AND EQUIPMENT (SIC 35XX)

- METAL PLATING OR CLEANING, ETCHING, DEGREASING
- MACHINE SHOPS

Activity – Machine shops, chemical processes for mirror and coating manufacturing.

Material – Strong acids and alkalis.

Prohibit.

Special permit.

Activity – Foundries, metal forming machine shops, equipment cleaning and maintenance, use and storage of fuels, hazardous and non-hazardous waste generation.

Material – Strong acids and alkalis, metals, chlorinated solvents, cyanides, waste oils.

Prohibit.

Activity – Storage and use of hazardous materials, hazardous waste generation, equipment cleaning and maintenance, machine shops.

Prohibit.

Material – Heavy metals, chlorinated hydrocarbons, strong acids and alkalis, waste oils, paint and thinner wastes, cyanides.

Special permit, if assembly only.

Activity – Storage and use of hazardous materials, hazardous waste generation, equipment cleaning and maintenance, machine shops.

Prohibit.

Material – Heavy metals, chlorinated hydrocarbons, strong acids and alkalis, waste oils, paint and thinner wastes, cyanides.

ACTIVITY/LAND USE	CRITICAL ACTIVITY AND MATERIAL	RECOMMENDED CONTROL COMMENT
R. ELECTRONIC AND OTHER ELECTRIC EQUIPMENT (SIC 36XX) <ul style="list-style-type: none"> • METAL PLATING OR CLEANING, ETCHING, AND DEGREASING 	Activity – Storage and use of hazardous materials, hazardous waste generation, equipment cleaning and maintenance, machine shops. Material – Heavy metals, chlorinated hydrocarbons, strong acids and alkalis, waste oils, paint and thinner wastes, cyanides.	Prohibit.
S. TRANSPORTATION AND OTHER ELECTRIC EQUIPMENT (SIC 37XX) <ul style="list-style-type: none"> • METAL PLATING OR CLEANING, ETCHING, AND DEGREASING 	Activity – Storage and use of hazardous materials, hazardous waste generation, equipment cleaning and maintenance, machine shops. Material – Heavy metals, chlorinated hydrocarbons, strong acids and alkalis, waste oils, phenols, cyanides.	Prohibit.
T. INSTRUMENTS AND RELATED PRODUCTS (SIC 38XX) <ul style="list-style-type: none"> • METAL PLATING OR CLEANING, ETCHING, AND DEGREASING 	Activity – Storage and use of hazardous materials, hazardous waste generation, equipment cleaning and maintenance, machine shops. Material – Heavy metals, chlorinated hydrocarbons, strong acids and alkalis, oils.	Prohibit.
U. MISCELLANEOUS MANUFACTURING INDUSTRIES (SIC 39XX) <ul style="list-style-type: none"> • METAL PLATING OR CLEANING, ETCHING, AND DEGREASING 	Activity – Storage and use of hazardous materials, hazardous waste generation, equipment cleaning and maintenance, machine shops. Material – Heavy metals, chlorinated hydrocarbons, strong acids and alkalis, oils.	Prohibit.
V. MACHINE OR MAINTENANCE SHOPS AS A SUPPORT ACTIVITY (no contract work)	Activity – Accidental or illegal discharge of cleaning solvents and waste oils. Material – Solvents, waste oils.	Special permit.

ACTIVITY/LAND USE	CRITICAL ACTIVITY AND MATERIAL	RECOMMENDED CONTROL COMMENT
<p>W. TRANSPORT; COMMUNICATIONS; UTILITY (SIC 49XX)</p> <ul style="list-style-type: none"> • TRANSPORTATION SYSTEMS MAINTENANCE • CRUDE PETROLEUM PIPELINES • REFINED PETROLEUM • FOSSIL FUEL POWER PLANTS • ELECTRIC SERVICES • ELECTRIC AND OTHER SERVICE COMBINATION • COMBINATION UTILITIES 	<p>Activity – Large petrochemical storage and distribution, equipment and vehicle maintenance.</p> <p>Material – Hydrocarbons, fuels, solvents, waste oils.</p>	<p>Prohibit.</p>
<p>X. WHOLESALE TRADE OR WAREHOUSING (SIC 50XX-51XX)</p> <ul style="list-style-type: none"> • COAL, OTHER MINERALS AND ORES • METAL AND AUTO PARTS SALVAGE • CHEMICALS AND ALLIED PRODUCTS, NEC • PETROLEUM BULK STATIONS/TERMINALS • PETROLEUM PRODUCTS • PAINTS, VARNISHES, SUPPLIES AND OTHER CHEMICAL 	<p>Activity – Large volume storage of various hazardous materials, spillage or accidental releases.</p> <p>Material – Liquid fuels, hydrocarbons, organic and inorganic chemicals.</p>	<p>Prohibit. Very large volumes of hazardous material can get released by accident or disaster.</p>

Supplement C

Tools for Groundwater Protection

Introduction

The following models and actual town examples are provided for illustration and may not be appropriate or may require modifications for your needs. Part IV of this Manual discusses the purpose and usefulness of the various tools. Common regulatory measures are presented here as well as useful non-regulatory education and information materials to protect groundwater. *As with any proposed regulatory measure, it should be assured that statutory authority exists for the regulation, and any regulation proposed should be reviewed for legal sufficiency by your legal counsel.* The document *What's Legally Required*, available from DEP's Publications Office, is also a good reference to the legal rules for land use regulations and decisions. As with any regulation, consideration should be given to your ability to administer and enforce it.

Part 1: Model Zoning Regulations

Following are models and existing town examples of zoning provisions to protect groundwater. The provisions provided are the most common zoning components used by towns. In selecting any of these provisions, or modifications of them, you should evaluate what is most suitable for your town. In some cases entire zone map changes, such as industrial to residential or commercial, may be more appropriate.

a. Aquifer Protection Overlay Zone

Following is a format for developing the most common groundwater protection regulation: an **aquifer protection overlay zone**. This is a “performance” zone used as an “overlay” in which present zoning remains in place but certain uses are restricted or controlled based on their potential impacts to the aquifer. The zoning district boundaries are related to the hydrogeologic characteristics of the aquifer (aquifer area, recharge areas, wellfield, etc.) you want to protect. This model has been designed for a typical stratified drift aquifer which is or has potential to be a public water supply source.

NOTE: The terms and mechanisms discussed in the regulation are based on typical zoning tools. These tools include: prohibiting or restricting certain land uses; a special permit or special exception for uses requiring a more detailed review; conditionally allowing uses subject to specific conditions.

NOTE: The model has been written as a guide to develop a specific local regulation. It is recommended each town have their regulation reviewed by their legal counsel prior to adoption.

The main components of the aquifer protection zone regulation are:

- Title and Purpose
- Authority
- Definitions
- Applicability
- Designation of the Zone
- Use Regulations (permitted, prohibited, special or conditional)
- Permit Requirements
- Performance or Design Standards

I. PURPOSE, STATEMENT OF INTENT

The purpose of this regulation is to protect and preserve ground water quality within stratified drift aquifers which are existing or potential public drinking water supplies. These ground water resources have been shown to be easily contaminated by many land uses and activities and it is necessary that specific controls over land use be exercised within these areas to protect ground water quality.

NOTE: Specific aquifers, aquifer areas or wellfields areas may be identified.

II. AUTHORITY

These regulations are promulgated pursuant to Connecticut General Statutes Section 8-2 and 8-23 (zoning and planning regulations).

NOTE: Public Act 85-279 amended both sections to **require** municipal planning and zoning commissions to consider protection of existing and potential public water supplies in their plans and regulations.

III. DEFINITIONS

NOTE: Below is a list of key terms which may need to be defined. Other specific definitions may be needed.

Aquifer – a geological unit capable of yielding usable amounts of water to wells.

Ground water – water below the land surface, in the saturated zone.

Hazardous Material – any virgin or waste substance which because of its physical, chemical or infectious characteristics poses an actual or potential hazard to human health or drinking water quality when improperly managed. Generally the material has the following characteristics: toxic, flammable, corrosive or reactive. (Included are substances, wastes and chemicals listed as hazardous under the following laws or regulations-, hazardous material as defined in 49 CFR 171.8 and includes each material listed in 49 CFR 172.101, any hazardous substance as defined in 40 CFR 302.4 and listed therein at Table 302.4, or any hazardous waste as defined in section 22a-115 of the general statutes. Excluded are those which do not pose a threat to water quality.

Recharge Area (for stratified drift aquifers) – the area overlying the aquifer and adjacent stratified drift and till/bedrock areas in which ground water flows directly into the **aquifer**.

Note: Till and bedrock areas which provide direct ground water inflow to stratified drift areas are sometimes referred to as secondary recharge areas.

Wellfield – an area containing one or more pumping water supply wells in close proximity.

Wellfield Recharge Area – the area from which ground water flows directly to the wellfield.

Stratified Drift – predominantly sorted sediment deposited by glacial meltwater consisting of gravel, sand, silt or clay in layers of similar grain size.

IV. APPLICABILITY

The provisions of these regulations shall apply to all land within the area designated on the zoning map. This zone is established as an overlay and these regulations shall be in addition to the underlying zone or other underlying regulations. In the case of conflict, the most restrictive regulation shall apply.

V. DESIGNATION OF THE ZONE

The aquifer protection zone consists of the stratified drift aquifer and its **recharge areas**. Where the boundary of the zone is in doubt or dispute, the commission may amend the boundary. The burden of proof for amendment shall be on the applicant or petitioner questioning the boundary to demonstrate why and where the boundary should be amended. A petition for amendment shall be in the form of maps and information sufficient to justify the change based on the zone boundary as defined and shall be in accordance with procedures for amending the zoning map.

NOTE: In some cases specific hydrogeologic information or mapping may be available which define existing or proposed wellfields and their recharge areas. Where this information is complete for an aquifer or portion of it, it can be used to designate the protection area boundary. This will more accurately define the actual portion of the aquifer that supplies water to a well and is called a wellhead protection area.

VI. USE REGULATIONS

Uses which are permitted in the existing underlying zones are permitted except as prohibited or restricted by the following provisions:


NOTE: Supplement B-2 lists land uses and activities of concern to ground water quality and notes the recommended control. This should be used, based on the existing underlying zone, to complete the use categories below. High risk uses should be prohibited, other commercial and industrial uses allowed only after a special permit review and approval, and other uses may be allowed conditionally. It may be more desirable to use a table of **permitted uses**, if one exists in the town regulations, to indicate specific uses allowed as **opposed** to a long list of those prohibited. If not, a table similar to that below could be used to list specific uses. All uses, except 1 or 2 family residential, can be subject to **Site Plan Approval** (C.G.S. Section 8-3.g) to allow the local commission or official to determine conformity of the proposed use with the regulations, especially the performance and design standards.

1. Prohibited Uses

The following uses are prohibited:

NOTE: the following general use category (a) should precede specific listed uses.

- a. Any use in which the manufacture, use, handling, storage, or disposal of hazardous materials is a **principal** activity.
- b. Gasoline Service Stations
- c. Dry Cleaners
- d.

LAND USE CONTROLS				
LAND USE	POTENTIAL GROUNDWATER CONTAMINATION	TYPE OF CONTROL		
		PROHIBIT	SPECIAL PERMIT	CONDITIONAL
WASTE DISPOSAL (Sanitary Landfill, Hazardous Waste)	 <p>HIGH</p> <p>low</p>	✓		
HEAVY INDUSTRIAL (Manufacturing, Processing, Major Chemical User/Storer)		✓		
HEAVY COMMERCIAL (Processing, Major Chemical User/Storer)		✓		
LIGHT INDUSTRY (Non-Manufacturing, Minor Chemical Storage)			✓	
LIGHT COMMERCIAL (Domestic Sewage Only)			✓	✓
INSTITUTIONAL			✓	✓
AGRICULTURAL				✓
RESIDENTIAL				✓
RECREATION/OPEN SPACE				

2. Special Permit Uses

The following uses are permitted subject to approval of a Special Permit:

NOTE: Some uses are a moderate risk and need a more detailed review, for example.

- a. Light Industrial, Assembly or Fabrication Only
- b. Lumber, Hardware Stores
- c. ...

3. Conditional Uses

The following uses are permitted subject to the conditions listed:

NOTE: Some uses may be appropriate if certain measures or conditions are in place, such as connection to public sewers. For example the following uses are allowed only if connected to public sewers.

- a. Medical, Dental Offices
- b. Commercial Laundries
- c. ...

VII. SPECIAL PERMIT REQUIREMENTS

NOTE: See Supplement C-1-b Special Permit Requirements.

VIII. PERFORMANCE AND DESIGN STANDARDS

NOTE: See Supplement C-1-c Performance and Design Standards. The extent to which you will need these will depend on what you choose to prohibit versus allow.

IX. NON-CONFORMING USES

All pre-existing uses which do not conform to these regulations upon the effective adoption date shall be considered existing non-conforming uses. No existing non-conforming use shall be enlarged, expanded or changed unless in compliance with these regulations.

X. CHANGE OF USE

Any change of use shall be in compliance with these regulations. The change in use of a principal activity shall be subject to review by the zoning agent and allowed only if found to be in compliance with the intent of these regulations.

b. Special Permit Requirements

NOTE: If potential high risk industrial or commercial uses are allowed, the local commission may want to exercise a greater degree of review such as a zoning special permit. The permit review should consider the specific use, its location, and potential impact to water resources. The information required here is in addition to that contained in the underlying zone requirements.

Uses subject to a special permit shall submit an application for permit. The application shall be accompanied by required information, and subject to the evaluation below.

1. Required Information

The following written and mapped information shall be submitted:

- Description of proposed use: type of use or activity; commercial (trades and services), industrial (manufacturing and processing); product produced; Standard Industrial Code (S.I.C.) if applicable.
- A complete list of the types and volumes of all hazardous materials (including fuels) used, stored, processed, handled or disposed, other than those volumes and types associated with normal household use.
- Description of types of wastes generated and method of disposal including: solid wastes, hazardous wastes, sewage and non-sewage wastewater discharges.
- Location of adjacent (within 200 feet of property line) private drinking water supply wells. Location of public water supply wells within 1000'.
- Provisions for management of stormwater runoff.
- A site plan and building plan showing: hazardous materials loading, storage, handling and process areas; floor drains; process vents; sewage disposal; and waste storage or disposal areas.
- Plans and documents containing information to show compliance with the Performance and Design Standards.
- Other additional information as may be required by reviewing agencies regarding: the proposed use, its potential impact to water quality, hydrogeologic information, monitoring, and mitigation measures.

2. Evaluation Criteria and Considerations

In considering a special permit the commission shall consider the following:

- The type of use and the area in which the use is proposed.
- The degree of threat to ground water quality caused by the proposed use.
- Compliance with the performance and design standards.
- The commission may attach conditions to a permit to insure the protection of ground water quality.

c. Performance and Design Standards

NOTE: Below are typical aquifer protection standards which can be applied to overlay zones or special areas of concern to set design and operational standards to minimize groundwater pollution. They could be applied in some modified form to all areas, but you should consider the limitation you may be placing on some necessary land uses or activities.

Uses shall conform to the following standards. The purpose of the standards is to prevent or minimize potential groundwater pollution from improper waste disposal, releases of hazardous materials, and other sources. An alternative standard or protection method may be approved if it is clearly demonstrated to provide equivalent protection of that listed.

Exemption: the storage and use of hazardous materials associated with customary residential use (except underground fuel storage) is exempt from these standards.

1. Stormwater Management

- a. No wastewater discharges shall be connected to the stormwater system.
- b. Stormwater from developed site areas shall be directed to an above-ground outlet point (swales, basins, surface waters). Discharges to drywells or other subsurface leaching structures may be allowed for the recharge of clean stormwater only, such as clean roof drainage.
- c. Stormwater contact with sources of pollution shall be prevented with roofs, covers, berms and directing runoff away from sources.
- d. Parking, storage, loading and other areas where releases can occur shall be an impervious surface.
- e. The use of sodium chloride as a deicing agent shall be minimized.

2. Wastewater Discharges

No wastewater shall discharge to the ground other than approved domestic sewage systems or other certain discharges approved by state wastewater discharge regulations.

3. Floor Drains

No floor drains shall discharge to the ground. Floor drain discharges may be connected to public sanitary sewers in accordance DEP (or local authorized agent) approval. Exemption: bathroom and kitchen drains connected to a septic system in accordance with the public health code.

NOTE: Generally floor drains should be discouraged and strict materials management required instead. Where necessary, approved holding tanks is an option.

4. Storage Use and Handling of Hazardous Materials

All areas and facilities where hazardous materials are stored, used or handled shall be designed and constructed to prevent ground water contamination, including provisions for the control of inadvertent or accidental spills, leaks, or other discharges. The following standards shall apply:

- a. Manufacturing, processing, or other activities using hazardous materials shall only be conducted on flooring impervious to the material being used and within a building or structure. If floor drains are present, they shall conform to the standards of Section 2.
- b. Underground storage tanks and distribution lines for hazardous materials are prohibited.

NOTE: If for some extreme overriding reason underground storage must be allowed, the following standards may be required: Tanks shall be double walled fiberglass reinforced plastic, or a double walled steel cathodically protected; piping and distribution lines shall be protected against corrosion and constructed of double wall pipe or within a secondary containment pipe or conduit; a monitoring or failure detection system; an overfill prevention device or containment area.

- c. Above-ground storage tanks, containers, or drums shall be within a building or structure meeting the following requirements:

1. Have an impervious floor and containment area or dike of adequate size to contain 30% of the total stored volume or 110% of the largest tank (whichever is larger).
 2. Area shall be protected by a roof and adequate sides to prevent exposure to precipitation.
 3. Tank overfill protection devices shall be designed to prevent release of overfill outside the storage area.
 4. Storage areas shall be located outside flood zones or flood prone areas or be flood proofed.
 5. Have no floordrains.
- d. Venting systems for evaporation or distillation of hazardous materials shall be designed with a recovery system to prevent the discharge of contaminated condensate or drippage.
 - e. Loading or transfer activities shall be conducted on impervious surfaces, roofed, and diked to capture and control any spills or leaks.

NOTE: The on-site disposal of hazardous waste is a prohibited activity (listed in the use regulations) for any use. Hazardous waste is managed under state and federal regulations, and businesses which generate a hazardous waste must store, handle, as well as dispose of it accordingly. The above standards apply to both virgin substances and waste (definition of hazardous material).

5. Bulk Material and Solid Waste Storage

- a. Bulk storage facilities of non hazardous materials which may leach into the ground such as deicing salt, sludge, manure, or silage shall have an impervious floor and roof, and be raised or designed to prevent surface water runoff from entering.
- b. Solid Waste dumpsters shall be on a concrete pad, covered and be plugged so as to be water tight.

6. Security and Emergency Spill Contingency Plan for Hazardous Materials

A plan and procedure shall be submitted that identifies the following:

- Security and inspection measures to control vandalism or accident.
- Procedures to contain and clean up spills or leaks of hazardous materials.
- Procedures for notification of local and state officials.
- Schedule of update when any changes in materials or procedure occur.
- Procedure to control hazardous materials release in case of total structure loss because of fire.

7. Pesticide and Fertilizer Use

Any use which includes more than 5 acres of land used for crop, lawn, garden or landscaping, requiring regular applications of chemical pesticides or fertilizers shall be accompanied by a management plan. The management plan shall indicate types of materials, application schedule, and conformance with applicable best management practices.

8. Monitoring

If it is determined that additional safety measures and monitoring are needed because of hydrogeologic conditions or high potential contamination, then a monitoring program may be required which may consist of:

- Installation of monitoring wells.
- Periodic sampling.
- Reporting of analysis.

d. Town Samples: Cheshire, Hebron, Salem

Aquifer Protection (Section 47 From Town of Cheshire Regulations)

47.1 Objective. The purpose of this regulation is to safeguard public health by reducing risks of contamination of public water supply in the Town of Cheshire. Over 80 percent of Cheshire residents are served by public water supply wells which draw upon stratified drift aquifers that lie within the town boundaries, and the other 20 percent rely on private wells. In recognition of the fact that these aquifers are vulnerable to contamination from land use activities, and that protection of Cheshire's groundwater resources is vital to ensure an adequate supply of safe, potable water, this section establishes Aquifer Protection Zones and prescribes land use regulations within the zones.

47.2 Establishment of Zone Boundaries. Boundaries of the Aquifer Protection Overlay Zones are shown on the maps entitled:

- 1) South Central Connecticut Regional Water Authority, North Cheshire Wellfield, Base Map Level B, Map No. B-040 Original Map approved July 1, 1991, Scale 1"=1000' Base Map produced by CCRPA for the CT DEP GIS program or the State Aquifer Protection Program.
- 2) Southington Water Department, Level B Aquifer Map, Map No. B-022 Original Map approved May 21, 1991, Scale 1"=1000' Base Map produced by CCRPA for the CT DEP GIS program for the State Aquifer Protection Program.
- 3) South Central Connecticut Regional Water Authority, South Cheshire Wellfield, Base Map Level B, Map No. B-040, Original Map approved July 1, 1991, Scale 1"=1000'. Base map produced by CCRPA for the CT DEP GIS program for the State Aquifer Protection Program.

These maps are on file with the Cheshire Town Clerk's and Town Planner's Offices. Boundaries shown on maps 1 and 3 were delineated by the South Central Connecticut Regional Water Authority ("Regional Water Authority") and map 2 was delineated by the Southington Water Department, and are intended to meet the requirements for Level B aquifer mapping specified in the Connecticut General Statutes, Section 22a - 354b and guidelines promulgated thereunder by the Connecticut Department of Environmental Protection ("DEP"). These Level B maps are interim maps until the final Level A mapping is complete. The maps may be periodically updated, based on new technical information as approved by the DEP and adopted by the Planning & Zoning Commission after a Public Hearing. These considerations for a map change may include, but are not limited to the following:

- 1) Changes in knowledge about the extent and configuration of contributing or recharge areas for public water supply wellfields.
- 2) Changes in the permitted pumping capacity of wellfields.
- 3) Modification of standards for aquifer mapping as defined in regulations promulgated by the DEP.

47.2.1 Resolution of Overlay Zone Boundaries. Where the boundaries of the Aquifer Protection Overlay Zones are in dispute, the landowner must demonstrate that the boundaries are incorrect, based on reliable and convincing evidence of a qualified hydrogeologist. When doubt exists with respect to the conclusions to be drawn from the evidence of the hydrogeologist, the Level B maps shall be conclusive evidence of the boundaries of the Aquifer Protection Overlay Zone.

47.3 Aquifer Protection Overlay Review. An Aquifer Protection Overlay Zone review shall be completed before any special permits and/or site plans are approved for development and uses that lie within in the designated overlay zone, other than for one or two family houses and their customary accessory buildings.

47.4 Application. An application for an Aquifer Protection

Overlay Zone review shall include, in addition to the other requirements set forth in the Zoning Regulations and Subdivision and Other Land Use Regulations, the following information:

- 1) The amount and composition of any hazardous materials that will be handled, stored, generated, treated, or disposed of on the property.
- 2) Provisions for treatment, storage and/or disposal of any hazardous materials. "Hazardous Materials" means hazardous materials as defined in 40 CFR 171.8 and includes those materials listed in 40 CFR 172.101, "hazardous materials table", or any "hazardous substance" as defined in 40 CFR 302.4 and listed in Table 302.4, "list of hazardous substances and reportable quantities", or any "hazardous waste" as defined in Section 22a-115, CGS.
- 3) Distance to nearest public or private drinking water supply well or AA streams (tributary to public drinking water supply).
- 4) Whether public sanitary sewers are available or proposed at the location.
- 5) Septic tank location, size and capacity, and/or sewage lift stations, force mains and grease traps.
- 6) Expected types and amount of discharge to sewers, to the ground and to surface water.
- 7) Emergency plan to detect and control hazardous materials' leaks and spills, including but not limited to inspections, notification of official emergency containment and cleanup procedures.

47.5 Application Review. All applications for Aquifer Protection Overlay Zone reviews located in the North and South Cheshire Aquifers shall be submitted to the Planning & Zoning Commission and subsequently with a completed copy to the South Central Connecticut Regional Water Authority (RWA). Copies of all applications for Aquifer Protection Overlay Zone reviews located within 500 feet of the town lines of Hamden, Meriden and Southington shall be submitted to each town's Planning & Zoning Commission for their review. The RWA and/or each town notified, shall submit a report within 30 days of receipt of said application to the Cheshire Planning & Zoning Commission. Applicant's failure to submit a copy of the Aquifer Protection Overlay Zone review application to the RWA and abutting town within two (2) business days from when the application was filed in the Cheshire Planning Office, shall be cause for denial of the permit application due to non-conformance with this regulation. The report submitted by the RWA and/or town shall include, but not be limited to a review of information provided by the applicant as part of the Aquifer Protection Overlay Zone review application and any recommendations the RWA and/or town may have. Failure by the RWA or town to submit a report to the Planning & Zoning Commission within 30 days shall not delay the Planning & Zoning Commission in taking any action on the pending permit application. The Planning & Zoning Commission in making its decisions shall consider reports and/or comments made by the appropriate reviewing agencies, departments and commissions. Requests for approval of industrial or commercial uses which involve use, storage, treatment or disposal of hazardous materials, may also be referred to the Connecticut Department of Environmental Protection Waste Management Bureau and/or Water Management Bureau by the Commission.

47.6 Prohibitions. The following list of prohibited uses/activities refers to specific Standard Industrial Classification Codes (SIC). The SIC codes were developed for use in the classification of establishments by type of activity in which they are engaged. Each operating establishment is assigned an industry code on the basis of its primary activity which is determined by its principal product or group of products produced or distributed or services rendered.

The SIC codes listed in this section refer to major groups as a whole. For more detailed information, refer to the Standard Industrial Classification Manual, revised 1987, prepared by "Executive Office of the President, Office of Management and Budget", available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, Order No. PB 87-100012. A reference copy is available at the Town Planning Office.

There may be activities or uses that are prohibited under the following section, but may through best management practices or other means (as recommended by the DEP) be allowed by special permit after review by the appropriate agencies, departments and commissions, providing it is a permitted use in the underlying zone.

After the effective date of this regulation, no person, company, etc., shall initiate any of the following activities or uses within an aquifer protection zone:

- A) The following waste handling and disposal practices: new, private or municipal solid waste disposal areas, private or special solid waste disposal areas, regional solid waste disposal areas, resources recovery facilities, transfer stations, biomedical waste treatment facilities and regional processing centers, hazardous waste water facilities, septage disposal areas, publicly-owned treatment works, and wastewater treatment systems which discharge to the groundwater other than those which treat domestic sanitary sewage and sanitary sewage generated from employee restrooms, provided that the primary use of the facility is not prohibited under this section, and portable water treatment discharges.
- B) The following waste processing systems: floor drains, dry wells or other leaching structures intended to convey waste or spillage to the groundwaters, excluding septic systems which receive only domestic sanitary waste, excluding non-contaminated roof drainage or stormwater runoff to the ground.
- C) The following facilities for the underground storage or transmission of petroleum liquids or hazardous materials: underground storage tanks, underground distribution systems and liquid fuel pipelines.
- D) Outdoor storage of hazardous materials.
- E) Any facility for the primary storage (excluding small handling), loading or handling of pavement deicing materials.
- F) Public Airports.
- G) The following textile mills, tanneries, and apparel production facilities: those which are described in SIC codes 22, 31, and 23 and which specifically engage in dyeing, textile coating or treatment, and fabric printing.
- H) The following wood products and manufacturing facilities: those which are described in SIC code 24 and which specifically engage in hard or softwood veneer or plywood production, wood preservation, production of reconstituted wood products, and pulp and paper manufacturing.
- I) The following printing and publishing facilities: those which are described in SIC code 27 and which specifically engage in platemaking, commercial lithography, photoengraving and gravure.
- J) The following production facilities: those described in SIC codes 28 and 29 and which specifically engage in the production of chemicals, petroleum or products derived from petroleum or coal.
- K) The following facilities for the production of rubber and miscellaneous plastic products: those described in SIC code 30 and which specifically engage in the manufacture of coated rubber products, elastomer and resin cements, tires and tubes.
- L) The following facilities which are primary metal industries or fabricate metal, clay, glass and electrical parts or engage in manufacturing of metal products, including those described in SIC codes 32, 33, 34, 35, 36, 37, 38 and 39, and which specifically engage in foundry operations, metal forming, machine shops, chemical processes for mirror or glass coating, metal plating, degreasing shops and etching operations or which engage in the use, storage, handling or disposal of hazardous materials.
- M) Facilities for the generation of electrical power by the means of fossil fuel or nuclear power, with the exception of those facilities intended for the generation of electricity during emergencies and those facilities which utilize natural gas as a fuel.
- N) The following facilities for retail trade involving motor vehicles or petroleum liquids: those described in SIC codes 55 or 59 and which specifically engage in: the sale of new or used motor vehicles, boats or power equipment, and which provide product repair and service for such vehicles, boats or power equipment, petroleum terminals, fuel oil dealers, automobile service stations, automobile body repair and paint shops, automobile radiator, tire, exhaust, trans-

mission repair shops, tire retreading facilities, and other facilities for the repair and service of internal combustion engines or vehicles powered by them, including all new uses involving the servicing of motor vehicle/equipment and petroleum distribution activities.

O) The following facilities for wholesale trade: those described in SIC codes 50 and 51 and which specifically engage in coal, ore and mineral sales, metal and auto parts salvage, chemical and allied products' sales, and sales of paints, varnishes and solvents.

P) The following personal and business service operations: those described in SIC codes 72, 73, and 76, and which specifically engage in, dry cleaning; industrial laundering; commercial laundering; construction equipment rental; funeral services (except when connected to a municipal sewer); photographic processing operations (except when connected to a municipal sewer); and furniture stripping and finishing.

Q) The following laboratory facilities: those described in SIC codes 80, 82, and 87 and which specifically engage in biological or chemical research or testing, except those associated with the testing of a public water supply or photographic processing from radiological examination or those which are connected to a public sewer.

R) Any new residential development which includes discharge of sodium chloride backwash waters from water treatment systems to the groundwaters or the use of garage or basement floor drains.

S) The initiation of any home occupation which includes any primary activity or use prohibited in this section.

T) Amusement parks, motor vehicle race tracks, drive-in theaters, junk yards, motor vehicle junk yards, motor vehicle junk businesses and mobile home parks.

U) Ammonia, chlorine or bleaching powder manufacture; industrial processes utilizing the combustion of soft coal; blast furnaces; steam and drop hammers; creosote treatment and manufacture; petrochemical manufacture; distillation of coal, petroleum, refuse, grain, wood or bones; explosive manufacture or storage; glue, size or gelatin manufacture; grain drying; commercial incineration; reduction, storage or dumping of slaughterhouse refuse, garbage, dead animals or offal, radioactive materials or wastes; raw hides or skin storage, cleaning, curing or tanning, soap manufacture from animal fats; sulphurous, sulfuric, nitric, picric, carbolic or hydrochloric acid manufacture or any similar use.

47.7 Chemical and Fuel Storage — Above Ground. Any above-ground chemical or fuel storage tank shall be on an impervious, structurally-diked area to contain any leaks or spills, with no drains other than a sump pit, and suitably covered to prevent precipitation accumulation.

47.8 Manure, Fertilizer, Pesticide and Herbicide Storage. New or enlarged sites for the accommodation or storage of manure, fertilizers, pesticides and herbicides shall:

- 1) Have a roof which shall prevent precipitation from coming into contact with these materials.
- 2) Have a liquid-tight, diked floor with no drains other than a sump pit.
- 3) Be located so that surface water runoff drains away from the storage area.

47.9 Stormwater runoff management. Stormwater runoff management in aquifer areas shall promote pre-treatment of runoff prior to discharge and aquifer recharge.

Stormwater drainage for new industrial and commercial development shall be treated to remove particulate and dissolved pollutants associated with road and parking lot runoff prior to discharge. Infiltration of clean or pretreated runoff should be maximized, except in areas subject to an unusually high risk of hazardous material spillage. Open vegetated basins, depressions, and buffer strips are the preferred methods of infiltrating stormwater runoff from paved surfaces.

Aquifer Protection District (AP) (Section 8 From Town of Hebron)

8.1 Statement of Intent. Within this district lies an extensive deposit of coarse grained, stratified drift. The U.S. Geologic Survey notes a portion of this area has a saturated thickness of greater than forty (40) feet, indicative of high water yielding conditions. Creation of this district is deemed essential to protect this significant water supply source for the Town. As ground waters have been shown to be easily, and in many cases, irrevocably contaminated by many common land uses, it is imperative all reasonable controls over land use, waste disposal and material storage be conscientiously exercised.

8.2 Establishment of District. The Aquifer Protection District is herein established as an overlay district. The boundaries of this District are those shown on map entitled, "Aquifer Protection" in section 2 of these zoning regulations. The District includes the entire coarse grained stratified drift deposit with a saturated thickness of greater than forty (40) feet and all land directly upgradient.

Where the bounds of this District are in doubt or dispute, the burden of proof shall be upon the owners of the land in question to show where they should be located. Such proof shall be in the form of a map, prepared by a professional engineer and land surveyor, at a scale of 1 inch to forty feet, with two feet contours, showing the existing district boundary and that proposed.

8.3 Permitted Uses. Within this District the requirements of the underlying districts continue to apply, except that notwithstanding the requirements of the underlying district, no uses indicated by an "N" in the following schedule shall be established subsequent to the effective date of these regulations, nor shall any uses indicated by an "SP" in the following schedule be established subsequent to the effective date of these regulations without first receiving a special permit subject to the criteria set forth in section 5.8.4. Single-family dwellings are exempt from these aquifer protection regulations.

Prohibited Uses

- N a. Manufacture, use, storage, transport or disposal of hazardous materials as a principal activity.
- N b. Sanitary landfill, septage lagoon, waste water treatment facility for municipal or industrial wastes.
- N c. Road salt storage.
- N d. Junkyard, salvage yard, truck terminal.
- N e. Gasoline station, carwash, auto repair or auto body shop.
- SP f. Excavation, filling or removal of earth materials.

Accessory Uses

- N g. Underground storage of hazardous materials.
- SP h. Above-ground storage of hazardous materials in quantities greater than associated with normal use, other than fuel storage for residential space heating.

8.4 Special Permit Criteria. Special permits required under Section 5.8.3 shall be granted only if the PZC determines the ground water quality resulting from on-site wastewater disposal or other operations on-site shall not cause degradation of ground waters outside any authorized zone of influence which would result in a condition which renders the ground waters unsuitable for direct human consumption. If existing ground water quality is not now suitable for drinking water purposes, on-site disposal or operations on-site shall cause no further deterioration.

8.5 Submittals. In applying for a Special Permit under this Section, the PZC may require, in addition to that required under Section 8, all or some of the following information:

- a. A complete list of all chemicals, pesticides, fuels or other potentially hazardous materials to be used or stored on the premises in quantities greater than associated with normal household use. Information on the measures proposed to protect all storage containers from vandalism, corrosion, leakage and spillage and for control of spilled materials may also be requested.
- b. A description of all potentially hazardous wastes to be generated, including provision for storage and disposal measures as described in part (a) above.

- c. For above-ground storage of hazardous materials or waste, evidence of qualified professional supervision of the design and installation of such storage facilities or containers.
- d. For areas with an impervious surface greater than 30% of total lot areas, a showing of runoff water disposal plans. Dry wells shall be used only where other methods are infeasible and shall be preceded by oil, grease and sediment traps designed to remove contaminants. A schedule for maintenance of such traps may also be required.
- e. For on-site disposal of sewage in quantities in excess of 2000 gpd, documentation from the wastewater discharge permit granting authority that such system meets all applicable codes and regulations.

Groundwater Protection Regulations (Section 25 from Town of Salem Regulations)

25.1 Background, Purpose, and Authority

A fundamental need of any community is a safe and adequate water supply. This natural resource is essential to residential, business, governmental, and institutional interests alike. In Salem all water is taken from wells dug or drilled into saturated earth strata or into fractured bedrock. Such sources are generally referred to as groundwater.

Groundwater percolates from the earth's surface into the underlying strata, and its quality is dependent on the extent to which it remains uncontaminated by elements added to it or materials through which it must pass. Consequently, groundwater quality is influenced primarily by the use of the land at the surface. All of the liquid discharges from surface uses — such as the runoff from parking lots, the effluent from sewage disposal systems, and accidental chemical spills — enter the same geologic formations from which we derive our drinking water. Since the flow of groundwater is measured in inches per day, by the time contamination is discovered, it is usually too late for corrective action. Water quality in underground sources can be protected only by exercising care in all activities that occur in the areas where the water and other liquids enter the ground. This is the reason for groundwater protection regulations.

It is the purpose of these Regulations to promote the health, safety and general welfare of the residents of the Town of Salem by protecting the existing and potential groundwater supplies within the Town of Salem from contamination due to discharges of hazardous materials.

Authority for promulgating these Regulations is found in Section 8-2 of the Connecticut General Statutes, which states, in part: "Zoning Regulations...shall be made with reasonable consideration for the protection of existing and potential public surface and ground drinking water supplies."

25.2 Definition of Hazardous Materials

Hazardous material means any substance or combination of substances which, because of quantity, concentration or physical, chemical or infectious characteristics, poses a significant present or potential hazard to water supplies or to human health if disposed into or on any land or water, including groundwater. Any substance deemed a "hazardous waste" under the Connecticut General Statutes or the Regulations of Connecticut State Agencies shall also be deemed a hazardous material for the purposes of these Regulations. Hazardous materials include, but are not limited to, the following:

- 25.2.1 Substances which are toxic, flammable, corrosive, explosive, radioactive or infectious;
- 25.2.2 Substances listed in the U.S. Environmental Protection Agency's "Title III of Lists - Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986";
- 25.2.3 Acids and alkalies outside the pH range of 2 to 10;
- 25.2.4 Petroleum products, including fuels and waste oils;

- 25.2.5 Synthetic organic chemicals;
- 25.2.6 Any solid material which if exposed to water will leach or dissolve to form a hazardous material as defined above.

25.3 Special Requirements for Storm Drainage

The site plan for any new or modified building or use shall conform to the following:

- 25.3.1 Dumpsters and other waste receptacles shall have covers or shall be located within roofed areas and shall be placed on impervious surfaces, away from storm drains.
- 25.3.2 Loading docks shall be designed to contain spillage or discharges and shall be located away from storm drains.
- 25.3.3 Except for clean roof drainage, the use of underground drywells or leaching trenches is not allowed for any stormwater runoff from developed areas.
- 25.3.4 The Commission may require detention ponds, basins, swales, oil separators, or other measures designed to treat runoff, contain pollution, control peak flows, and/or allow for clean water infiltration into the ground.

25.4 Special Requirements for Use and Storage of Hazardous Materials

Whenever a use is proposed that can reasonably be expected to involve the use or storage of hazardous materials in quantities greater than necessary for normal household use, the site plan shall include the following:

- 25.4.1 An inventory of all hazardous materials which are manufactured, produced, stored or utilized at the facility and a description of the methods utilized for the receipt, handling, storage, utilization, treatment and disposal of such materials.
- 25.4.2 The locations and types of containers used to store hazardous materials and a description of any leak detection
- 25.4.3 A description of the operations on the site, including service or manufacturing processes which may result in contamination of surface or groundwater, and copies of any discharge permits issued for the operations by the Connecticut Department of Environmental Protection.
- 25.4.4 A plan for emergency response to natural or man-made disasters. The plan shall include a description of the potential damage that could result in pollution of surface or groundwater by a release of hazardous materials on the site and any methods that would be utilized to prevent such potential releases.

25.5 Required Findings by Commission

- 25.5.1 Sufficient information shall be provided to allow the Commission to find that all possible measures have been or will be taken to protect and preserve the quality of groundwater. A site plan shall be denied if the Commission determines proposed activities and/or the lack of groundwater protection measures might reasonably be expected to result in groundwater contamination.

Part 2: Example Ordinances

a. Hazardous Materials Storage Model Ordinance (From City of Waterbury)

Purposes. (Sec. 8-27) The purpose of this article is to provide a continuing source of current information concerning hazardous substances and chemicals being utilized in the Town of _____ to protect the general health and safety of the public, and to enable emergency personnel to respond safely and speedily to emergency situations which may arise.

Definitions. (Sec. 8-28) For purposes of this article, the following terms shall be defined as follows:

Hazardous substances – those substances identified by the U.S. Environmental Protection Agency in Table 117.3, 40 C.F.R., Section 117.3 (1982) or in any subsequent update thereto. Said term shall include oil and oil-based derivatives as listed in 40 C.F.R., Section 112.2 (1982) or in any subsequent update thereto.

Significant quantity – the amount of any hazardous substances equivalent to the “reportable quantity” of such substance as listed in Tables 117.3, 40 C.F.R., Section 117.3 (1982) or in any subsequent update thereto. A significant quantity of oil or oil-based derivatives shall be any “quantity” of such substances exceeding those listed in 40 C.F.R., Section 112.1 (d)(2)(i)(ii)(1982) or in any subsequent update thereto.

Storage area – shall be defined in 40 C.F.R. (1980) or in any subsequent update thereto and in accordance with all applicable city and state fire code regulations.

Environmental authority of the Town of _____. The director of health of the Town of _____.

Application. (Sec. 8-29)

(a) The provisions of this article shall apply to any person or entity, including government entities, storing, treating, mixing, using or producing a significant quantity of a hazardous substance or substances within the corporate limits of the Town of _____.

(b) The provisions of this article shall not apply to any person or entity, including government entities, storing hazardous substances within the corporate limits of the Town of _____ for purposes of retail consumer sale or individual private use unless the environmental authority of the Town of _____ determines that such storage presents a real or potential danger to the public health and safety and notifies the person or entity of that determination in writing.

(c) Any person or entity subject to the provisions of this article may, for valid reasons, request an exemption from any or all provisions thereof on a form provided by the environmental authority. The environmental authority may, in its sole discretion grant such exemption(s) based on the information provided by the applicant if the environmental authority determines valid reasons for such exemption(s) exist and that there is no significant health or safety hazard present.

Emergency response plan. (Sec. 8-30)

(a) Any person or entity subject to the provisions of this article upon its effective date shall submit, as to such person or entity, an emergency response plan to the environmental authority of the Town of _____ on or before the effective date. The emergency response plan shall include the following elements:

- (1) A map of the site showing the buildings thereon which shall describe hazardous substance storage areas and indicate their normal location; and

- (2) A hazard identification and emergency action statement which shall include a concise procedure for responding to emergency situations in each area; and
- (3) A procedure for the submitters for reporting fires, chemical spills, or other emergency situations, including procedures for notifying police, fire, health, and civil preparedness departments of the Town of _____; and
- (4) A fire response plan, as required by OSHA, identifying the level of fire response which shall be implemented by personnel as outlined in 29 C.F.R., Section 1910(L) (1981) or in any subsequent update thereto; and
- (5) An evacuation plan including a list of those persons who are trained in the implementation of a response plan and in the supervision of evacuation procedures. The plan shall also include a system for accounting for all personnel in an evacuation; and
- (6) A spill prevention, control and counter-measure plan designed to prevent or minimize the release into the environment of any hazardous substance stored, treated, used, mixed, or produced on the site. This plan shall be based on the types and quantities of hazardous substances which are on the property as well as the location and design of the major storage and use areas. The plan shall designate at least one person and an alternate, one of whom shall be on site during all working hours and who shall be responsible for implementing the spill control procedures. The plan shall also specify construction features designed to control and contain spills from hazardous substance storage areas. These control features shall include one or more of the following systems or their equivalents:
- a. Dikes, berms or retaining walls which are sufficiently impervious to contain spills of hazardous substances;
 - b. Weirs, booms, curbing or other barriers;
 - c. Culverting, guttering, or other drainage system which leads to a contained impervious area;
 - d. Sorbent materials;
 - e. Sumps and collection ponds;
 - f. Retention ponds.

(b) Each spill prevention, control and countermeasure plan required hereunder shall be implemented within ninety (90) days of receipt of approval from the environmental authority of the Town of _____.

Rejection of plan. (Sec. 8-31) The environmental authority of the Town of _____ may, in his or her sole discretion reject any plan or plans found to be inappropriate when considering the types, quantities or locations of hazardous substances on the site. Any plan so rejected shall be returned to the submitter with written suggestions for compliance and specific reasons for rejection of the plan. Thereafter, a modified plan incorporating the environmental authority's suggestions shall be submitted to the environmental authority within thirty (30) days of receipt of a notice of rejection. If said revised plan is not agreeable to the environmental authority it may also be rejected and the submitter shall thereafter comply with any and all orders imposed by the environmental authority subject to the appeal rights available herein.

To whom plans shall be submitted. (Sec. 8-32) The environmental authority of the Town of _____ shall distribute all emergency response plans submitted in accordance with section 8-30 of this article to the Town Fire Marshal. The environmental authority may distribute any such emergency response plan to the director of civil preparedness, the city engineer, the city planner and/or the building official of the Town of _____ as needed.

When plan is to be submitted. (Sec. 8-33) Any person or entity that begins storing, treating, mixing, using, or producing a significant quantity of a hazardous substance or substances within the corporate limits of the Town of _____ on or after the effective date of this article shall submit a plan as required in section 8-30 prior to the commencement of such activity and thereafter continue to comply within the other provisions of the article.

Inspection of hazardous sites. (Sec. 8-34) The environmental authority of the Town of _____ or his or her designee may inspect any sites where a hazardous substance or substances are stored, treated, used, mixed or produced during all reasonable business hours to establish compliance with the provisions hereof. Emergency inspections may be made at any time where the environmental authority has reason to suspect imminent danger or an obvious infraction of the provisions of this article.

Notification of hazardous substance storage areas. (Sec. 8-35) Each submitter of emergency response plans shall identify the location of their hazardous substance storage areas using the National Fire Protection Association (N.F.P.A.) 704m marking system. The intent of this paragraph is not to require labeling of individual barrels or small containers, but rather to require the labeling of large containers or areas on any given site.

Change in storage areas or types of hazardous substances. (Sec. 8-36) In the event of either a change in the design or normal location of hazardous substance storage areas or a change in, or addition to the type or types of a hazardous substance or substances being stored, treated, used, mixed, or produced on a site by an amount equal to a reportable quantity for which an emergency response plan has been submitted, the plan shall be revised and resubmitted within thirty (30) days of any change and implemented within ninety (90) days of receipt of notice of approval. Upon the resubmittal of an emergency response plan, the environmental authority shall have the same powers and discretion, and shall follow the same procedures as set forth in section 3-31 of this article. Any person or entity exempted from any or all provisions of this article, having undergone a change as contemplated in this paragraph, shall resubmit an emergency response plan as required herein and/or a new request for exemptions pursuant to section 8-29(c) hereof.

Documentation of liability insurance. (Sec. 8-37) After review of any emergency response plan submitted pursuant to this article, the environmental authority of the Town of _____ may require any submitter to submit, as part of its emergency response plan, documentation of appropriate liability insurance.

Emergency response plan shall be sworn to. (Sec. 8-38) The emergency response plan shall be submitted together with an affidavit on a form provided by the environmental authority of the Town of _____ as to the truth and accuracy of the plan. This affidavit shall be signed under penalty of false statement by the person or, in the case of an entity, a duly authorized representative of the firm, partnership, corporation, or other entity required to report hereunder.

Penalty. (Sec. 8-39) Any person or entity required to report or act hereunder who does not comply with the provisions hereof within thirty (30) days of either the required reporting date or the date any act is required to be done shall be subject to a fine of one hundred dollars (\$100.00) per violation under such time as either the report is received by the environmental authority or the act is performed. Each day such report is not submitted or such act is not performed shall constitute a separate violation. No such fine shall be levied during the process of an appeal filed pursuant to this article.

Appeal. (Sec. 8-40)

(a) For purposes of this article, an appeals board is hereby created consisting of the fire marshal, the building official, the town planner, the town engineer, two (2) members of the board of aldermen of the Town of _____, one from the majority party, one from the minority party, who shall serve for his or her term and one person, selected by the environmental authority from nominees submitted by the persons or entities regulated by this article, who shall serve for one year. Any vacancy of this board shall be filled for the remainder of the original term.

(b) Any person or entity aggrieved by any order or decision made in accordance with the provisions of this article may, within fifteen (15) days of the date of mailing of the order or decisions, appeal therefrom to the appeals board in writing. Said appeal shall be filed with the environmental authority. The appeals board shall convene to hear said appeal within ten (10) days of its filing, shall hear said appeal *de novo*, and shall render a written decision thereon within fifteen (15) days of conclusion of the hearing. At least seventy-two-hour notice of the date, time and place of an appeal hearing shall be given to the appellant. The appeals board shall act upon an appeal by a majority vote of its membership present and voting, so long as a quorum exists. Four (4) members shall constitute a quorum.

(c) Any person or entity aggrieved by an appeals board decision may appeal said decision to the superior court for the judicial district of the Town within twenty (20) days of the date of said decision.

(d) The filing of an appeal to the appeals board shall stay enforcement of the environmental authority's order or decision. The filing of an appeal to the superior court for the judicial district of the Town shall not of itself stay enforcement of the appeals board decision. The reviewing court may order a stay upon appropriate terms.

Disclosure of information. (Sec. 8-41) Nothing herein shall be construed to require disclosure of information which is deemed confidential or constituting a trade secret. Any information submitted in accordance with this article shall only be distributed or released on a need-to-know basis .

Conflict with state and/or federal law. (Sec. 8-42) In the event this article or any part thereof is found to be in conflict with any state or federal law or regulation, the more stringent of the two (2) shall prevail.

Severability. (Sec. 8-43) In the event any provision of this article shall be held to be invalid or unenforceable by any court of competent jurisdiction, such holding shall not invalidate or render unenforceable any other provision hereof.

Annual report to board of aldermen. (Sec. 8-44) The environmental authority shall submit a report to the board of aldermen on or before July 1 of every year. Said report shall delineate information gained from reports submitted pursuant to this article and recommendations and suggestions relative thereto.

Effective date. (Sec. 8-45) This article shall become effective six (6) months from the date of passage.

b. A Regulation Pertaining To Underground Petroleum Storage Facilities (From Chesprocott Health District)

Pursuant to Section 19a-243 of the General Statutes of the State of Connecticut, be it ordained by the Board of Directors of the Chesprocott Health District that these regulations are amended by adding sections (1)-(12) as follows:

Purpose. The purpose of the proposed regulations is to prevent or minimize contamination of the waters of this district resulting from a failure of underground facilities which store oil and petroleum liquids. Concurrently, this ordinance regulates the transmission lines of all facilities which are not underground. Lastly, this ordinance will establish standards defining the criteria for the design, installation, operation, maintenance, and monitoring of such facilities.

Scope. The provisions of sections (1)-(12) inclusive shall be applicable to all residential facilities in this district. In addition these regulations will apply to all small commercial and industrial facilities which are not under the jurisdiction of section 22a-449 (d)-1, the state regulation governing the control of nonresidential underground storage of oil and petroleum liquids.

SECTION 1. Definitions

Abandoned—rendered permanently unfit for use in accordance with Section ten of these regulations.

Discharge—the emission of any water, substance, or material into the waters of this district, whether or not such a substance causes pollution.

Existing facility—a facility in which the construction or installation began prior to the effective date of these regulations.

Facility—a system of interconnected tanks, pipes, pumps, vaults, fixed containers, and appurtenant structures including any monitoring devices singly or in any combination which are used or designed for use in the storage, transmission, or dispensing of oil or petroleum liquids.

Failure—a condition which can or does allow the uncontrolled passage of liquid into or out of a facility, including but not limited to a discharge to the waters of this district.

Failure determination—the evaluation of a facility component in accordance with section (8) of these regulations in determining the occurrence of a failure.

Groundwater—water present in the zone of saturation.

Life expectancy—the time period in which a failure is not expected to occur as determined in accordance with section (7) of these regulations

Life expectancy determination—the evaluation of a facility component in accordance with section (7) of these regulations.

Liquid—any liquid including but not limited to oil and petroleum liquids.

New facility—a facility in which the construction or installation begins on or after the effective date of these regulations including but not limited to facilities which replace existing facilities and facilities that are moved from one location to another.

NFPA 30—the national fire protection association publication number 30 entitled “flammable and combustible liquid code” as enforced by the fire marshals of this district.

Nonresidential facility—a facility which serves any commercial, industrial, institutional, public or other building or use including but not limited to hotels and motels, boarding houses, hospitals, nursing homes, and correctional institutions, and not including residential buildings. “nonresidential buildings” as used in these regulations refers only to nonresidential underground facilities what are not regulated by the State of Connecticut Regulation section 22a-449 (d)-1.

Oil or petroleum liquid (or product)—oil or petroleum or any kind in liquid form but not limited to waste oils and distillation products such as fuel oil, kerosene, naptha, gasoline, and benzene.

Operator” and/or owner—a person who is ultimately responsible for maintaining the facility in conformance with applicable statutes, regulations, and the required facility permits.

Residential building—any house, apartment, trailer, mobile home, or other structure occupied by any individual as a dwelling.

Substantial modification—the construction or installation of any addition to a facility or any restoration or renovation of a facility which: increases or decreases the on-site storage capacity of the facility; significantly alters the physical configuration of the facility; or impairs or improves the physical integrity of the facility or its monitoring systems.

Transmission lines—the pipes and/or tubing that extend from an above-ground storage tank to the main furnace.

SECTION 2. Prohibitions

- A. Underground tanks are hereby prohibited in areas of high groundwater.
- B. No owner and/or operator is allowed to install underground oil tanks or bury transmission lines in this district without first obtaining a permit for such an installation from the local health department.
- C. The burial of oil transmission lines in an above-ground facility is not permitted without the protection of a safety shield or sleeve.

SECTION 3. Reporting

- A. Effective December 1, 1986 the owner and/or operator of any existing underground storage facility shall notify the local director of health.

B. Effective December 1, 1986 the owner and/or operator of any proposed facilities must notify the director of health for a permit to install an underground facility or to bury a transmission line in a basement.

C. Fifteen days prior to the installation of a new underground facility, an owner and/or operator shall notify the director of health as to the date of installation.

1. This notification is imperative because the director of health or his representative is to be present at the time of installation.
2. At the time of the notification, the owner and/or operator of a proposed facility shall provide the following information:
 - a. facility location and capacity
 - b. proposed date of installation
 - c. type of facility and any monitoring systems present
 - d. results of the life expectancy determination and any other information the director of health deems necessary.
3. The notification required by the director of health shall be submitted on forms furnished and prescribed by the director of health.
4. Within 30 days upon the completion of a failure determination, the owner and/or operator shall notify the results to the director of health.

SECTION 4. Design, Construction, Installation, and Maintenance

A. All new facilities and any new components of a substantially modified facility shall conform to the following standards.

1. Each underground tank shall:
 - a. be a listed-fiberglass-reinforced plastic (frp) tank which is equipped with overfill protection and contact plates under all fill and gauge openings and is chemically compatible with the contained oil or petroleum liquids as determined by the tank manufacturer's warranty;
 - b. be a listed steel tank with overfill expansion and externally coated with a factory applied resistant coating approved by the manufacturer for the proposed purpose, and equipped with cathodic protection and permanent cathodic protection monitoring devices, and contact plates under all fill and gauge openings.
2. Be designed specifically for the purpose of underground installation.
3. All underground facility components shall be designed, constructed, and installed so as to allow failure determination of all underground storage and piping without substantial excavation.
4. All cathodic protection systems that protect underground tank components shall be tested annually. A structure to soil test voltage reading of at least negative 0.85 volts measured between the structure and the copper-copper sulfate electrode must be maintained. Voltage drops other than those across the structure electrolyte boundary must be considered for valid interpretation of the voltage measurements. This yearly record of voltage output shall be maintained by the owner and/or operator. If any cathodic protection system malfunctions or fails to meet the above structure to soil test voltage requirement, it shall be repaired as quickly as possible but in no event later than thirty days from the date of discovery that the measures are not sufficient to maintain the structure to soil test voltage of at least negative 0.85 volts.
 - a. It is the responsibility of the owner to correct any malfunction of the cathodic protection system and report correction to the director of health within 15 days.
5. No owner and/or operator of an existing tank shall use or operate any component of a facility beyond three years after the effective date of these regulations, or longer than three years beyond its life expectancy, whichever is later, unless the existing facility is tested every three years. Otherwise, the existing facility shall be removed or abandoned in accordance with procedures specified in NFPA 30.
6. No underground storage facility shall be moved from one location to another without prior written approval by the director of health.
7. The installation and maintenance of all underground components of a new facility shall comply in accordance with the nfpa 30 and the following specifications:
 - a. For coated steel components the excavation shall be free from materials that may cause damage to the tank coating. Extreme care shall be taken during installation to prevent the introduction of foreign material into the excavation or backfill.

- b. The excavation shall extend a distance of at least one foot around the perimeter of the underground facility component.
- c. To insure compliance to these regulations the tank and piping shall be pressured tested at the job site before being covered, enclosed, or placed in use. The pressure shall not exceed 5 pounds per square inch (psig) during which time a soap solution shall be brushed over the weld seams and pipe joints. Tin caps shall be replaced with pipe plugs or cap piping before testing.
- d. The bottom of the excavation should be firm and level and then covered with at least a foot of non-corrosive material such as sand, pea gravel, or no. 8 crushed stone. A full length concrete pad shall be placed into the excavation.
- e. At least 6 inches and preferably 12 inches of clean sand, pea gravel, or no.8 crushed stone must be placed on the entire surface of the pad to separate the tank from the concrete pad.
- f. The remainder of the excavated area shall be contained with at least 6 inches of clean sand, pea gravel, or no.8 crushed stone. Ashes, stones, and other corrosive materials are not to contact the tank or its components.
- g. The tank must be 24-36 inches below the grade or paving. If the need arises to install a tank greater than 36 inches the tank manufacturer must be consulted for additional specifications and recommendations.
- h. If a manufacturer's specifications or recommendations are inconsistent with any of the provisions of these regulations, the provisions which impose the most stringent and protective requirements shall prevail. Within thirty days following the completion of installation, the owner and/or operator shall submit to the director of health a statement signed by the installation contractor and the representative of the health department that the installation has been carried out in accordance with this subsection.

SECTION 5. Transfer of Ownership

In the event that an owner and/or operator shall transfer the ownership of an underground facility a full disclosure to the transferee of the status of the facility with respect to these regulations shall be submitted at least 15 days prior to the transfer. The disclosure shall include any information previously submitted to the director of health.

SECTION 6. Records

The owner of a new or existing facility shall assure the maintenance of up-to-date records of significant installation activities, substantial modification, abandonment, removal, or replacement of underground components or any protective devices for such components, and any other information required by the director of health. An owner and/or operator shall review all records and attest to their accuracy by signing the records no later than 7 days following the completion of the recorded activity. All records must be copied and submitted to the director of health within thirty days of the completion.

SECTION 7. Life Expectancy

Life expectancy is defined as follows:

- A. For a fiberglass reinforced plastic (frp) facility and component, the period of the manufacturer's corrosion warranty.
- B. For a cathodically protected facility component which meets the requirements of subsection 4a(1)-(7) of these regulations, the period of the manufacturer's corrosion warranty or the life expectancy of the existing or replaced anode(s) as calculated using standard formulas approved in writing by the director of health.
- C. For existing facility components that are not in compliance of these regulations, 15 years from the date of installation. If the date of installation cannot be documented, the life expectancy shall be determined by a method approved by the director of health.

SECTION 8. Failure Determination

A. The failure determination on all existing facility components not in compliance with these regulations shall be carried out within 33 to 36 months prior to the end of the life expectancy. These existing facility components shall undergo hydrostatic pressure testing or other approved means every 3 years. If the existing facility is not functioning adequately, it shall be abandoned, replaced, or substantially modified in accordance with these regulations.

B. Failure determination on new facility components shall be done at least 6-12 months prior to the end of the life expectancy. At this time the facility components shall undergo hydrostatic pressure testing or other approved means by the director of health. If the facility is determined to be in good condition and will remain in use, hydrostatic pressure testing shall be repeated in 3 years. No new facility shall remain underground greater than 5 years beyond its life expectancy. At this time, the facility component shall be abandoned, replaced or substantially modified in accordance to these regulations.

SECTION 9. Failures

A. An owner and/or operator of a new or existing facility shall report any failures to the director of health immediately.

B. An owner and/or operator of a leaking transmission line must report any failure to the director of health immediately.

C. The owner and/or operator of a new or existing facility in which a failure occurs shall immediately empty the failed facility component within 24 hours and discontinue use of the failed facility component; and:

1. Remove, repair, or abandon it within 90 days in accordance to the procedures specified in nfpa 30; or
2. Replace all damaged components within 30 days in accordance with the standards listed in these regulations.
3. If the repair to an existing oil transmission line is made a sleeve or shield shall be placed on the line at the time of the repair.
4. An owner and/or operator of a new or existing facility which discharges oil or petroleum liquid to the environment shall immediately cease such a discharge and reclaim, recover, and properly dispose of the discharged liquid and any other substances contaminated by it. Restoration of the environment shall be of a quality and condition acceptable to the director of health.

SECTION 10. Abandoned Facility

A. An owner and/or operator shall notify the director of health in writing within 30 days when a new or existing facility component part is abandoned.

B. A facility or facility component shall be abandoned in accordance with procedures specified in NFPA 30.

C. No owner and/or operator shall use or operate an abandoned facility.

SECTION 11. Penalties for Violations

An owner and/or operator in violation of any of these regulations adopted under sections (1)-(12), inclusive, shall be fined no greater than \$100 nor less than \$25 depending upon the violation. Each day that a violation of these regulations continues constitutes a separate violation.

SECTION 12. Severability Clause

Should any section, paragraph, sentence, clause, or phrase of these regulations be declared unconstitutional or invalid for any reason, the remainder of said regulations shall not be affected thereby.

Adopted: October 15, 1986
Board of Directors, Chesprocott Health District
91 North Brooksville Road, Cheshire, CT 06410

Part 3: Inspection Guide

1. Site Background Information

Name:

Address:

Type of Business:

Contact Person and Phone No.:

Inspector:

Date:

2. General Site Information (attach simple site sketch if necessary)

Description of Site Activities:

Water and Sewage Facilities:

☐ onsite septic system OR ☐ public sewer

☐ onsite well OR ☐ public water supply

3. Site Checklist of Potential Pollution Sources

Wastes/Wastewaters Present

Disposal/Handling Method

☐ hazardous wastes

☐ non-domestic wastewaters

☐ floor drains

☐ sewage

☐ dumpsters, solid wastes storage

☐ other (list)

Fuel and Chemical Storage Present:

Type of fuel/chemical

Volume

Above Ground

Underground

Containment

Stormwater Drainage:

Potential Pollution Source

Comment

- ☐ exposed materials/storage
- ☐ unauthorized connections
- ☐ discharge to drywell or subsurface
leaching structure
- ☐ large parking or pavement areas
- ☐ deicing salt

Other Potential Site Hazards

Comment

- ☐ spills/leaks
- ☐ illegal dumping
- ☐ oil/chemical stained areas
- ☐ outside work or transfer areas
- ☐ pesticide or chemical applications
- ☐ other

4. Inspection Information

Violations/Problems

- 1.
- 2.
- 3.

Referral:

- 1.
- 2.
- 3.

Recommendations:

- 1.
- 2.
- 3.

Part 4: Case Study — Wellhead Protection Program (Cheshire, Connecticut)

Introduction

Cheshire is a growing suburban town of 26,000 people located in the south central part of the state. It borders the Quinnipiac River and is linked to a major interstate highway, Route I-84. High yielding stratified drift (sand & gravel) aquifers are associated with the river valley and are the main source of drinking water supply in the region. 82% of Cheshire's residents rely on two wellfields located in town for their water supply which is operated by the South Central Connecticut Regional Water Authority (SCCRWA). The north wellfield produces about 1.5 MGD and the south wellfield about 1.3 MGD. Additional yields are possible from the north wellfield to support future town growth.

Water Quality and Land Use Issues

Both the north and south wellfields have been affected by contamination. The south wellfield was contaminated by solvents, and the north wellfield was contaminated by solvents and pesticides. The Connecticut Department of Environmental Protection (DEP) investigated potential sources of contamination. The general location and potential sources of solvent contamination were identified. Although the exact source was not identified, the investigation resulted in pollution abatement orders to 8 establishments. Agricultural activity was found to be the source of the pesticide contamination. The south wellfield was temporarily removed from service and then an aeration treatment facility installed. An interceptor well, to divert contamination, and aeration treatment facility had to be installed at the north wellfield. Cost for the north wellfield treatment alone was \$3 million. Despite the treatment and remediation efforts, pollution concerns grew because the investigation evidence indicated contaminants could have come from a number of existing sources and travelled significant distances to the wells (thousands of feet). Also, identifying and cleaning up the contamination was difficult and costly.

In addition to the existing pollution threats, there was concern about potential sources from future land use development in the wellfield recharge areas. The north wellfield was of particular concern because over 600 acres of the potential recharge area was industrially zoned. Also land use development was being intensified by recent construction of a major highway connector and sanitary sewers.

Source Protection Efforts

Initial protection efforts were undertaken in the early 1980s. These were based on state aquifer protection planning efforts of the 208 program (Section 208 of the Clean Water Act) and were typical of model recommendations for Connecticut towns at the time. Although useful, the protection focused on an overlay protection zone adopted in 1983 based on general hydrogeology (the entire aquifer), a short list of prohibited activities, and site plan review authority. Controls and review were limited to primarily waste disposal, and didn't address many non-point pollution sources. Contamination incidents, as well as inspections and monitoring by the SCCRWA, indicated improved protection measures were needed. In 1985, state legislative efforts were being intensified to develop more proactive aquifer protection programs. This included: amendment of the planning and zoning statutes to require, rather than merely allow, protection of existing and potential public water supplies; and study of management options for a state aquifer protection program and implementation of federal requirements for wellhead protection. Led by the SCCRWA, efforts to improve protection were cooperatively undertaken with the Town of Cheshire, State Departments of Environmental Protection (DEP) and Public Health (DPH), Regional Health District, and the public. Several sources of federal funds and state assistance were used to help support planning, inspection, and education efforts. The Cheshire aquifer protection program now includes a comprehensive mix of regulatory and non-regulatory mechanisms tuned to the community needs and ability of agencies to administer them. It includes the following:

1. Mapping Protection Areas — Accurate delineation of the wellfield recharge area was desirable to insure protection is concentrated where it is needed. Delineation was done by the SCCRWA and a private consultant, with review and assistance from DEP. The mapping used hydrogeologic modeling which is essentially what will be required under the State Aquifer Protection Area Program. The north wellfield recharge area was refined to 2,120 acres.

2. Land Acquisition — The SCCRWA owns 115 acres of land surrounding the north wellfield and 15 acres surrounding the south wellfield. The SCCRWA, town and the local land trust have coordinated to identify critical areas for acquisition or conservation easements, which may not only protect the aquifer but provide other open space and recreational needs.
3. Pollution Source Inventory — The SCCRWA and town identified high risk uses within the recharge areas which could then be concentrated on for monitoring, inspection, and education efforts. Approximately 130 existing high risk land uses were identified. The Health District and DEP also used USEPA funds to identify and inspect businesses which may be using unauthorized underground injection wells (drywells, leaching structures, and septic systems) to discharge floor drain wastewaters to the ground.
4. Monitoring Water Quality — The SCCRWA maintains an extensive network of monitoring wells throughout the wellfields and on some properties nearby. Monitoring wells serve as an early warning system and are used to track existing contamination and monitor for new ones based on land use. Many of the contaminant parameters and frequency of monitoring exceed state and federal drinking water standards requirements.
5. Land Use Controls — The town and SCCRWA with assistance of the DEP initiated several proposals to upgrade the 1983 land use controls. They included changing the Plan of Development, rezoning areas from industrial to residential and mixed use, and revising the overlay zone. After much discussion, which involved the town, SCCRWA, DEP, business, and the public, a new Aquifer Protection Zone was adopted in 1994. The zoning regulation was an overlay zone which prohibits high risk industrial and commercial land uses, prohibits high risk activities such as underground fuel and chemical storage, requires a special permit review and compliance with performance standards, and includes a coordinated site plan review and referral process. Coordination with the two adjacent towns who share groundwater supply resource areas is also done with referrals of land use applications.
6. Inspection and Enforcement — The SCCRWA and the town use a combination of existing authorities to inspect and enforce the area. The SCCRWA uses its watershed inspection authority under the Public Health Code, and the town its zoning authority. The inspections are many times coordinated between the two. Violations of state pollution laws are reported to DEP for action. Inspection records are kept for about 1,000 sites.
7. Underground Storage Tanks — The regional health district adopted a regulation to cover small commercial and all residential underground petroleum tanks which are not covered under state regulations. The regulations cover registration of existing tanks, permits for new ones, and standards for integrity, installation, and maintenance. The regulation covers tanks anywhere in town.
8. Spill Response Plan — Local emergency response plans included specifically identifying the wellfields and sensitive recharge areas, and coordinating response efforts with water company personnel and equipment.
9. Information and Education Efforts — Efforts to help better inform the public have included roads signs posting the wellhead protection boundaries, a regional household hazardous waste collection facility, voluntary best management practices for business, groundwater curriculum for schools, and public information meetings.

Conclusion

The town, state, and water authority cooperatively worked to establish a local program to protect important groundwater supplies and guide town development. The program augmented existing state protection efforts. Their program used a mix of regulatory and non-regulatory measures to address the critical issue — land use. They took advantage of funding sources, where available, and technical assistance to help with planning, mapping, and to implement measures. They have already initiated many actions that will be required under the Connecticut Aquifer Protection Area Program (state wellhead protection program) and developed model guidance for use in the program.

December 1995

Part 5: Fact Sheets

a. YOUR SEPTIC SYSTEM

If you are a suburban or rural resident, you probably depend on a septic system to treat and dispose of your household wastewater. The purpose of a septic system is to treat liquid wastes from your home in order to prevent contamination of your well, groundwater and nearby lakes, streams, and coastal waters.

When a septic system is suitably located, properly designed, carefully installed and adequately maintained, you will have a waste disposal system that is effective, economical, and safe! Proper maintenance is the key to a lasting septic system.

How Your System Works

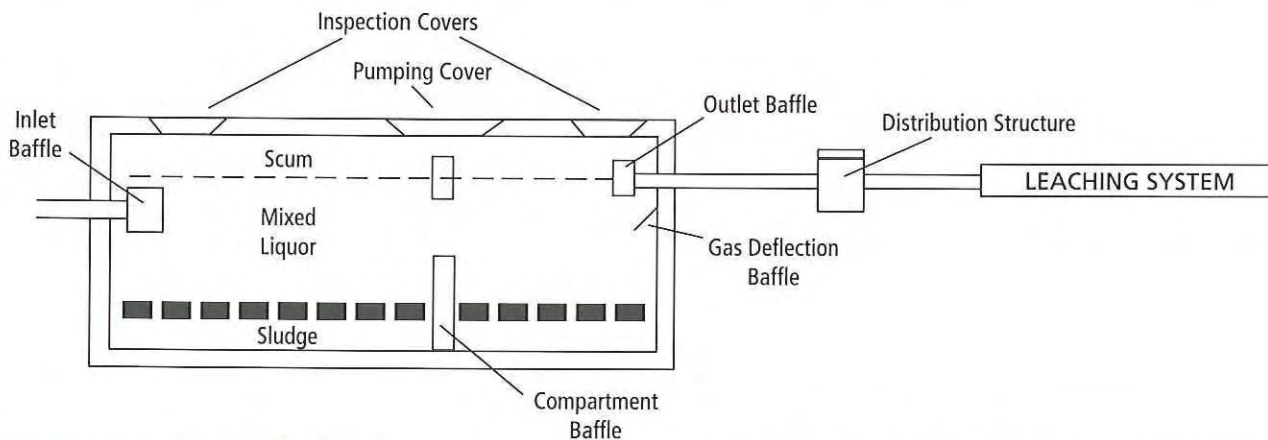
A septic system has two basic working parts:

Septic Tank

Wastewater flows from the house into the septic tank. Here heavy solids settle and are partially decomposed by bacteria in the tank to form sludge. Light solids and grease float to the top, forming a scum layer.

Leaching System

Partially treated wastewater is discharged from the septic tank into a leaching system. Here, the water is further purified by filtration and decomposition by microorganisms in the soil. The soil is the essential treatment mechanism to prevent polluted water from entering surface and groundwater.



Common Causes of Failure

- leaking fixtures/overuse of water
- neglecting to regularly inspect and clean the septic tank
- lack of understanding on proper use of the system
- poor soil conditions and/or faulty design or installation

Signs of Failure Include...

High surface water in the leaching area, lush growth of grass, odor and wastewater draining slowly from the bathroom or kitchen fixture...or even backing up.

Most problems can be prevented by simple maintenance...but not all. A regular cleaning costs relatively little and can help prevent system failures. If failure does occur, it is best to contact the sanitarian or health officer for instructions — as pumping and cleaning alone may not cure the problem.

Homeowner should verify cleaner/installer is licensed, and comes well-recommended.

Do...

- keep accurate records about location and cleaning of system in the permanent house file so this information can be passed on to the next owner.
- if tank is 3-4 feet below ground level, simplify inspection and cleaning by installing a 20-24 inch manhole about 12 inches below ground level. ...most recently installed tanks are just 6-12 inches below ground and this would make a manhole unnecessary.
- set-up and adhere to a sound system of inspection and cleaning
- check for faucet leaks...it is estimated that one leaky faucet can waste as much as 700 gallons of water a year.
- educate your family to proper use of the system.

Don't...

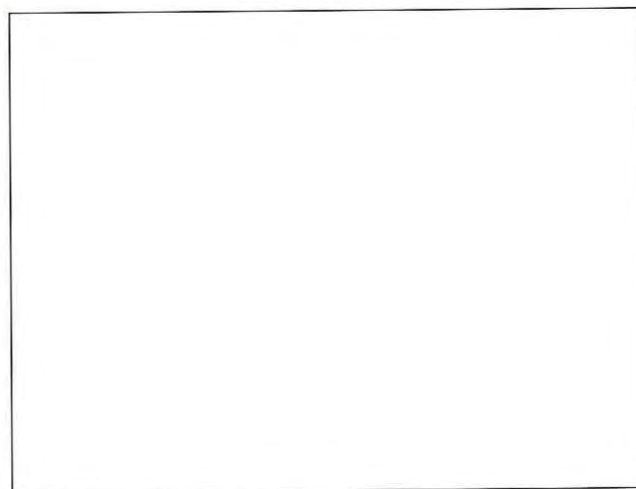
- allow excess amounts of fat or grease to enter the system — it can congeal and cause obstructions.
- use garbage grinders.
- use chemical compounds, enzymes or septic tank “cleaners” — there is no such thing as a “quick fix.”
- use large amounts of laundry soaps, detergents, bleaches, drain cleaners — recommended quantities should not adversely affect the system.
- flush down paper towels or other heavy matter.
- soak diapers in toilet bowl — a child may come along and try to flush the toilet.
- discharge salt brine solution from water softeners into subsurface sewage systems. CT Dept. of Health regulations prohibit this. Salt brine may also build up in the groundwater and pollute wells and springs supplying drinking water.
- use matches or an open flame to inspect septic tank; gases produced by decomposing sewage may explode and cause serious injury.
- allow trucks or heavy equipment to drive over the tank or leaching field.
- put a lot of water into the system all at once...use water sensibly and teach children to do the same.
- do all your laundry in one day...space it out.

Septic System Recordkeeping

1. Make a rough sketch locating your septic tank and leaching facility in relation to two or more fixed reference points. Begin by sketching your house, driveway, water well, and other landscape features such as trees, rocks, or fences.

2. Measure and record distances from your house to the cover of your septic tank and to the corner of your leaching facility, if possible. As long as the distances are correct, do not be concerned if the drawing is to scale.

3. Keep this information on file as a permanent record for use in maintenance and to pass on to subsequent owners.

YOUR MAP

4. Staple a copy of the “as built” plan to a beam near the waste pipe.

Maintenance Guidelines

Generally, septic tanks should be cleaned out every three to five years, depending on the size of the tank and the amount and type of solids entering the tank. As a rule of thumb, the clean-out interval is determined on the basis of 100 gallons of tank capacity per person per year. For example, a 1,000 gallon tank used by a family of two should be cleaned after five years $[1,000 / (100 \times 2)]$. Use of a garbage disposal increases solids loading by about 50%, thereby necessitating pumping twice as often. For this reason, the use of garbage disposals with septic systems is not recommended.

Maintenance Record

Keeping a record of when your septic system is pumped will help you plan when the next cleaning should be scheduled.

Size of Tank:
_____ Gallons

Date	Work Done	Firm	Cost

Your Septic System Installer

Name _____
Address _____

Phone _____
Date Installed: _____

Your Septic System Pumper

Name _____
Address _____

Phone _____

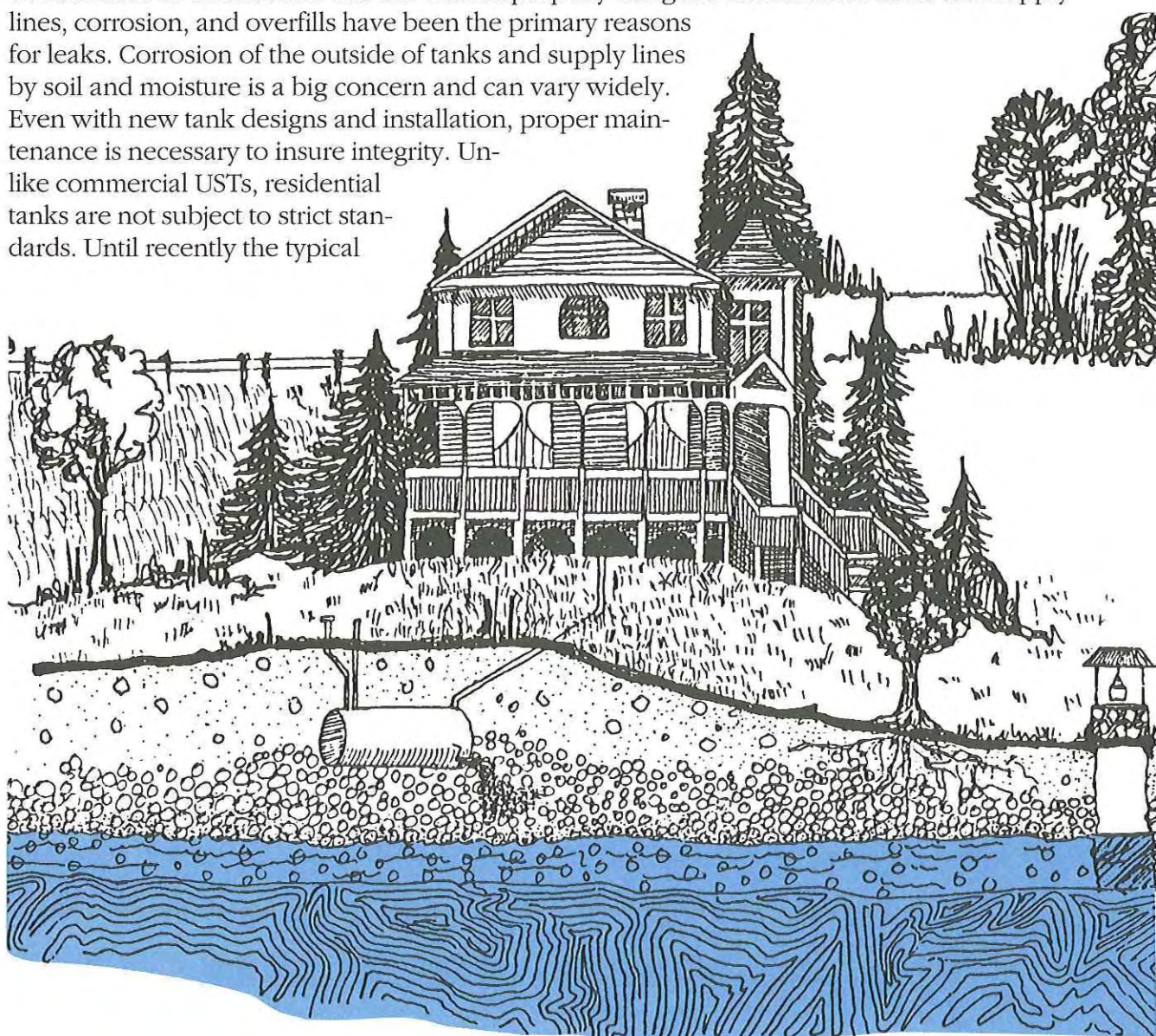
b. UNDERGROUND HEATING OIL STORAGE TANKS — WHAT HOMEOWNERS SHOULD KNOW

Introduction

Home heating oil is typically stored on-site in 275-gallon tanks located in basements, garages or underground. Environmental problems have been identified with underground storage tanks (USTs). Leaking tanks, supply lines, and overfill spills are the most common problems. Leaks can go undetected for years resulting in widespread groundwater contamination and polluted water supplies.

Problems and Concerns

DEP estimates that 25% of all existing bare steel USTs are leaking (the typical life expectancy of bare steel tanks due to corrosion is about 10 years). Causes of leaking residential USTs are well documented in Connecticut and the U.S.. Improperly designed and installed tanks and supply lines, corrosion, and overfills have been the primary reasons for leaks. Corrosion of the outside of tanks and supply lines by soil and moisture is a big concern and can vary widely. Even with new tank designs and installation, proper maintenance is necessary to insure integrity. Unlike commercial USTs, residential tanks are not subject to strict standards. Until recently the typical



Source: Connecticut DEP

residential UST was painted or asphalt coated steel and had a warranty of one year for manufacturing defects only. USTs provided convenience by getting them below ground and out of buildings, but created new environmental problems. Leaks can go undetected underground until gross losses have occurred. Fuel can pollute groundwater and get into water supply wells, basement walls, drains, or streams. Areas with private on-site wells, and recharge areas of public water supplies are particularly a concern. Liability for the clean up of the pollution would be on the homeowner who owned the tank, and few insurance policies cover residential USTs. Clean up costs can be very expensive depending on the extent of pollution.

What To Do

To reduce the risks of leaking residential USTs there are a number of steps you can take. The following recommendations should be considered.

1. Replace existing USTs with above-ground tanks in a basement or garage. Put tanks for new houses above ground. Supply lines should be put above basement floors or encased in a plastic sleeve (larger pipe) before cementing over it.
2. Regularly monitor existing USTs by checking tank levels for unusual losses.
3. If your tank is 10 years old, have it tested by a company using state approved methods.
4. If you must put your tank underground, use a tank which meets state commercial tank integrity standards — corrosion protected steel or listed fiberglass tanks. Although more expensive double walled tanks provide even greater protection.
5. Have your well tested if you suspect fuel contamination.

Who To Contact For More Information

1. Department of Environmental Protection Underground Storage Tank Program (860/424-3374).
2. Local Fire Marshal
3. Department of Environmental Protection Potable Water Program (860/424-3705) or your local Health Department for advice on well water testing.

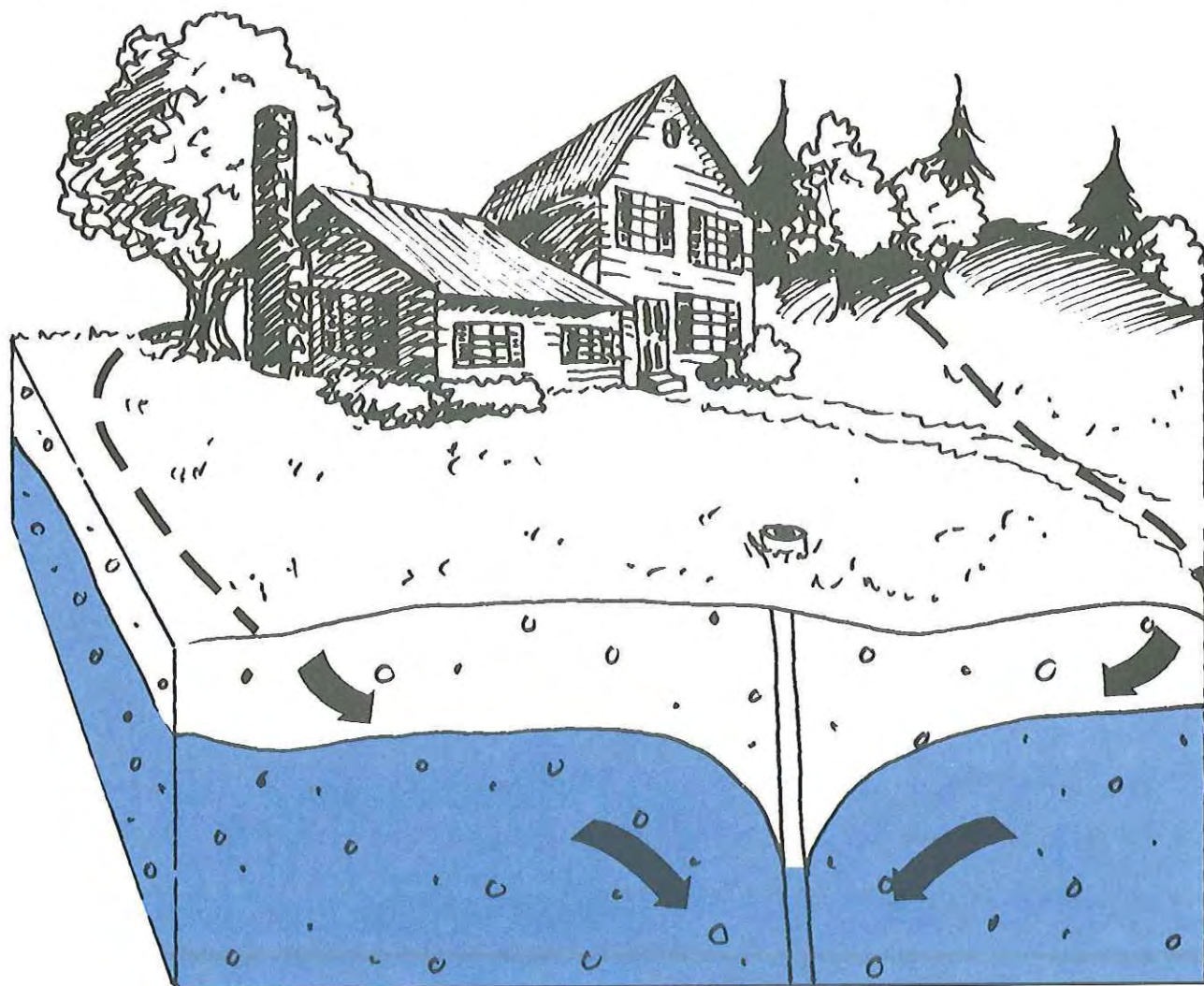
c. WELL PROTECTION TIPS — KEEPING YOUR WELL WATER SAFE

Introduction

More than one quarter-million residents and many small businesses rely upon on-site wells for their water supply. The source of water for wells comes from the groundwater beneath the land and is recharged locally from precipitation falling on nearby land. Activities you do at your property can affect the quality of your drinking water. As a homeowner or business, there are things you can do to protect your health and property value by keeping your well water safe.

Potential Problems and Concerns

Like many things, wells require some care and oversight to ensure they operate and continue to supply clean water. Newer deep bedrock wells with sealed steel casings provide considerably better pollution protection than older dug wells, but broken casings or seals can still cause surface pollution to directly enter a well. Just as important, however, are activities happening on your property and surrounding land areas which recharge water to your well. Potential pollution sources such as sewage and other waste disposal, chemical and fuel storage, and stormwater runoff can affect well water quality. Common contaminants are bacteria, nitrates, salt, petroleum, solvents and other



Source: Connecticut DEP

chemicals. Many common materials used around the home and business can contain hazardous and persistent chemicals. When released they can reach groundwater sources supplying wells.

What To Do

To protect your well you should first familiarize yourself with your well, its location, and surrounding property. Consider the following actions to protect your well.

1. Examine the well casing and cap to insure it is sealed tight and is not cracked. For dug wells insure the cover is tight. Ideally the cap should be at least 6" above the ground and the land should slope away from the well.
2. Examine the land areas surrounding the well, especially areas uphill, for potential pollution sources such as waste, chemicals or fuels.
3. Dispose of all waste properly. Do not dump chemicals or household hazardous waste down the drain to septic systems or pour them on the ground.
4. Store all chemicals and fuels inside a building or structure in which spills can be contained. Minimize the use and storage of chemicals where possible.
5. Keep the following activities away from the well:
 - fuel or chemical tanks, containers, or storage sheds. If you have an underground fuel oil tank consider putting it above ground or have it regularly tested.
 - gardens, pets, or animals pens.
 - don't apply pesticides, fertilizers, or deicing salt near the well. Always use and store these materials according to instructions.
 - septic systems by code should be a minimum of 75' from a well.
 - direct stormwater from paved areas away from wells.
6. Test your well water quality periodically depending on its pollution risk.

Who To Contact For More Information

1. Your local Health Department.
2. Connecticut Department of Environmental Protection, Water Management Bureau (860/424-3020).

d. POLLUTION PREVENTION TIPS FOR BUSINESS

Introduction

Groundwater is an important source of drinking water supply in many areas and replenishes surface water streams and lakes. Groundwater is recharged from precipitation falling on nearby land areas and flows within local drainage basins. Land uses, including many businesses, can affect groundwater quality from various activities occurring at the land surface. Groundwater pollution can go undetected for long periods and can be very difficult and expensive to clean up.

Potential Problems and Concerns

Improper waste disposal and fuel and chemical releases are the most common sources of groundwater pollution. Hazardous substances are used, stored, and handled by many businesses, including industry and small commercial services. Petroleum products and synthetic chemicals such as solvents can be a particular problem in groundwater because of their potential toxicity, mobility, and persistence. Businesses of particular concern are those which generate process waste, use chemicals in manufacturing, processing or services, and those which store large amounts of fuel or chemicals.

Businesses which are located in important water supply aquifers, recharge areas of public supply wells, and areas of on-site private wells are a particular concern because of the potential to contaminate those water supplies in the event of a release. Business liability for pollution can include: remediation of the soil and groundwater pollution, water treatment, monitoring, providing alternative water supply, and legal costs. Cost can total in the hundreds of thousands of dollars and devalue the property and business.

What To Do

There are a number of measures that businesses can take to prevent pollution at existing and proposed facilities, thereby protecting water resources and reducing liability. Examining your facility operation, material hazards, and proper handling and disposal methods is the place to start. Educating and training your staff is next. Below are some basic actions you can take.

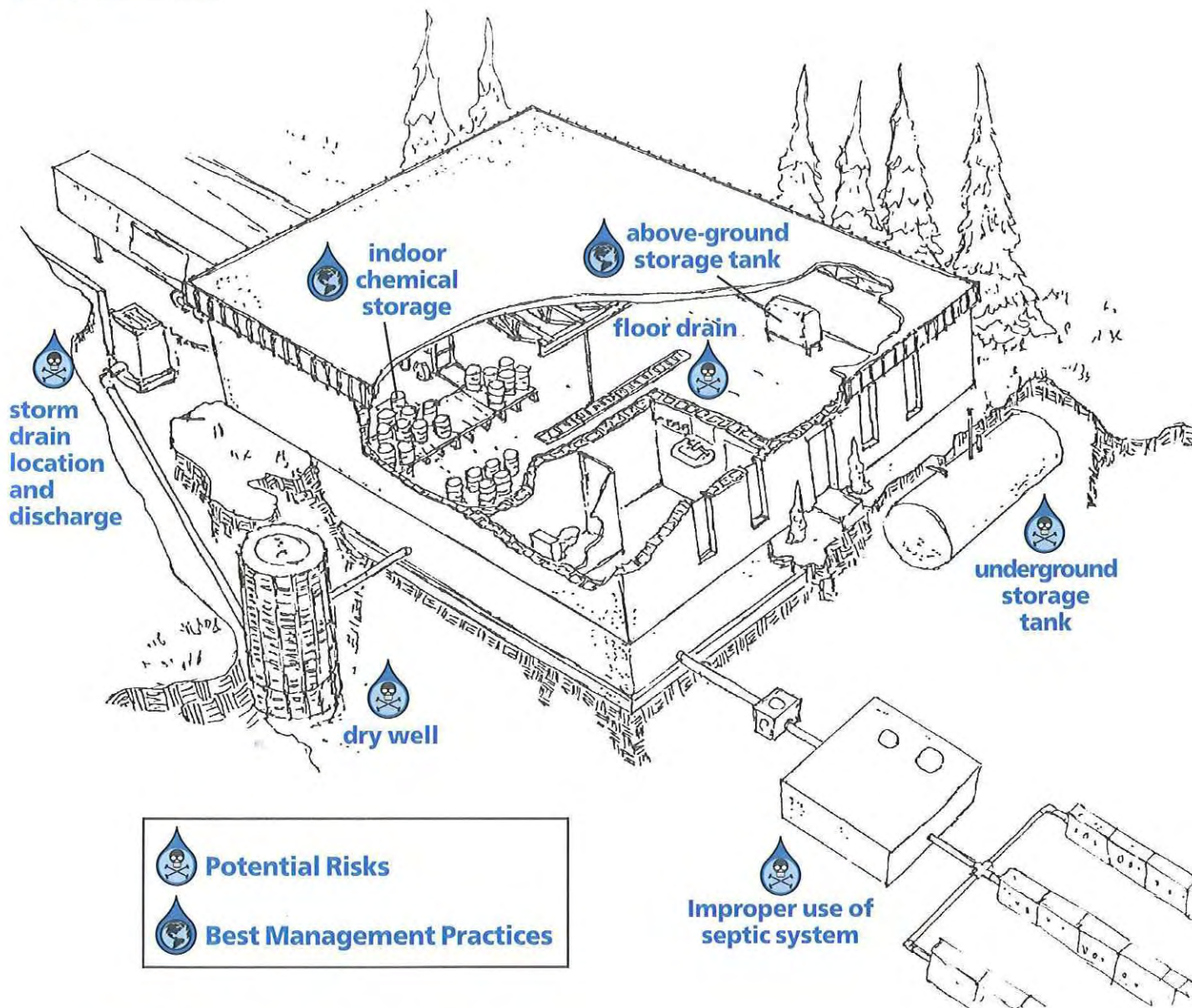
1. Waste Disposal

Septic Systems – are to be used for domestic (sewage) waste only. Do not dispose of process wastewater, hazardous waste or raw chemicals down the drain because they can pass untreated to groundwater.

Floor Drains – should be eliminated if not needed, and should not connect to an on-site septic system, drywell (leaching structure), or stormdrain. If needed, they should connect to a public sewer system or approved holding tank.

Hazardous Waste – must be properly contained, stored, and disposed of according to regulations. Storage areas should have impervious floors with secondary containment, and be protected from the weather.

Solid Waste Dumpsters – should have plugs intact and covers closed.



2. Chemical and Fuel Storage and Handling

Underground Storage Tanks – if required, ensure tanks are properly registered and monitored for leaks according to regulations, including underground supply lines. Provide overfill protection devices. Where possible replace with above-ground tanks and lines, or double walled underground structures.

Above-Ground Storage – storage areas should be inside a building where ever possible, or in areas protected from weather with an impervious floor and secondary containment.

Loading/Transfer Areas – should have a containment pad or be done directly inside.

3. Stormwater

Keep all waste and chemical materials out of contact with rain, especially materials that can leach. Isolate loading areas from drains. In groundwater supply areas, do not direct stormwater from developed surfaces to drywells or leaching structures (clean roof water, etc. is acceptable). Minimize the use of de-icing salt, especially in areas of water supply wells.

4. Other Management Practices

Environmental Audit – conduct a review of your facility to identify potential problems and corrective action.

Develop a Pollution Prevention Plan

Inspections – regularly monitor high risk areas for spills or leaks.

Spill Control/Emergency Response – have a plan in place to quickly respond to incidents and contact proper authorities.

Reduce or substitute the use of chemicals where possible.

5. Considerations For Locating New Facilities

Consider the following general guidance, if possible, when locating or relocating:

- locate outside public water supply source areas if possible
- locate in areas which are served by public sewer and water
- consider reuse of existing developed sites

Who To Contact For More Information

Connecticut Department of Environmental Protection

- Water Management Bureau (860) 424-3020
- Waste Management Bureau (860) 424-3023
- Permits Information & Assistance (860) 424-3003

Supplement D

Information Resources

This Supplement will help you find additional information about the subjects and issues covered in this manual. Part 1 lists government agencies in Connecticut that have responsibilities related to groundwater protection. Part 2 lists the references used or described in this manual and includes information on how to obtain them.

Part 1: Connecticut Governmental Agency Contacts and Resources

<u>Agency</u>	<u>Responsibility</u>
CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION	
Bureau of Water Management 79 Elm Street Hartford, CT 06106 (860) 424-3020	Primary groundwater protection contact. Manages water resource and water quality protection programs; regulates discharges and other pollution sources and water diversions. Provides technical assistance for local groundwater protection.
Bureau of Waste Management 79 Elm Street Hartford, CT 06106 (860) 424-3023	Management of activities relating to the treatment, storage, and disposal of solid and hazardous wastes, hazardous substances, and pesticides.
Bureau of Environmental Services Natural Resources Center 79 Elm Street Hartford, CT 06106 (860) 424-3555	Inventory of environmental and natural resource information. Publication and sales of maps and other information. Free catalog of publications.
CONNECTICUT DEPARTMENT OF PUBLIC HEALTH	
Water Supplies Section 450 Capitol Avenue Hartford CT 06134 (860) 509-7333	Drinking water supply standards, monitoring and inspection. Water supply planning and coordination.

Agency**Responsibility****U.S. GEOLOGICAL SURVEY,
CONNECTICUT OFFICE**

Water Resources Division
Abraham A. Ribicoff Fed. Bldg.
450 Main St., Room 525
Hartford CT 06103
(860) 240-3060

Conducts technical studies of water resources, inventory of hydrologic information, monitoring of surface and ground water.

UNIVERSITY OF CONNECTICUT COOPERATIVE EXTENSION SYSTEM

With offices located in each county, the Cooperative Extensions assist communities in resource management and analyzing community problems. They are also a source of information and research results.

Cooperative Extension System

The University of Connecticut, U-36
1376 Storrs Road
Storrs, CT 06269-4036
Tel: (860) 486-4125

New Haven County Cooperative Extension System

43 Marne Street
Hamden, CT 06514
Tel: (203) 789-7865

Fairfield County Cooperative Extension System

67 Stony Hill Road
Bethel, CT 06801
Tel: (203) 797-4176

New London County Agricultural Extension System

562 New London Turnpike
Norwich, CT 06360
Tel: (860) 887-1608

Middlesex County Extension System

1066 Saybrook Road, Box 70
Haddam, CT 06438
Tel: (860) 345-4511

Tolland County Cooperative Extension System

24 Hyde Avenue
Vernon, CT 06066
Tel: (860) 875-3331

Hartford County Cooperative Extension System

1800 Asylum Avenue
West Hartford, CT 06117
Tel: (860) 241-4940

Windham County Cooperative Extension System

139 Wolf Den Road, Box 1300
Brooklyn, CT 06234
Tel: (860) 774-9600

Litchfield Cooperative Extension System

1304 Winsted Road
Torrington, CT 06790
Tel: (860) 626-6240

SOIL AND WATER CONSERVATION DISTRICTS

With offices located in each county, the Soil and Water Conservation Districts provide technical services for soil- and water-related programs, review local and regional conservation projects, and conduct soil and water conservation education. The Districts also provide technical assistance to the agricultural community.

Fairfield County

District Conservationist
69-B Stony Hill Road
Bethel, CT 06801
Tel: (203) 744-6108

Hartford County

District Conservationist
627 River Street
Windsor, CT 06095
Tel: (860) 688-7725

Litchfield County

District Conservationist
1185 New Litchfield Street
Torrington, CT 06790
Tel: (860) 626-8258

Middlesex County

District Conservationist
1066 Saybrook Road
Extension Center, P.O. Box 70
Haddam, CT 06438
Tel: (860) 345-3219

New Haven County

District Conservationist
900 Northrop Road, Suite A
Wallingford, CT 06492
Tel: (203) 269-7509

New London County

District Conservationist
238 West Town Street
Norwich, CT 06360
Tel: (860) 887-3604/887-4163

Tolland County

District Conservationist
24 Hyde Avenue
Vernon, CT 06066
Tel: (860) 875-3881

Windham County

District Conservationist
Agriculture Center
P.O. Box 112
139 Wolf Den Road
Brooklyn, CT 06234
Tel: (203) 774-0224

REGIONAL PLANNING AGENCIES

With offices in each of the state's 15 planning regions, these agencies provide regional planning services, coordinate intermunicipal activities, give technical planning assistance to communities, and are a repository for municipal, regional, and state information.

Capitol Region Council of Governments

221 Main Street
Hartford, CT 06106
Tel: (860) 522-2217

Central Connecticut Regional Planning Agency

225 North Main Street
P.O. Box 1880
Bristol, CT 06011-1880
Tel: (860) 589-7820

Central Naugatuck Valley Council of Govts.

20 East Main Street
Waterbury, CT 06702
Tel: (203) 757-0535

Connecticut River Estuary Regional Planning Agency

455 Boston Post Road
P.O. Box 778
Old Saybrook, CT 06475
Tel: (860) 388-3497/Fax: (860) 395-1404

Greater Bridgeport Regional Planning Agency

Bridgeport Transportation Center
525 Water Street
Bridgeport, CT 06604-4902
Tel: (203) 366-5405

Housatonic Valley Council of Elected Officials **

Old Town Hall, Rt. 25
Brookfield Center, CT 06804
Tel: (203) 775-6256

Litchfield Hills Council of Elected Officials

42 North Street
P.O. Box 187
Goshen, CT 06756
Tel: (860) 491-9884

Midstate Regional Planning Agency

P.O. Box 139
Middletown, CT 06457
Tel: (860) 347-7214

Northeastern Connecticut Council of Governments

175 Connecticut Mills Avenue
P.O. Box 198
Brooklyn, CT 06234
Tel: (860) 774-1253

Northwestern Connecticut Council of Governments

17 Sackett Hill Road
Warren, CT 06754
Tel: (860) 868-7341

South Central Regional Council of Governments

23 Peck Street
North Haven, CT 06473
Tel: (203) 234-7555

Southeastern Connecticut Regional Planning Agency

139 Boswell Avenue
Norwich, CT 06360
Tel: (860) 889-2324

Southwestern Regional Planning Agency

213 Liberty Square
East Norwalk, CT 06855-1093
Tel: (203) 866-5543

Valley Regional Planning Agency

12 Main Street, Derby RR Station
Derby, CT 06418
Tel: (203) 735-8688

Windham Regional Planning Agency

968 Main Street
Willimantic, CT 06226
Tel: (860) 456-2221

Office of Policy and Management

(coordinates regional planning activities)
80 Washington Street
Hartford, CT 06106-4459
Tel: (860) 566-8398

Part 2: References

- American Planning Association, 1995. **A Guide to Wellhead Protection**. PAS Report No. 457/458.
- Arendt, R.A., 1990. **Dealing with Change in the Connecticut River Valley: A Design Manual for Conservation and Development**. University of Massachusetts Center for Rural Development. Available from DEP Maps and Publications Office, 165 Capitol Avenue, Room 555, Hartford, CT 06106, (860) 566-7719.
- Bell, M., 1985. **The Face of Connecticut: People, Geology, and the Land**. DEP Geological and Natural History Survey Bulletin No. 10. Available from DEP Maps and Publications Office, 165 Capitol Avenue, Room 555, Hartford, CT 06106, (860) 566-7719.
- Benes, M., 1989. **Private Well Protection Handbook for Local Boards of Health**. Massachusetts Association of Health Boards, Inc., 56 Taunton St., Plainville, MA 02762.
- Born, S.M., D.A. Yanggen, and A. Zaporozec, 1987. **A Guide to Groundwater Quality Planning and Management for Local Governments**. Wisconsin Geological and Natural History Survey, Special Report 9: Wisconsin Department of Natural Resources, Groundwater Management Plan Report No. 12. Available from Wisconsin Geological and Natural History Survey, 3817 Mineral Point Rd., Madison, WI 55705.
- Buick, W., et al., 1984. **Ensuring the Quality of Drinking Water in Private Wells**. Lower Naugatuck Valley District Public Health Department, 470 Howe Ave., Shelton, CT 06484, (203) 735-9548.
- Cape Cod Aquifer Management Project (CCAMP), 1988. **Guide to Contaminant Sources for Wellhead Protection**. Available from EPA Region I, (617) 565-3600, or National Technical Information Services (NTIS), 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650.
- Cimochowski, J., 1988. **Underground Storage Tanks: A Guide for Municipalities**. Connecticut Department of Environmental Protection.
- Connecticut Aquifer Protection Task Force, 1989. **Report of the Aquifer Protection Task Force**.
- Connecticut Department of Environmental Protection, 1985. **Septic Systems Manual: A Guide to On-Site Subsurface Sewage Disposal for Local Land-Use Officials**. Available from DEP Maps and Publications Office, 165 Capitol Ave., Rm. 555, Hartford, CT 06106, (860) 566-7719.
- Connecticut Department of Environmental Protection, Nov. 1992. **Best Management Practices for the Protection of Ground Water, A Local Official's Guide to Managing Class V U.I.C. Wells**.

- Connecticut Department of Environmental Protection, Nov. 1993. **Manual of Best Management Practices for Agriculture, Guidelines for Protecting Connecticut's Water Resources.**
- Conservation Foundation, 1987. **Groundwater Protection: Groundwater — Saving the Unseen Resource; and A Guide to Groundwater Pollution — Problems, Causes, and Government Responses.** The Conservation Foundation, 1255 23rd Street, N.W., Washington, DC 20037.
- Cornell Cooperative Extension System, 1988. **Highway Salt Management Handbook for Local Government Officials.** Cornell Cooperative Extension Regional Office, 146 State St., Albany, NY 12207.
- Dunne, T., and Leopold, L.G., 1978. **Water in Environmental Planning.** W.H. Freeman and Company.
- Handman, E.H., 1986. **Delineating Recharge Areas for Stratified-Drift Aquifers in Connecticut with Geologic and Topographic Maps.** U.S. Geological Survey Water-Resources Investigations Report 83-4230, prepared in cooperation with the Midstate Regional Planning Agency, Middletown, CT. Available from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225, (303) 234-5888.
- Heath, R.C., 1984. **Ground-Water Regions of the United States.** U.S. Geological Survey, Water Supply Paper 2242. U.S. Government Printing Office, Washington, DC 20402.
- Heath, R.C., 1982. **Basic Ground-Water Hydrology.** U.S. Geological Survey, Water Supply Paper 2220. U.S. Government Printing Office, Washington, DC 20402. Available from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225, (303) 234-5888.
- H.V.A., 1992. **The Ground Water Action Project Workbook, A Guide to Protecting Community Ground Water Resources.** H.V.A., P.O. Box 28, Cornwall Bridge, CT 06754, (203) 672-6678.
- Jaffe, M., and F. K. DiNovo, 1987. **Local Groundwater Protection.** The American Planning Association, 1313 E. 60th Street, Chicago, IL 60637.
- Lash, J.E., and R. May, 1982. **Community Sewerage Systems: A Primer for Developers and Local Officials.** Connecticut Department of Environmental Protection, Water Management Bureau (860) 566-1932.
- Massachusetts Audubon Society. **Groundwater Flyer Series:** #1 – An introduction to groundwater and aquifers; #2 – Groundwater and contamination: From the watershed into the well; #3 – Mapping aquifers and recharge areas; #4 – Local authority for groundwater protection; #5 – Underground storage tanks and groundwater protection; #6 – Protecting and maintaining private wells; #7 – Pesticides and groundwater protection; #8 – Landfills and groundwater protection; #9 – Road salt and groundwater protection. Available from Massachusetts Audubon Society, South Great Road, Lincoln, MA 01773, (617) 259-9500.
- Massachusetts Water Resources Commission, 1990. **Guidelines for Preparing a Concept Plan for the Protection and Management of Water Resources.** Massachusetts Department of Environmental Management, Division of Water Resources, 100 Cambridge Street, 13th floor, Boston, MA 02202, (617) 727-3267.
- Morrissey, D.J., 1987. **Estimation of the Recharge Area contributing Water to a Pumped Well in a Glacial-Drift, River-Valley Aquifer.** U.S. Geological Survey Open-File Report 86-543. Prepared in cooperation with the Rhode Island Department of Environmental Management. Available from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225, (303) 234-5888.
- Page, W.G., ed., 1987. **Planning for Groundwater Protection.** Academic Press, Inc., Orlando FL 32887.
- Paly, M., and L. Steppacher, 1990. **The Power to Protect, video and companion workbook.** U.S. EPA. Available from Massachusetts Audubon Society, South Great Road, Lincoln, MA 01773, (617) 259-9500.
- Pioneer Valley Planning Commission, 1986. **The Road Salt Management Handbook.** Pioneer Valley Planning Commission, 26 Central St., West Springfield, MA 01089.

- Pye, V.I., R. Patrick, and J. Quarles, 1983. **Groundwater Contamination in the United States.** University of Pennsylvania Press, Philadelphia, PA.
- Raymond, L.S., Jr., 1986. **Chemical Hazards in Our Groundwater — Options for Community Action: A Handbook for Local Officials and Community Groups.** Center for Environmental Research, 468 Hollister Hall, Cornell University, Ithaca, NY 14853.
- Schenectady County Planning Department, 1987. **Groundwater Supply Source Protection: A Guide for Localities in Upstate New York.** Schenectady County Planning Department, 620 State Street, Schenectady, NY 12307, (518)382-3286.
- Underground Injection Practices Council, 1985. **Protection of Public Water Supplies from Ground-Water Contamination.** U.S. EPA, Center for Environmental Research, Cincinnati, OH 45268.
- U.S. Congress, Office of Technology Assessment, 1984. **Protecting the Nation's Groundwater from Contamination, Volumes I and II.** U.S. Congress OTA-0-233. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
- U.S. EPA:
 1993. Wellhead Protection: A Guide for Small Communities (Seminar Publication).
 1990. A Review of Sources of Ground-Water Contamination from Light Industry.
 1990. Guide to Ground-Water Supply Contingency Planning for Local and State Governments.
 1990. Citizen's Guide to Ground-Water Protection.
 1989. Local Financing for Wellhead Protection.
 1989. Wellhead Protection Programs: Tools for Local Governments.
 1988. Model Assessment for Delineating Wellhead Protection Areas.
 1987. EPA Activities Related to Sources of Ground-Water Contamination.
 1987. Guidelines for Delineating Wellhead Protection Areas.
 1986. Septic Systems and Ground-Water Contamination.Available from Office of Ground-Water Protection (WH 5506), Washington, DC 20460, (202) 382-7779.
- U.S. EPA, 1987. **Handbook: Ground Water.** U.S. EPA, Office of Research and Development, Cincinnati, OH 45268.
- University of Connecticut Cooperative Extension Service:
 1989. Water Quality Fact Sheet No. 6: Water Testing of Private Wells.
 1988. Water Quality Fact Sheet: Land Use and Well Water Contamination.

GLOSSARY

- aquifer** – any geologic formation that can yield a usable amount of water (*see page 10*)
- Aquifer Protection Area Act** – legislation affecting a water supply well if it is in a stratified drift aquifer and serves more than 1,000 people (*see page 15*)
- Aquifer Protection Zone** – areas designated to protect an aquifer (*see page 17*)
- area of contribution** – (*see well recharge area*)
- artesian well** – a rare case in which water under pressure (between confining layers), may move upward when released (*see page 13*)
- attenuation** – elimination or reduction (*see page 20*)
- bedrock (consolidated material)** – solid rock, commonly called ledge, usually buried below soil (*see page 11*)
- biodegradation** – a process by which materials are broken down by microorganisms or biological processes (*see page 20*)
- cone of depression** – a low pressure zone in the shape of an inverted cone caused by pumping, which depresses the water table around the well (*see page 13*)
- discharge** – to flow out of the ground into streams or other surface waters (*see pages 6, 10*)
- drainage basin** – the land area draining water to a river, stream or other point on the landscape (*see pages 6, 8*)
- drift** – sediments deposited by glaciers that repeatedly advanced and retreated across our landscape until about 10,000 years ago (*see page 12*)
- evaporation** – loss of water to the atmosphere from water surfaces (*see page 6*)
- evapotranspiration** – loss of water to the atmosphere from water bodies, land, and living plants (*see page 6*)
- groundwater** – water that lies below the surface of the earth, filling the spaces or pores in soil and rock
- hardpan** – a compact layer of till soil nearly impervious to water (*see page 12*)
- hydraulic head** – the energy associated with water at any point below the water table, a result of its relative elevation, velocity, and pressure (*see page 10*)
- hydraulic gradient** – differences in hydraulic head from one place to another; groundwater moves along this gradient from areas of high head to areas of low head (*see page 10*)
- hydrologic cycle** – the movement of water on, above, and below the earth's surface (*see page 6*)
- hydrolyze** – to react with water (*see page 21*)
- impervious surfaces** – surfaces, such as roofs and pavement, through which water does not drain (*see page 7*)
- induced infiltration** – when pumping lowers the water table under a nearby river or other water body so that surface water flows downward through the streambed into the aquifer (*see pages 14, 21*)
- infiltrate** – movement of water into an area as it filtrates underground (*see page 7*)

injection wells – wells used to dispose of industrial, mining or other wastes below the ground
(see page 21)

ion exchange – a reversible chemical reaction between a solid and liquid in which charged particles may be interchanged (see page 20)

permeability – the ability of a material to transmit water; a measure of the interconnectedness of the open spaces in a material (see page 10)

plume – a discrete source of pollution extending from its source (such as a landfill or leaky storage tank) along the groundwater flow path to the point where the groundwater is either pumped from a well or discharged into a surface water body (see page 21)

pollution prevention – eliminating or reducing the amount of toxicity of potentially harmful substances before they are introduced into the environment (see page 2)

porosity – the volume of open spaces in rock or soil; if pores are large and abundant more water can be stored (see page 10)

precipitation – the release of water from the atmosphere (see page 6)

recharge – addition of water to the saturated zone (see pages 6, 9)

runoff – rainfall not absorbed by the soil (see pages 6, 7)

saturated zone – where all the available pores and spaces are filled with water (see page 9)

sorption – to take up and hold (see page 20)

State Aquifer Protection Area – a special type of wellhead protection area defined by state statute
(see page 15)

storage capacity – a measurement of the volume of water that can be held in the spaces in soil and rock (see page 10)

stratified drift – meltwater sediments, deposited in layers of similar-size particles (see page 12)

surficial deposits (unconsolidated material) – particles of soil and broken rock that lie over bedrock, including both till and stratified drift deposits (see page 11)

till – a jumble of earth particles, from fine clay to huge boulders, deposited directly by glaciers (see page 11)

transmissivity – how readily groundwater flows through an aquifer (see page 10)

transpiration – the release of water vapor to the atmosphere by plants (see page 6)

unsaturated zone – the area just below the ground surface which is filled with both air and water
(see page 9)

water budget – an accounting of the inflow to, outflow from, and storage in a watershed or aquifer
(see page 6)

watershed – (see drainage basin)

water table – the top of the saturated zone (see page 9)

well – a borehole or shaft into the ground that penetrates an aquifer and allows water to flow in

Wellhead Protection Area (WHPA) – portion of the aquifer recharging the well (see page 15)

well recharge area – the portion of the cone of depression from which groundwater is diverted to the well (sometimes referred to as **area of contribution**), and upgradient areas from which water flows naturally into the cone (see page 14)

PRINTED ON RECYCLED PAPER USING SOY-BASED INKS
BY THE PYNE-DAVIDSON COMPANY
HARTFORD, CONNECTICUT