

**Worthington
Source Water
Protection
Plan**

March 2005

Prepared by:



Prepared for:
Town of Worthington
and Worthington Fire District

*The cover page for the **Worthington Source Water Protection Plan** is a picture taken by **Adam Hart-Davis** of the DHD Multimedia Gallery titled “*Splash of Stream of Water Drops*”.*

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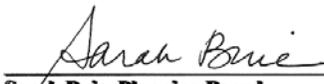
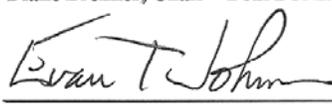
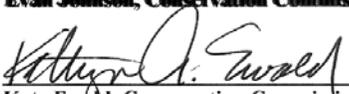
"There shall be no man or woman dare to wash any unclean linen, wash clothes,...nor rinse or make clean any kettle, pot, or pan or any suchlike vessel within twenty feet of the old well or new pump. Nor shall anyone aforesaid, within less than a quarter mile of the fort, dare to do the necessities of nature, since by these unmanly, slothful, and loathsome immodesties, the whole fort may be choked and poisoned."

--Governor Gage of Virginia, Proclamation for Jamestown, Va. (1610)

Worthington Source Water Protection Plan

Town of Worthington and Worthington Fire District Worthington, MA

Adopted by the Source Water Protection Committee March 2005:

 _____ John Sullivan, Worthington Fire District, Operator	<u>2-28-05</u> Date
 _____ Stephan Schultz, Worthington Fire District, Treasurer	<u>3/2/05</u> Date
 _____ Jane Christensen, Chair - Planning Board	<u>2/28/05</u> Date
 _____ Helen Sharron-Pollard, Planning Board	<u>2/28/2005</u> Date
 _____ Roan Katahdin, Planning Board	<u>2/28/05</u> Date
 _____ Sarah Baic, Planning Board	<u>3/2/05</u> Date
 _____ Diane Brenner, Chair - Board of Health	<u>3/10/05</u> Date
 _____ Evan Johnson, Conservation Commission	<u>3/2/05</u> Date
 _____ Kate Ewald, Conservation Commission	<u>3.2.05</u> Date

Review Annually and Update Every 3 Years

Date Reviewed	Reviewer	Changes or Comments

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MRWA wishes to thank all the individuals and organizations that contributed to this effort, including the system operator, Mr. John Sullivan, who provided helpful information regarding the history and site characteristics of the Worthington Fire District. Local officials cheerfully attended monthly meetings to help formulate this plan and expertly presented their water protection goals and methods at the Source Water Protection Workshop on January 31, 2005.

The Source Water Assessment and Protection Report (SWAP) prepared by Catherine Skiba of the Massachusetts Department of Environmental Protection (MA DEP, western division) provided an excellent resource to begin this planning process. Ms. Skiba also generously contributed her time and expertise to the technical questions this plan addressed and participated at the Worthington's Source Water Protection Workshop in January.

A Steering Committee composed of the Water Commissioners from the Worthington Fire District, members of the Worthington Planning Board, Board of Health, Conservation Commission and Massachusetts Rural Water Association worked together to develop this plan and a number of water supply protection strategies including:

1. A community plan for the long-term protection of watershed land for the Worthington Fire District, a public water system (pws) and residential private wells;
2. A public education and outreach program for residents and businesses focusing on protecting source water;
3. A means to help private well users test and protect their wells;
4. A need to establish a septic system inspection program in recharge areas;
5. A need to monitor hazardous materials and create a floor drain inspection program in recharge areas; and,
6. Strategies for controlling high-risk land use development in the Interim Wellhead Protection Areas (IWPA) and Zone IIs.

Wellhead Protection Plan Steering Committee

The Steering Committee provided valuable information about Worthington's water supply and its watershed, and assisted in the development of protection strategies. Members of the Advisory Committee include:

Diane Brenner, Board of Health
Sarah Buie, Planning Board
Jane Christensen, Planning Board (Chair)
Kate Ewald, Conservation Commission
Evan Johnson, Conservation Commission
Roan Katahdin, Planning Board
Stephan Schultze, Water Commissioner
Helen Sharron, Planning Board
Camille Smith, Board of Health
John Sullivan, Water Commissioner

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Introduction

Source Water Protection Plan

A Source Water Protection Plan (SWPP) identifies water system vulnerabilities to contamination and describes techniques to manage potentially contaminating land uses. The Worthington Source Water Protection Plan has been developed by the Worthington Source Water Protection Committee and Massachusetts Rural Water Association (MRWA) to aid in the protection of the Worthington Fire District, a public water system (PWS), and the Town's residential private wells.

Public water suppliers around the state of Massachusetts and across the nation are increasingly finding that proactive planning and prevention are essential to both preserving the long-term integrity of their water systems and helping to limit their costs and liabilities. Despite our best efforts, accidental spills of hazardous chemicals are all too common and bacterial outbreaks still occur unexpectedly, sometimes with dangerous consequences. These types of events may result in costly treatment, remediation and/or litigation, and, in a worst-case scenario, could permanently destroy a water source or injure/kill a water customer.

According to the National Center for Small Communities (2000), successful planning and prevention requires six basic steps:

1. Source protection area (SPA) delineation;
2. Identification of sources of contamination within SPA's;
3. Assessment of the risks to drinking water posed by contaminant sources;
4. Publication of the risk assessment results;
5. Implementation of measures to manage contaminant sources; and
6. Contingency planning for response to contamination incidents.

Source protection planning has numerous benefits including:

- Increasing consumer confidence that their drinking water source will continue to be protected and reliable;
- Reducing the likelihood that contamination incidents will occur with costly and/or potentially harmful results;
- Relationships with regulatory agencies, employees and the public are often enhanced through source protection
- Source Protection Plan's provide strong support to requests for financial assistance.

Source Water Assessment and Protection Reports

As a first step toward drinking water protection planning on a statewide basis, the Massachusetts Department of Environmental Protection (DEP) recently completed Source Water Assessment Program (SWAP) reports for most of Massachusetts PWSs. The SWAP reports include descriptions of SPA delineation and land uses which may potentially contaminate water sources, as well as recommendations for managing those land uses. Consequently, the reports provide water suppliers with an important tool for initiating or improving source water protection in their area. (Please see the **Resources** section for a copy of the Worthington Fire District SWAP report completed October, 2003.)

Worthington Fire District

The SWAP report for the Worthington Fire District determined that the overall ranking of source susceptibility at this site is “**Moderate**” based on land uses in the associated Source Protection Area (SPA). The Key issues identified by the SWAP report include:

1. A non-conforming Zone I.
2. Residential land uses posing potential threats to the system.
3. The proximity of the transportation corridor.

The Worthington Fire District is commended in the SWAP report for current and past protection measures including the development of a protection plan, upgrading the infrastructure and the purchase of land around the sources. By continuing to implement protection measures and Best Management Practices (BMP's), the Worthington Fire District will reduce the well's susceptibility to contamination. Due to the delineation of the Zone II contribution area for the springs, the SWAP recommended that the district review the existing protection plan, update information as appropriate and work with the community in the development of additional protection strategies.

Specific protection strategies and recommendations by the SWAP report and the Source Water Protection Planning Committee will be addressed in detail throughout the Worthington Source Water Protection Plan.

Residential Private Wells

The Worthington Source Water Protection Steering Committee also expressed the need to address source protection for residential private wells. Approximately 2/3 of the residents in the Town of Worthington rely on private wells for their drinking water source. This plan will also recommend Best Management Practices (BMP's) for private wells including:

- The importance of septic system maintenance;
- How to have private well water tested for contaminants;
- The impacts of hazardous materials on private wells;
- The dangers of improperly capped/sealed well-heads; and
- The impacts of road salt on private wells located near major transportation corridors.

Action Plan

ACTION	WHO	WHEN
1. Acquire available funds for land purchase and all other implementation strategies using the Worthington Source Water Protection Plan as water resource management tool required by the Commonwealth Capital funding process.	Worthington Fire District (WFD), Planning Board (PB), Select Board (SB)	When available.
2. Conduct a drinking water resources study to determine the sites for future drinking water resources.	Private consultant	When funding available
3. Worthington may take proactive steps to acquire land through the adoption of the Community Preservation Act.	All Town Boards and residents.	2005
4. Revise the Water Supply Protection District (WSPD) to include language that protects the Zone II delineation and the Interim Wellhead Protection Area (IWPA).	WFD, PB	2005
5. Include current and future maps depicting all Worthington's Zone II's and IWPA's in the revised WSPD bylaw.	WFD, PB	2005
6. Conduct outreach to the operators/owners of all the other operators/owners of Worthington's public well sources to determine if they want to be protected by the Water Supply Protection District overlay zoning.	PB	2005
7. Restrict public access to outside of the Zone 1.	WFD, Police	2005
8. Adopt "Right of first refusal" bylaws in order to purchase all the Zone I lands. Encourage Conservation Restrictions if this is not feasible.	WFD, PB, Conservation Commission (CC)	2005-2006
9. Continue to work with Zone II landowners to either purchase the land within the Zone II of implement a conservation restriction. A conservation restriction essentially establishes that the land must remain undeveloped. A conservation restriction can be purchased from the landowner or voluntarily donated by the landowner. Whether donated or bought, it is the development potential of the land that is being secured, rendering the land preserved as open space.	CC, PB, WFD	2005-2010
10. Conduct outreach to owners with septic systems in Zone I and II of the wellhead area.	WFD, BOH	2005-2006
11. Enlist voluntary homeowner participation in septic system inspection program. Especially in Zone I and II of the wellhead area.	WFD, BOH	2005-2006
12. Strongly encourage septic system maintenance for all residential septic systems in Zone I, II, and for private well owners.	WFD, BOH	2005

ACTION	WHO	WHEN
13. Adopt regulations for the Water Supply Protection District that specifically prohibit septic system cleaners which contain toxic chemicals such as methylene chloride and 1-1-1 trichlorethan, and other hazardous wastes.	PB, BOH	2005
14. Assist homeowners in getting financial assistance for failing septic systems.	BOH	2005-2010
15. Adopt a Floor Drain Regulation either as a General Bylaw or Board of Health Regulation	BOH, Select Board (SB)	2005
16. Include language in WSPD to prohibit commercial and industrial floor drains.	PB, BOH	2005
17. Educate local businesses about proper handling and storage of hazardous materials.	BOH	2005-2010
18. Consult with the Town Highway Department to insure there is a reduced salt application on Ridge Road near the wellfield.	WFD, Highway Department (HD)	2005
19. Install signs prohibiting the transport of hazardous materials along Ridge Road.	WFD, SB, HD	2005-2006
20. Keep the ratio of salt to sand low when treating winter roadways. The appropriate ratio should be determined by weather conditions and providing optimum public safety. Public and Private wells can be affected by road salt.	MassHighway, BOH, SB, HD	2005-2010
21. The Board of Health and Board of Selectman should submit a joint letter to MassHighway requesting compliance with the low-salt zone application rates and procedures along Route 112 and 143 in Worthington.	BOH, SB, MassHighway	2005-2010
22. All waste oil, automotive fluids, paints and other hazardous fluids should be taken to designated collection sites for proper disposal.	BOH, Transfer Station Administer	
23. Residential fuel tanks are a concern and a survey to determine the age and leak potential of the tanks is suggested. Prevention of future oil spills is paramount.	BOH	2005-2010
24. Educate residents about appropriate landscape practices and products to prevent contamination of the aquifer.	WFD, BOH	2005-2010
25. Survey area residents to determine if abandoned wells exist, and whether a program for capping these wells is warranted.	BOH	2005-2010
26. Conduct outreach to area farmers to inform them of the relationship of their lands to the public drinking water supply and provide information about agricultural best management practices.	CC, BOH, SB	2005-2010
27. Inform farmers about local waste oil and automotive fluid collection centers and services.	BOH	2005-2010

ACTION	WHO	WHEN
28. Work with local supplier of agricultural farms to ensure availability of organic fertilizers and pesticides, slow release nitrogen fertilizers, integrated pest management products, and other products appropriate for protecting water sources from contamination.	CC, BOH, SB	2005- 2010
29. Limit and monitor carefully any timber operations in the Water Supply Protection District.	WFD, PB	2005- 2010
30. Require oil arresting pads at the timber operation site to contain any potential hazardous spills.	WFD, PB	2005- 2010
31. Adopt a Forestry Management Plan that outlines acceptable forestry practices within the WSPD.	CC, WFD, PB	2005- 2010
32. Encourage private well owners to test their wells for contaminants.	BOH	2005- 2010
33. Institute a community-wide private well testing program. Provide information for private well testing labs and costs.	BOH	2005- 2010

Description of Water Supply

Worthington Fire District

The Worthington Fire District is the Town of Worthington’s public water supply system. The water distribution system was originally constructed in 1911. It was initially developed to protect Worthington residents living in the Town center from house fires, a common threat to early American households. Eventually, the system became the primary source of drinking water for the households connected to the fire district.

The water system provides 168 service connections to approximately 565 residents and 50 hydrants located primarily in the Town center. It costs \$1500 for a new house to be tied into the system with an annual rate of \$440 for the first 40,000 gallons of water and \$6.60 for every thousand gallons thereafter. The system is estimated to be capable of serving approximately 30 additional hook-ups. However, development constraints such as protected conservation land, inadequate frontage, and the expense of back lot subdivision development is expected to limit any additional household additions to the Worthington Fire District.

The District maintains and operates eleven (11) sources of water. The sources are seven bedrock wells (01G-04G and 09G-11G) and four-spring sources (05G-08G); all are located in relatively close proximity to each other in the north central section of town on Ridge Road between Buffington Hill Road and Cold Street. The following table is provided by the SWAP Report for the Worthington Fire District.

Table 1: Worthington Fire District Water Sources

<i>Well Name</i>	<i>Source ID#</i>	<i>Zone I (in feet)</i>	<i>IWPA</i>	<i>Source Susceptibility</i>
Well #1	1349000-01G	217	533	Moderate
Well #2	1349000-02G	217	533	Moderate
Well #3	1349000-03G	301	889	Moderate
Well #4	1349000-04G	217	533	Moderate
Well #5	1349000-09G	165	460	Moderate
Well #6	1349000-10G	232	568	Moderate
Well #7	1349000-11G	255	640	Moderate
<i>Spring Name</i>			<i>Zone II –GIS ID number#</i>	
Spring #1	1349000-05G	291	604	Moderate
Spring #2	1349000-06G	291	605	Moderate
Spring #3	1349000-07G	291	605	Moderate
Spring #4	1349000-08G	291	606	Moderate

Source: Massachusetts DEP SWAP Report, 2003

Water Quality

The Worthington Fire District's water supply is considered to be a high quality drinking water that is treated minimally and is consistently cold throughout the year. Treatment consists of Potassium Hydroxide and Bicarbonate of Soda to reduce the effect of acidic water on household plumbing. A minimum amount of chlorine is added for disinfection.

The system has a monitoring waiver for Synthetic Organic Compounds, Inorganic Compounds and Volatile Organic Compounds, due to not detecting any of these substances in previous monitoring. Because the water has been found by the Massachusetts Department of Environmental Protection to be free of these contaminants, monitoring frequency has been reduced. The last sample for these contaminants was collected in 2003.

During the mid-1990s, the area experienced a dry summer and the District's sources were inadequate to meet demand. Some of the existing wells were deepened and additional wells drilled to meet the system's needs. Wells range in depth from 280 to 550 feet and the springs are bedrock fed springs with collection boxes that have been reconstructed and/or otherwise protected from surface water influences.

Geology and Soils

The bedrock in the area is mapped as the lower Goshen Formation, a carbonaceous schist and phyllite. There is significant bedrock exposure with some areas of thin to moderate depth of till overlying bedrock. Although some of the wells are flowing artesian wells, there is no evidence of a significant and continuous protective, confining unit throughout the protection areas. Sources located in aquifers such as this are considered highly vulnerable to contamination from activities conducted on the land surface. Recent experience has shown that activities that cause significant disturbance to the land surface, such as logging, on areas within the Zone I and Zone II of spring sources with thin overburden or exposed bedrock, can have negative impacts by increasing the turbidity in the ground water.

Protection Zones

All the Worthington Fire District's spring sources have a Zone II delineation and the wells have an Interim Wellhead Protection Area (IWPA).

Zone I is the most protected area around a groundwater source. The Interim Wellhead Protection Area (IWPA) is an area that is assumed to contribute recharge water for a groundwater source until a scientifically determined Zone II can be delineated. The radii of the Zone I and IWPA for the wells are based on estimated yields of the wells as determined from pumping tests conducted on each well. The estimated yield of the wells ranges from approximately 2 to 15.5 gallons per minute. The Zone I for a spring is a square area centered on the source in the direction of flow with the source located 50 feet from the downgradient edge of the Zone I. The lengths of the sides of the square are based on the estimated flow from the spring or estimated volume of water used from the source.

*Please refer to **Appendix D: Maps** to review the protection areas for the District's sources.

Protection Zones for Wells (IWPA) and Spring Sources (Zone II)

An Interim Wellhead Protection Area (IWPA) has been assigned by the Massachusetts Department of Environmental Protection (MA DEP) for all of the Worthington Fire District's wells. The IWPA provides an interim protection area for a water supply source in place of an official Zone II designation which delineates the recharge area of the well.

The USGS was contracted by the DEP to determine the contribution areas (Zone II) to spring sources as part of the SWAP program. All Massachusetts spring sources that contribute to public drinking water supplies were delineated with a Zone II during the SWAP process. Spring sources are considered more susceptible to potential contamination due to the influence of surface water on these sources.

Zone II delineation is a priority for wells and springs because the recharge area may be significantly larger or smaller than the current IWPA. The Zone I, IWPA and Zone II areas for the Worthington Fire District's wells and springs are primarily forest with a single dirt road and several residences. The Worthington Fire District is fortunate to have nearly 92 percent of their water sources in forest cover. Other Land uses within the district's Zone I, II and IWPA are included in Table 2.

Zone II Delineation for the Wells

During the process of completing Worthington's Source Water Protection Plan, Bruce Hansen of the USGS (co-author of the Zone II delineation for the springs) was contacted to assess the costs of a Zone II delineation for the rock wells in Worthington. Based on his experience, he estimated that a Zone II delineation effort for a bedrock well system would most certainly entail a large amount of field (geologic mapping, observation well installation/sampling, geophysics – surface and/or downhole, pumping test) and office (computer modeling) work – potentially spanning a six- to eight-month period. Associated costs could easily exceed \$100K.

The basic benefit of bedrock Zone II delineations is the potential for increased accuracy of recharge area delineation and the associated increase in protection confidence. In each of the three sites studied by the USGS, the Zone IIs determined through detailed analyses included land areas beyond those that would have been included by traditional IWPA delineation (in some cases, up to 1.5 miles beyond the hypothetical IWPA boundaries). This is significant because it is possible for a distant contaminant to quickly work its way through bedrock fractures to a well, in a relatively undiluted form.

Potential Contamination Danger for Wells without a Zone II Delineation

While a potential contamination is possible, the seven wells are spread out geographically so it seems unlikely that a plume of contamination would impact all of the wells at once. Also, the IWPA's as drawn provide at least a small buffer zone that allows some extra protection. Given these observations and the apparent cost of a Zone II delineation for the wells, the Town might be better served at this time by (a) protecting the existing IWPA's and Zone IIs and (b) focusing its efforts on identifying potential new or emergency sources of drinking water.

If the Town is still uncomfortable with the existing IWPA's, it is suggested that they voluntarily protect a larger area around the wells. One way this could be accomplished is by creating conservation bylaws protecting areas outside of the IWPA.

Distribution and Supply

The springs and wells are gravity fed to reservoirs on Spring Street where the water is treated and distributed. One of the reservoirs is used only as an emergency supply. The emergency supply reservoir is estimated to have approximately 14 days of water on reserve. The well field typically supplies 34,000 gallons of water per day (gpd), with peak rates of up to 72,000 gpd (2002 data).

Emergency Response/Contingency Planning

Worthington has an Emergency Spill Response Plan headed by the Chief of the Fire Department, with a Mutual Aid Agreement with the Towns of Cummington, Plainfield, Goshen, Chesterfield, and Windsor. These communities participate in annual emergency response training with certified hazmat specialists.

If the Worthington Fire District's water sources were to become compromised due to factors such as drought, contamination, pump failure, power failure or primary storage tank failure the reservoir used only for emergency supply would become active. The emergency supply reservoir is an elevated storage facility that is distributed through pressure release. The emergency reservoir is estimated to have the capacity to supply water for two weeks or 14 days with user restrictions (water conservation) enacted immediately. In the case that the source water remained compromised and recharge to the reservoir unpredictable, the Worthington Fire District has contact information for several bulk water suppliers in the region and would proceed to buy water from said suppliers.

Copies of the Emergency Response Plan for the Worthington Fire District are available for review by contacting operator John Sullivan or the Massachusetts Department of Environmental Protection.

Land Use

The drainage basin for the Worthington Fire District well field is mainly comprised of forested lands and protected open space, including the Worthington State Forest. Route 143 is located approximately ¼ mile up gradient of the wells field. Residential developments with on-site septic systems are located immediately downgradient of the well field. The wells and springs are mostly situated on town-owned parcels that are permanently protected. The district does not however own or control the entire Zone I for all of its sources. The non-conforming Zone I will be discussed in detail in the section titled **Potential Sources of Contamination in Zone I and II.**

Table 2: Land Uses in Worthington’s Protection Zones/Areas

Land Use	Acres	Percent
Pasture	1.1	1.4%
Forest	67.3	91.7%
Wetland	1.4	1.4%
Residential	2.1	2.7%
Waste Disposal	1.7	2.3%

Source: PVPC, based on Mass GIS data, 2003.

*According to John Sullivan the water operator of the Worthington Fire District there are no know waste disposal sites within the water districts IWPA. The nearest landfill is an old dumping ground on Dingle Road to the northeast of the wellhead protection area.

Non-Community Water Systems

Transient non-community wells (TNC) are public water systems that are neither community water systems nor non-transient non-community water systems, but which serve at least 25 different persons at least 60 days of the year. In Worthington, this includes the following businesses:

Table 3: Non- Community Water Systems in Worthington

PWS ID	PWS Name	Type
1349007-01G	Buffington Hill Partnership	TNC
1349006-01G	Worthington Golf Club	TNC
1349002-01G	Liston’s Bar and Grill	TNC
1349003-01G	Berkshire Park Camping	TNC
1349001-01G	Little River Cafe	TNC

Source: MA DEP, 2003

It is recommended that the Worthington Source Water Protection Committee conduct outreach to these smaller water systems to determine if these systems are in need of an overlay protection zone or could benefit from any other protections being developed by this planning process.



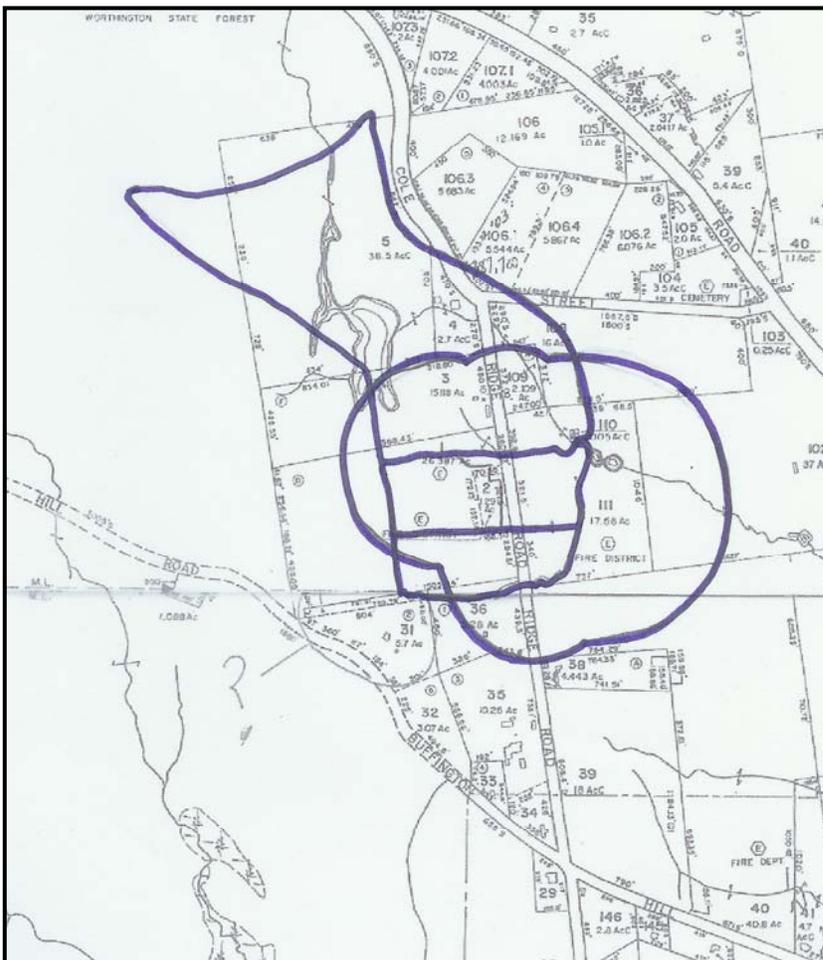
Installing new pipe for the Worthington Fire District on a cold winter day.

Potential Sources of Contamination Zones I and II

By their very nature, certain land uses are threatening to water supplies. There are some potential sources of contamination within the Worthington Fire District's Zone I, II and IWPA including:

1. A non-conforming Zone I.
2. Residential land uses posing potential threats to the system.
3. The proximity of the transportation corridor.
4. The potential for logging within the Zone II.

Table 4 identifies parcels within the Zone II and IWPA's of the Worthington Fire District wellfield. It is recommended that educational outreach to the owners of the parcels be conducted. A letter from the Source Water Protection Committee indicating that their land falls within an important recharge area of the wellfield is a priority. The outreach letter is intended to be a guide to landowners that promotes the care and maintenance of their septic system, fuel oil tanks and encourages non-toxic landscaping to help protect the Worthington Fire Districts wellfield from potential contaminants. If the owner is unknown due to the difficulty of tracking the parcel record, it is recommended that the assessor be contacted to help confirm the parcels owner and use.



***Zone II and IWPA
boundaries:
Worthington Fire
District***

Table 4: Inventory of Residential Parcels within Zone II and IWPA

Map/Parcel #	Owner	Address	Land Use	Mailing Address	Potential Contamination Source
406/ lot 1	<i>Contact Assessor</i>	Ridge Road			
406/ lot 2	Worthington Fire District	Ridge Road	Well field	Box 392 Worthington, MA 01098 John Sullivan, Operator	Protected
406/ lot 3	Ellen E. Urbano Realty Trust (Recently sold)	328 Ridge Road	Residential	Box 205 Worthington, MA 01098	septic, heating fuel, lawncare
406/ lot 4	Timothy J. & Jelinda Cleggett	346 Ridge Road	Residential	Box 142 Worthington, MA 01098	septic, heating fuel, lawncare
406/ lot 5	Luther Liimatainen	Cold/Ridge Roads	Vacant Land	36 Curtis Rd. Chesterfield, MA 01012	Potential development, agricultural use
406/ lot 6	Comm. of Mass.	North Rd./ Cold St.	Vacant/ Forested	100 Cambridge St. Boston, MA 02202	Worthington State Forest/ Protected land
406/ lot 102	Margaret S. Downey	168 Old North Rd.	Residential	C/O Costello 643 S. Branch Pkwy. Springfield, MA 01118-1901	septic, heating fuel, lawncare, agricultural use
406/ lot 108	Michael Downey	Ridge Road	Vacant Land	78 Riverview Terrace Springfield, MA 01108-1630	Potential development, agricultural use
406/ lot 109	<i>Contact Assessor</i>				
406/ lot 110	<i>Contact Assessor</i>				
406/ lot 111	Worthington Fire District	Ridge Road	Well field	Box 392 Worthington, MA 01098 John Sullivan, Operator	Protected
407/ lot 36	Robert&Catherine Perkins	278 Ridge Road	Residential	PO Box 141 Worthington, MA 01098	septic, heating fuel, lawncare
407/ lot 40	<i>Contact Assessor</i>	Buffington Hill Rd.			

Non-conforming Zone I

Worthington Fire District's water sources consisting of wells and springs are located in an aquifer with a high vulnerability to contamination. The wells and springs serving the District are drawn from fractured bedrock groundwaters. Unlike gravel and sand aquifers which can act as filters to contaminants, fractured bedrock has no significant hydrogeologic barrier to prevent contaminant migration.

All Massachusetts sources (wellheads) that provide public drinking water require that land use in the Zone I be restricted to water supply-related activities only. The district or municipality is therefore required to own and or protect the entire Zone I because it is considered the most vulnerable to contamination (Massachusetts Groundwater Source Approval Regulations [310 CMR 22.00]).



Ridge Road, Located near Wellhead Area

Public Road in Zone I

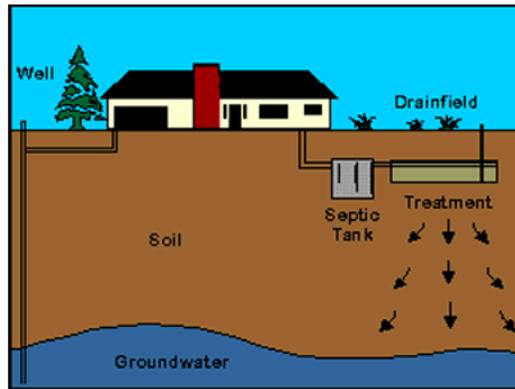
The Worthington Fire District does not own or control the entire Zone I of all of the water sources in its wellfield. The district does not own the entire Zone I for sources 01G, 02G, 04G and 05G. The Zone I area also contains a road. The road is maintained by the Town of Worthington's Highway Department.

Recommendations:

- 1. Consult with the Town Highway Department to insure that there is a reduced salt application on Ridge Road near the well field.**
- 2. Install signs prohibiting the transport of hazardous materials along Ridge Road i.e. residential fuel trucks.**
- 3. Do not pave Ridge Road. Paved roads invite more access and use.**
- 4. Adopt "Right of first refusal" bylaws in order to purchase the all Zone I lands. Encourage Conservation Restrictions if this is not feasible.**

Residential Land Uses

Residential land uses are known to pose threats to drinking water resources. Sources of residential land use pollutants include household hazardous waste, septic systems, landscape care products, and home heating oil fuel storage. In Worthington, septic systems, heating fuel storage tanks, and landscape care are potential threats to the aquifer. The following recommendations are also applicable to those residents in Worthington utilizing private wells for their drinking water.



Septic System Model

Residential Septic Systems

Worthington's Board of Health arranges and offers an annual septic pumping in October at a group rate for the residents in Town.

Recommendations:

- 1. Conduct outreach to owners with septic systems in Zone I and II of the wellhead area.**
- 2. Strongly encourage septic system maintenance for all residential septic systems in Zone I, II and for private well owners.**
- 3. Adopt regulations for the Water Supply Protection District that specifically prohibit septic system cleaners which contain toxic chemicals such as methylene chloride and 1-1-1 trichlorethane, and other hazardous wastes.**

Residential Fuel Tanks

Many residents in Worthington use oil or gas to heat their homes. The tanks that hold household fuel in older homes may be old and subject to leakage. Fuel tanks should be inspected visually on an annual basis and properly seated on spill pads to prevent accidental spills or leaks from reaching groundwater through cracks or drains in the basement floor. Groundwater sources near older homes, which still have dirt floors, are particularly vulnerable to contamination by hazardous materials.



Inspect and maintain home fuel tanks

A complete list of Hazardous Waste Releases in the Worthington can be found in **Appendix B: Hazardous Waste Spills Town of Worthington.**

Recommendation:

- 1. Residential fuel tanks are a concern and a survey to determine the age and leak potential of the tanks is suggested. Prevention of future oil spills is paramount.**

Timber Operations

As noted in the **Description of Water Supply** section, there is no evidence of a significant and continuous protective, confining unit throughout the Worthington Fire District's protection areas. Sources located in aquifers such as this are considered highly vulnerable to contamination from activities conducted on the land surface. Recent studies have shown that activities that cause significant disturbance to the land surface, such as logging, can have negative impacts by increasing the turbidity in the ground water. The Worthington Fire District's Zone I and Zone II spring sources, with only a thin overburden or exposed bedrock as a buffer, are especially vulnerable to contamination from logging or other earth moving/excavation activities.

Soil Erosion/Turbidity

All timber operations involve some level of risk in regards to soil erosion. For example, road construction and road use typically account for 90% of the total sediment runoff from forestry operations. Roads, ditches, cutbanks, slope failures, debris flows, stream bank erosion and channel scour, and the diversions of streams at road crossings all are potential sources of fine sediment. Erosion control mechanisms are necessary on skid roads, haul roads, and landings. Proper construction and maintenance are critical in order to prevent the filling of wetlands and stream channels by sediments.

Removing vegetation adjacent to streams and tributaries can destabilize banks, resulting in sedimentation. Increased sediments in streams can lead to turbidity problems associated with surface water supplies. For example, increased turbidity has the potential to damage water treatment pumps, reduce reservoir volume, and increase treatment costs. Harvesting trees along a stream bank also reduces shading which helps to regulate streamwater temperatures and oxygen levels for cold water fisheries.

Pathogens

The effects of increased sediment loads are various. Increased turbidity levels pose a significant risk to public health. Turbid water conditions can mask the presence of pathogens such as *Cryptosporidium*. *Cryptosporidium* (Crypto) is a parasite commonly found in surface waters such as lakes and rivers, especially where animal wastes and sewage are in contact with water resources. Crypto is resistant to chlorine disinfection, causes intestinal disorders in healthy people, and can result in death for immunosuppressed people. Wildlife is a potential source of Crypto. Even a well-operated water treatment system cannot ensure that drinking water will be completely free of this microorganism.

Notable crypto outbreaks occurred in Milwaukee, WI in 1993, and Las Vegas, NV, in 1994. During the Milwaukee outbreak over 400,000 people were effected. No specific source of the cryptosporidium was ever identified in the Milwaukee outbreak, but runoff from abnormally heavy spring rains most likely carried the crypto to the lake from a variety of sources.

Effects of Timber Harvesting

Timber harvesting can have the following effects on tributaries:

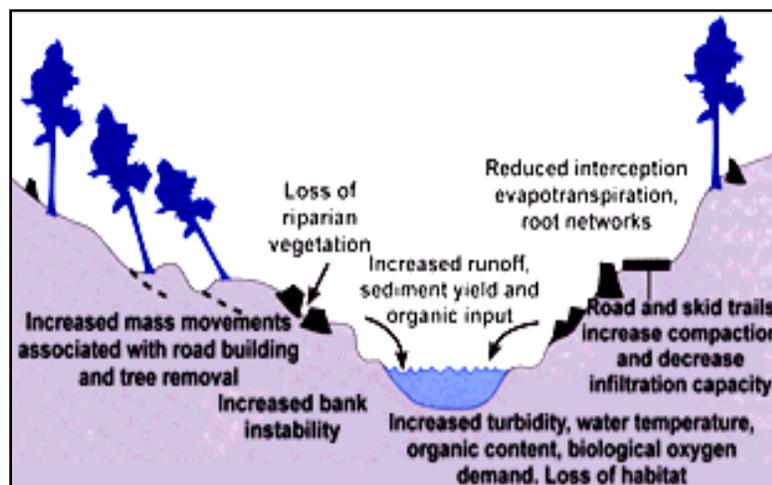
- Deplete stream oxygen (DO) due to additions of large amounts of fine litter to small low-turbulence streams
- Increase nutrient concentrations (e.g. increases of nitrate following harvest, high concentrations of nitrate observed in harvesting experiments in northern hardwoods of White Mountains (3 mg-N/L)).
- It is important to maintain riparian buffers to protect streams from increased sediment loads, decreased dissolved oxygen concentrations, and increased nutrient concentrations. Ideally, riparian buffers for all stream classifications and wetlands should be identified, inventoried, and mapped.

Other potential sources of contamination from Timber Operations include:

- Oil, fuel or hydraulic fluid spill from the timber operation machinery.

Recommendations:

- 1. Limit and monitor carefully any timber operations in the Water Supply Protection District.**
- 2. Require oil arresting pad at the timber operation site to contain any potential hazardous material spills.**
- 3. Adopt a Forestry Management Plan that outlines acceptable forestry practices within the watershed to protect the water recharge supply to the Worthington Fire District's wellfield.**



Generalized view of watershed impacts associated with logging.

Agriculture

Potential threats to the quality of water associated with agriculture include animal manure, pesticides, fertilizers, herbicides, and waste oil and fluids generated by farm equipment. There are no significant agricultural practices within the Zone I or II of the Worthington Fire District's wells, and the majority of the recharge area is forested landscape. However, the Town of Worthington has been an agricultural community for many years and the siting of future wells may be difficult due to contamination by agricultural chemicals. In particular, private wells near large-scale farming activities may be especially vulnerable to contamination.



Potato Fields

A barn burned on Radiker Road a few years ago that was full of temic, a potato pesticide. The water that was used to douse the fire dissolved the temic and it is believed to have entered groundwater supplies in that area rendering the site unfit for future wells. If a resident suspects that temic has entered their well water, it is important to test the water for the presence of Inorganic Compounds IOC's and treat the water accordingly.

It is also recommended to the extent feasible, that all new permanent manure pits and new animal feed lots shall be designed to restrict infiltration, run-off or other movement of animal wastes or manure to surface waters or aquifers. Although grazing cattle do not constitute a feed lot or manure pit, similar considerations should be given to the proximity of groundwater, surface water and the flow of runoff.



Agricultural Fertilizer Tanks

Recommendations:

- 1. Conduct outreach to area farmers to inform them of the relationship of their lands to the public and private drinking water supply and provide information about agricultural best management practices.**
- 2. Inform farmers about local waste oil and automotive fluid collection centers and services.**

Roads

Two state highway roads are located in the Town of Worthington: Routes 112 and 143. The Worthington Source Water Protection Committee expressed concern about the possible contamination of private wells from road salt near these roads. The following is an example of how the Town of Worthington may address the issue of road salt along Routes 112 and 143.



Sample of a Low-Salt Sign: Cummington, MA Rt. 9

The Massachusetts Highway Department (MassHighway) instituted a low-salt zone along portions of Route 9 in 1983 at the request of PVPC and the Town of Cummington due to the contamination of nearby wells from road salt. One of these zones is a one-mile section from the Dudley Manor Bridge in the east to the western entrance of Main Street. This section of road is posted with 'Low-Salt Zone' signs at each end. (Personal Interview, R. Longton, MHD, 8/13/03) The Cummington Section of Route 9 was one of the four model reduced road salt areas initially designated in the Pioneer Valley region. This program was so successful that it led to a statewide policy on reduced road salting in water supply areas.

MassHighway Salt Application Procedures

Each year, the MassHighway Board of Commissioners votes to renew the low-salt zones throughout the Commonwealth. The application policies and salt to sand ratios vary between zones. Along Routes 112 and 143, (Route 9 also) the application rate is based on a mixture of a commercial Premix and sand. Premix is a mixture of sodium chloride and calcium chloride at a 4:1 ratio. The sand and salt mixture spread on Route 112 and 143 is one part Premix to three or four parts sand, depending on weather conditions, at an application rate of 240 pounds per lane mile. One lane mile is 12 feet wide by one mile long.

The application rate of 240 pounds per lane mile is programmed into a computerized spreader on the plow trucks. The drivers have the ability to override the computer and increase the application if extreme weather conditions necessitate. Any one section of road can receive multiple applications throughout the life of a storm. MassHighway has recently begun pre-wetting with liquid calcium chloride to break up the ice bond with roads before making low-salt applications. This makes the low-salt treatment more effective reducing the need to override the computerized spreader and increase the salt ratio.

MassHighway acknowledges that low-salt applications are not always adhered to in low-salt zones due to staff turnovers and general oversight. The Board of Health has expressed concern that the salting along this section Route 112 and 143 may be heavy thus causing the salt contamination of nearby private wells.

If a Worthington resident suspects that their well has been contaminated by road salt contact the Worthington BOH for more information. MassHighway has a policy that if a homeowner has a medical condition that is exacerbated by sodium, and can prove that the high sodium content is the result of road salt, the agency will financially aid the homeowner with remediation. Possible actions may include water treatment or siting a new well away from the road.

Recommendation:

- 1. The Board of Health and Board of Selectmen should submit a joint letter to MassHighway requesting compliance with the low-salt zone application rates and procedures along Routes 112 and 143 in Worthington near wells that have been contaminated by the application of road salt.**

Landscape Care

Residential landscape care and maintenance typically involves the use of fertilizers, herbicides, and pesticides which pose a significant threat to drinking water and other water resources. Most of these products are highly soluble in water and are readily transported by stormwater to the nearest catchbasin, and ultimately to a wetland, pond, stream or groundwater.

An outreach program to educate Worthington residents that fertilizers, pesticides, herbicides, lawn care chemicals or other similar materials shall be used with manufacture’s label instructions and applied minimally within significant recharge areas or near private wells is recommended. Encouraging caution with hazardous landscaping materials will minimize adverse impacts to surface and groundwater.



Worthington Golf Course

Recommendations:

- 1. Educate residents about appropriate landscape practices and products to prevent contamination of the aquifer.**
- 2. Work with local suppliers of landscape care products to ensure availability of organic fertilizers and pesticides, slow release nitrogen fertilizers, integrated pest management products, and other products appropriate for landscape care within a sensitive environmental area.**

Protection and Management of the Wellhead Protection Area

Regulatory Strategies

Implement a Zone II overlay district along with the Water Supply Protection District

In the 1990's, Worthington adopted a Water Supply Protection District (WSPD) as a zoning overlay district. The district delineation was largely based on surficial hydrology and topography since a more in depth Zone II hydrogeologic study had not been completed for any of the public water supplies. The Zone II's have since been designated for the springs in the wellhead area by the United States Geological Service (USGS). The Water Supply Protection District should be revised to include these newly delineated priority recharge areas.



Entrance to Worthington Fire District Treatment Station

Floor Drain Regulation

The DEP recommends that all communities adopt a separate Floor Drain Regulation either as a town wide General Bylaw or as a Board of Health regulation.

“Any floor drainage systems in existing facilities, in industrial or commercial process areas or hazardous material waste storage areas, which discharge to the ground without a DEP permit or authorization. Any existing facility with such a drainage system shall be required to either seal the floor drain (in accordance with the state plumbing code, 248 CMR 2.00), connect the drain to a municipal sewer system (with all appropriate permits and pretreatment), or connect the drain to a holding tank meeting the requirements of all appropriate DEP regulations and policies.” [310 CMR 22.21(2)(a)]

A model Floor Drain Regulation is included in the **Appendix A: Worthington Bylaws/Recommended Bylaws**.

Recommendations:

- 1. Revise Water Supply Protection District to include language that protects the Zone II delineation and the Interim Wellhead Protection Area.**
- 2. Include current and future maps depicting all Worthington's Zone II's and IWPA's in the revised bylaw.**
- 3. Conduct outreach to the operators/owners of all the other public well sources in Worthington to determine if they want to be protected by the Water Supply Protection District overlay zoning.**
- 4. Adopt a Floor Drain Regulation either as a General Bylaw or Board of Health Regulation.**
- 5. Adopt a "Right-of-first-refusal" Bylaw to ensure that the Water District is granted first bid on any property up for sale in the recharge area of the wellfield.**

Non-Regulatory Strategies

Septic System Inspection and Outreach Program

The absence of a public sewer system in Worthington means that all residences and businesses rely on subsurface waste water disposal (septic systems). Improperly functioning or failing septic systems can contribute viruses, bacteria, nitrates, and chemical compounds to groundwater. Proper maintenance will prevent costly problems in the future and prevent contamination of nearby drinking water supplies as well as other water resources such as rivers, ponds, and wetlands.



Worthington Town Hall

Some communities have implemented septic system inspection and outreach programs through their Water Department or Board of Health to reduce the threat an improperly functioning septic system poses to groundwater. Such a program involves voluntary participation by the landowner. To encourage participation, it is important to establish at the outset that the goal of the program is not to penalize or fine property owners, but to work cooperatively to ensure the protection of our water supply.

Recommendations:

- 1. Enlist voluntary homeowner participation in septic system inspection program.**
- 2. Assist homeowners in getting financial assistance for failing septic systems.**
- 3. Conduct public education and outreach about septic system care and maintenance**

How to Establish a Septic System Inspection and Outreach Program:

1. Inspect Septic Systems Regularly

The Water Department, or Board of Health, generates a list of all properties and landowners within the WSPD that have septic systems. Landowners are contacted by mail or telephone to request their voluntary participation in a quarterly (or some other regular interval) inspection program. Upon the first inspection, the inspector meets with the property owner to map the location of the septic system for future inspections. A visual inspection for odor, seepage or lush green growth is performed. If any of the symptoms of an improperly functioning septic system are present, the inspector recommends that the homeowner consult a licensed wastewater disposal engineer for a more in depth evaluation of the problem.

Because the program is purely voluntary, some property owners may opt not to participate fearing financial repercussions. The town should contact local septic system pumping contractors to request that they notify the Board of Health if any of the above described symptoms are observed so that the town can get involved.

2. Town Assists in Procuring Financial Assistance for Homeowner Septic System Repair

The town provides assistance to property owners in contacting appropriate sources of financial assistance for septic system repair. The Commonwealth of Massachusetts has developed programs to assist homeowners with wastewater management problems. The following financial assistance information was provided by the Department of Environmental Protection's Bureau of Resource Protection.

A. Massachusetts Housing Finance Agency (MHFA) Homeowner Septic Repair Program

Homeowners of low and moderate income are eligible. Approval is dependent on good credit and stable income. While income guidelines are geographically indexed, households of one or two with annual income of up to \$46,000 and households of three or more with annual income of up to \$57,000 generally are eligible. Homeowner Septic Repair Loans are available to eligible homeowners as low interest rates of 0%, 3%, and 5%, depending on income, for loans ranging in size from \$1,000 to a maximum of \$25,000.

Participating area lenders approved by MHFA include:

Bank of Western Massachusetts,
45 Federal Street, Greenfield, MA 01301, (413) 774-3713
29 State Street, P.O.Box 4950, Springfield, MA 01101, (413) 781-2265

Greenfield Cooperative Bank, 63 Federal Street, Greenfield, MA 01301,
(413) 772-5000

Lee Bank, 75 Park Street, Lee, MA 01238, (413) 243-0117

More information about this financial assistance can be obtained from MFHA at One Beacon Street, Boston, MA 02108, (617) 854-1020.

B. Tax Credit

The Septic Tax Credit is a credit equal to 40% of the actual costs incurred in the repair or replacement of a failed septic system. The expenses are the lesser of the taxpayer's actual costs paid to repair or replace the system, or \$15,000. The maximum credit amount that can be claimed in any tax year is \$1,500. Any excess credit amount may be used in the five tax years following the year in which the credit was initially claimed. The total amount of credit that may be claimed by the owner for a residential property is \$6,000.

C. The Hilltown Community Development Corporation (HCDC)

The Hilltown CDC has a Septic Repair Program within their Housing Development Program. The Septic Repair Program works with residents through the local officials to administer low interest loans to improve septic systems and thereby foster public health while assisting homeowners.

Contact the Housing Program Director at (413) 296-4536 x2
or email HCDC at staff@hilltowncdc.org

Schedule SC (Septic Credit) Forms are available from the Department of Revenue. This information is based on 2001 Department of Revenue Septic Credit Program.

3. Conduct Public Education and Outreach

Some objectives of the outreach are to inform septic system owners of how a septic system works, how to care for it, what not to put in it, and the connection between septic systems and groundwater. If these objectives are achieved, the Town's drinking water supply is much less likely to be contaminated by wastewater.

Public education and outreach about septic systems should be conducted at regular intervals throughout the year. Once the list of all septic system owners within the Zone II and IWPA is generated, a mailing containing information about the Town's voluntary septic system program and an educational flier published by the National Small Flows Clearinghouse (NSFC) entitled *Groundwater Protection and Your Septic System* can be sent to homeowners.

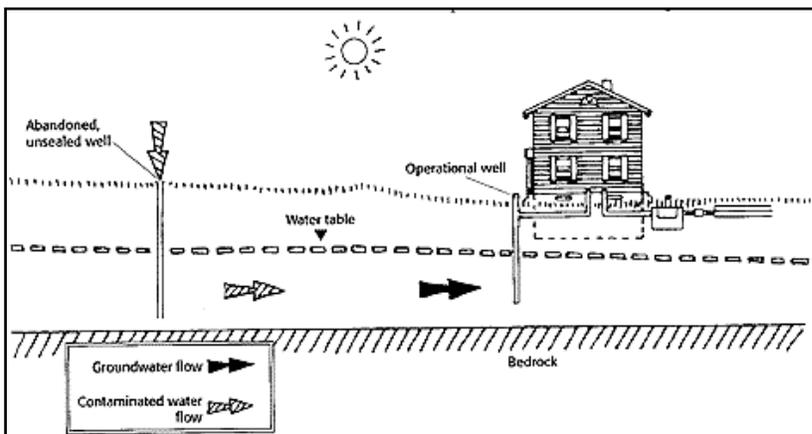
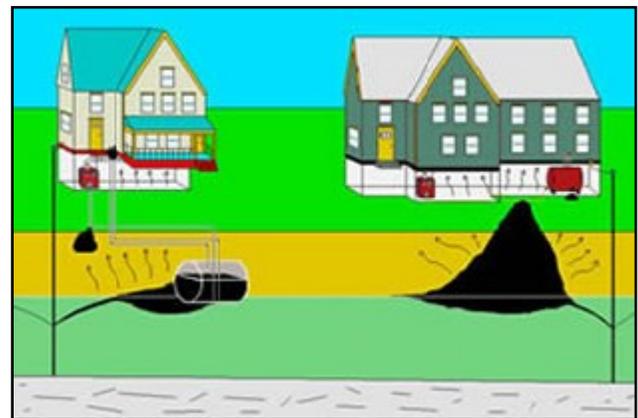
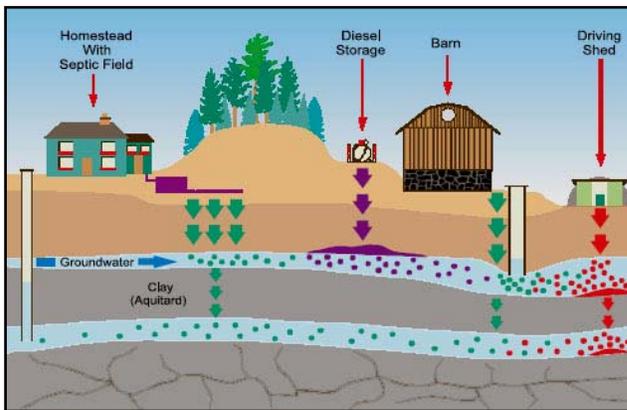
This information should also be made available at public buildings and storefronts around town. Periodically change the literature available in public locations and/or insert new fliers with the water bills. The NSFC also produces a video called *Your Septic System: A Reference Guide For Homeowners* that can be shown on local cable access television. The video can also be made available at the public library. Literature should also be provided to homeowners during inspections.

Table 4: Septic System Outreach Materials

Source	Materials
National Small Flows Clearinghouse West Virginia University P.O.Box 6064 Morgantown, WV 26506-6064 (800) 624-8301 (304) 293-4191 www.nsf.wvu.edu	Groundwater Protection and Your Septic System Item #WWBRPE21 pamphlets The Care and Feeding of Your Septic System Item #WWBRPE18 pamphlets Your Septic System: A Reference Guide to Homeowners Pamphlet and Video

Hazardous Materials, Abandoned Well and Floor Drain Inspection Program

Some businesses and municipal operations that use hazardous materials, produce hazardous waste products, and/or store large quantities of hazardous materials. It is also very likely that many homeowners fall within one of these categories as well. Home heating oil is a classified hazardous waste. Floor drains can act as a direct conduit to the aquifer for hazardous waste that is improperly stored or disposed of. Abandoned wells, often left boarded over but not sealed, can also act as a conduit to the aquifer.



Common contamination sources of public and private water supplies in rural areas.

Once the survey is complete, the Town should have a better understanding of whether home heating oil storage, floor drains, and abandoned wells pose a tangible threat to any of Worthington's aquifers. Based on the results, the Town will seek an appropriate course of action to reduce or eliminate the threat to the aquifer. Possible actions include, capping abandoned wells, replacing deteriorating heating oil storage tanks, and sealing illegal floor drains.

Recommendations:

- 1. Survey landowners about home heating oil storage, abandoned wells, and residential floor drains.**
- 2. Based on results of survey, contact landowners about removing threats to the aquifer.**

Automotive Waste Oil/Paints/ Hazardous Fluids

The proper disposal of automotive waste oil generated by homeowners and small businesses within the WSPD and for private wells is very important. Used motor oil should always be recycled - never thrown in the trash, dumped on the ground, or poured into the sewer or down the drain. Used oil contains heavy metals, which can contaminate water supplies and harm the environment. It doesn't take much to do a lot of damage. One gallon of used oil can pollute one million gallons of drinking water. One pint can produce an oil slick the size of a football field.



Under Massachusetts law, automotive stores must accept containers of used motor oil that they sell to individual customers if accompanied by a receipt. Sears Automotive, some Mobil and Exxon stations, and Valvoline Instant Oil Change will accept used oil without a receipt. The DEP Used Oil Hotline can provide the location of the nearest drop off location at (617) 556-1022 or visit the car oil recycling website at www.recycleoil.org.

Hazardous materials collection days, put on by the town or regional transfer station, are also successful means by which residents can properly dispose of automotive oils, paints and other hazardous fluids.

Recommendation:

- 1. Inform public about appropriate methods and locations for disposal of automotive waste oil, paints and other hazardous fluids with the use of a flier and displays around town.**

Land Protection Strategies

Residential and commercial developments, with all of its associated land uses, are the biggest threats to a drinking water supply. Their contamination is slow and insidious, often overlooked until a crisis is thrust upon the community, usually requiring a lot of money that no one has to fix. As is expressed in Worthington's Community Development Plan (2004), residents of Worthington value their rural landscape for the many benefits it provides including wildlife habitat, aquifer recharge, farmland, and aesthetic beauty. It is critically important that town officials discuss alternatives to development with landowners to preserve open space in Worthington. Table 5 provides a list of programs used to protect open space and how they operate.

Land Acquisition for Future Water Sources and Well Siting

The Worthington Source Water Protection Committee expressed a concern with the siting and acquiring land for future drinking water resources. A future study to determine the availability and siting of new water supplies is desired by members of the committee.

Recommendations:

1. Conduct outreach to landowners about options for protecting open space within the IWPA and Zone II.
2. Conduct a drinking water resource study to determine the site for future drinking water resources.
3. Town may take proactive steps to acquire land through the adoption of the Community Preservation Act.
4. Acquire available funds for land purchase and all other implementation strategies using the Worthington Source Water Protection Plan as water resource management tool required by the Commonwealth Capital funding process.



Worthington Fire District Wellhead Area

Table 5: Strategies for Protecting Open Space

	CHAPTER 61	CHAPTER 61A	CHAPTER 61B
<i>PURPOSE</i>	Tax incentive for long-term management of woodland for wood production.	Tax incentive for active agricultural or horticultural uses.	Tax incentive for land in natural, wild, open or landscaped use; or an approved recreational use.
<i>ELIGIBILITY</i>	Minimum of 10 contiguous acres. A continuous commitment to improving the ‘quality and quantity’ of timber crops on woodlands. Forest management plan approved by state forester.	Minimum of 5 acres “actively devoted” to agricultural and/or horticultural uses at least 2 years prior to classification. Minimum annual gross sales of \$500. Additional contiguous land may also qualify.	Minimum of 5 acres in open space or recreational uses.
<i>TAX ASSESSMENT</i>	Assessed at 5% fair market value, at commercial rate, plus 8% stumpage value of products harvested in prior year.	Assessed at agricultural/horticultural “use” value, at commercial rate. Values assigned by Board of Assessors and may change annually.	Assessed at maximum value of 25% fair market value, at commercial rate.
<i>HOW TO ENROLL</i>	Application package filed with State Forester by June 30. Approved application package submitted to Board of Assessors by August 31. Application good for 10 years.	Annual application filed with Board of Assessors by October 1.	
<i>ENROLLMENT PERIOD</i>	Enrolled until withdrawn from classification and withdrawal penalty paid. Forest management plan updated every 10 years.	Enrolled until sold for or converted to another use, and either conveyance tax or roll-back tax paid. Annual filing with Board of Assessors. Forest management plan updated every 10 years on acres classified as “productive woodlands”.	Enrolled until sold for or converted to another use, and either conveyance tax or roll-back tax paid. Annual filing with Board of Assessors.
<i>WITHDRAWAL OR CHANGE OF USE PENALTY</i>	Penalty payment depends on number of years in the program, and is difference between taxes paid under Chapter 61 and what would have been paid if not classified, plus interest. Annual forest products tax credit may or may not be applied to withdrawal penalty,	Conveyance or roll-back tax imposed, but not both. Conveyance tax rate applied when land sold for a non-qualifying use, decreasing from 10% to 1% over first 10 years of ownership. Roll-back tax is difference between taxes paid under Chapter 61A and what would have been paid if not classified, with no interest. Roll-back tax imposed for 5 prior years.	Conveyance or roll-back tax imposed, but not both. Conveyance tax rate applied when land sold for a non-qualifying use, and is 10% for first five years of ownership and 5% for second 5 years. Roll-back tax is difference between taxes paid under Chapter 61B and what would have been paid if not classified, plus interest. Roll-back tax imposed for 10 prior years.
<i>TOWN’S RIGHT OF FIRST REFUSAL</i>	Town has first right of refusal when land sold or converted to residential, commercial, or industrial use. Option lasts for 120 days unless waived. Exception allowed for residential use by family member.		

	CONSERVATION RESTRICTION	AGRICULTURAL PRESERVATION RESTRICTION	ESTATE PLANNING
<i>PURPOSE</i>	To limit the use of land in order to protect specified conservation values including the natural, scenic, or open condition of the land.	To permanently protect farmland by paying landowners the difference between “fair market value” and the “agricultural value” of their land in exchange for a permanent deed restriction which precludes any use of the land that will have a negative impact on its agricultural viability.	To protect your land in a way that makes good financial sense for you and your family.
<i>ELIGIBILITY</i>	Conservation Restriction must demonstrate public benefit	Farm must be at least five acres in size; devoted to agriculture for the two immediately preceding tax years; at least \$500 gross sales per year; soil suitability for agriculture; degree of threat to the continuation of agriculture; potential economic viability of agriculture at that site; and, proximity to other APR lands.	Decisions to protect land require careful consideration of the special features of your property, your land conservation goals, your financial situation, and your family’s needs and wishes.
<i>TAX ASSESSMENT</i>	Tax assessment varies by town and by the type of restriction. Call the Town Assessor for details on tax abatement.	The land is eligible for farmland tax assessment under Chapter 61A, and under the APR program, it will continue to be eligible as long as it is “actively devoted” to agriculture. The landowner should apply to the local assessor each year prior to October 1 and the tax will be based on the current farm use. Dwellings and their lots and farm buildings will continue to be taxed as other real estate.	Federal estate taxes can be as high as 55% of a property’s fair market value. The following options provide tax relief: outright land donation, donation of undivided partial interests, donation of land by will, donation of remainder interest in land with reserved life estate, bargain sale of land to a land trust or conservation agency, lease, and mutual covenant. Conservation restrictions are also appropriate estate planning tools.
<i>HOW TO ENROLL</i>	Conservation restrictions must be submitted according to the written procedures of and approved by the Secretary of Environmental Affairs.	Once a completed application is received by the Dept. of Food and Agriculture, it is reviewed and a field inspection is completed within 1 to 2 months. Applications reviewed on a rolling basis. Priorities are established based upon above eligibility requirements. Timing of acquisition depends on availability of funds.	Because land conservation is a technical area of the law and because your decisions can have significant consequences, it is important to seek out advisors who are experienced in this field. Consult one of the listed resources below, a local land trust, tax accountant, or lawyer with appropriate experience.
<i>ENROLLMENT PERIOD</i>	Allowed for a period of years written into the restriction or in perpetuity. Less than perpetual restrictions will be approved only where demonstrated critical public interest exists.	In perpetuity	N/A

	CONSERVATION RESTRICTION	AGRICULTURAL PRESERVATION RESTRICTION	ESTATE PLANNING
<i>WITHDRAWAL OR CHANGE OF USE PENALTY</i>	Withdrawal or change of use is very difficult. Conservation Restrictions should only be considered if they are to be in perpetuity or for a designated term written into the easement. There can be serious tax penalties for withdrawal from a conservation restriction.	Releasing an APR is very difficult and requires three steps: the Commissioner of the Dept. of Food and Agriculture must determine the land is no longer fit for agriculture, a 2/3 vote of the state legislature must approve the release (MGL Article 97), and landowner must reimburse the State for the value of the APR at today's value. A change in use other than stated in the APR also requires a 2/3 vote of the state legislature.	N/A
<i>TOWN'S RIGHT OF FIRST REFUSAL</i>	N/A	N/A	N/A
<i>FOR MORE INFORMATION</i>	MA Executive Office of Environmental Affairs Division of Conservation Services 617-626-1012	MA Dept. of Food and Agriculture 617-626-1700	Valley Land Fund 413-585-8513; Preserving Family Lands by Stephen J. Small available from Landowner Planning Center, PO Box 4508, Boston, MA 02101-4508

Public Education and Outreach

Public education and outreach are some of the most important actions a community can take to protect their water supply. Much of the information presented throughout the Source Water Protection Plan is simply not known by all homeowners. This information needs to be passed on to the public so that they can engage in best management practices for protecting Worthington's public and private water supplies.

On January 31, 2005, the Worthington Source Water Committee held a workshop for the residents of Worthington to help them understand how to best protect their drinking water supplies. Speakers at the workshop included the operator of the Worthington Fire District, the western regional SWAP coordinator, Town Board members and MRWA.

Table 5 lists some websites that contain further information about best management practices for homeowners.

Table 6: Internet Reference Sites for Educational Material

State of Massachusetts Community Recycling Information-Earth 911	http://massachusetts.earth911.org
Household Hazardous Waste Links Massachusetts	www.state.ma.us/dep/recycle/hazards/hhwhome.htm
EPA Recycling and Waste Homepage	http://www.epa.gov/epaoswer/osw/
Hazardous Waste Publications	http://www.epa.gov/epaoswer/non-hw/muncpl/hhwpubs.htm
Car Oil Recycling	www.recycleoil.org
Disposal and Management of Leftover Paint	http://www.paint.org/con_info/leftover.cfm
Non-Toxic Cleaning in the Home	http://www.ns-products.com/nontox.htm
Recycling Grass Clippings and Composting	http://www.state.ma.us/dep/consumer
Non-Point Source Information for Kids	http://www.epa.gov/owowwtr1/NPS/kids/whatwrng.htm

Residential Private Well Recommendations

Well Testing

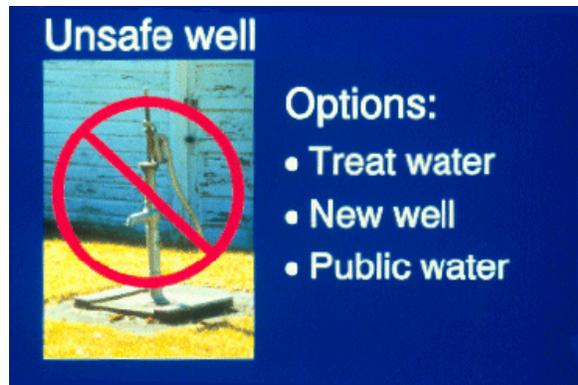
The Worthington Source Water Protection Committee deemed it important to address protecting residential private wells in the Worthington Source Water Protection Plan. Please see **Appendix C: Private Well Testing Information** for the flyer put out by the MA DEP in collaboration with the EPA and Massachusetts Health Board (MAHB) for more information on the benefits of testing your private well for contaminants. Appendix C also contains information on frequently asked questions pertaining to certified testing laboratories for drinking water.

The link to commonly asked questions about finding a lab is <http://www.mass.gov/dep/bspt/wes/files/qalabjp.htm>. Western Regional labs certified to do potable water are listed below (it is recommended that the MA DEP website or office be consulted to receive any updates or changes to the list.. The Worthington Board of Health or a member of the Source Water Protection Committee should contact the labs to determine if group/community rates are available.

Berkshire Enviro-labs - (413) 243-1416
Spectrum Analytical - (413) 789-9018
Severn Trent Labs - (413) 572-4000

The test for private well water typically cost around:

Standard analysis + coliform bacteria + nitrate/nitrite ~ \$75-125
Radon + Gross Alpha ~ \$75
VOCs (including MTBE) ~ \$100-125



Road Salt Contamination

If a private well owner suspects their well has been contaminated by road salt, contact the Board of Health and request assistance. Officials can then contact the MassHighway Department to determine if a low-salt zone is necessary to alleviate the problem. If the home-owner has a medical problem exacerbated by the high salt content the owner may be eligible for state grants to site and drill a new well.

Recommendations:

1. **Test your private well for contaminants.**
2. **Institute a community-wide private well-testing program.**
3. **Determine if road salt is contaminating your well/ take appropriate action.**

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Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program. October 9, 2003. *Source Water Assessment and Protection (SWAP) Report for Worthington Fire District*

Massachusetts Department of Environmental Protection, December 1997, *Making Wellhead Protection Work in Massachusetts*.

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Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup. Assessed March 2005. Hazardous waste spills, Worthington, MA. Available at: <http://mass.gov/dep/bwsc/sites/report.htm>

Massachusetts Department of Environmental Protection. February 21, 2001. Sanitary Survey for the Worthington Fire District.

Massachusetts Geographic Information System. Assessed 2004-2005. Executive Office of Environmental Affairs, Commonwealth of Massachusetts.

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Town of Worthington. 1991. Water Supply Protection District. Section X – Worthington Town By-laws and Regulations. Available at: <http://www.worthington-ma.gov/towninfo.html>

Mount Grace Land Conservation Trust, Inc. 1990. Conservation and Land Use Planning with Massachusetts' Chapter 61 Laws.

Appendices

Appendix A: Worthington Bylaws / Recommended Bylaws

1. **Revise Water Supply Protection District to include language that protects the Zone II delineation and the Interim Wellhead Protection Area.**
2. **Include current and future maps depicting all Worthington's Zone II's and IWPA's in the revised bylaw.**
3. **Conduct outreach to the operators/owners of other public well sources to determine if they want to be protected by the Water Supply Protection District.**
4. **Adopt a "Right-of-first-refusal" Bylaw to ensure that the Water District is granted first bid on any property up for sale in the recharge area of the wellfield.**

SECTION X - WATER SUPPLY PROTECTION DISTRICT

A. Purpose of District

To promote the health, safety, and welfare of the community by protecting and preserving the surface and groundwater resources of the Town and the region from any use of land or buildings which may reduce the quality of its water sources.

B. Definitions

1. Aquifer: Geologic formation composed of rock or sand and gravel that contains significant amounts of potentially recoverable potable water.
2. Groundwater: All water found beneath the surface of the ground.
3. Hazardous Waste: A waste which is hazardous to human health or the environment. Hazardous wastes have been designated by the U.S. Environmental Protection Agency under 40 CFR 250 and the regulations of the Massachusetts Hazardous Waste Management Act (MGL Ch21C).
4. Impervious Surfaces: Materials or structures on or above the ground that do not allow precipitation to infiltrate the underlying soil.
5. Leachable Wastes: Waste materials including solid wastes, sludge and pesticide and fertilizer wastes capable of releasing waterborne contaminants to the environment.
6. Primary Aquifer Recharge Area: Areas which are underlain by surficial geologic deposits including glaciofluvial or lacustrine stratified drift deposits or alluvium or swamp deposits, and in which the prevailing direction of groundwater flow is toward the area of influence of public or private water supply wells.
7. Toxic or Hazardous Materials: Any material in whatever form which, because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any other substance or substances, constitutes a present or potential threat to human health or to water supplies or to the environment when improperly stored, treated, transported or improperly disposed into or on any land or water in this Town.

“Toxic or hazardous materials” shall mean material including but not limited to any material or substance controlled as being toxic or hazardous by the provisions of MGL Ch21 C or defined as a hazardous substance by Section 101(14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C & 9605), as amended.

8. Trucking Terminal: Business which services or repairs commercial trucks which are not owned by the business.
9. Watershed: Land lying adjacent to water courses and surface water bodies which create the catchment or drainage areas of such water courses and bodies.

C. Scope of Authority

The Water Supply Protection District is an overlay district and shall be superimposed on the other Districts established by this By-Law. All regulations of the Town of Worthington Zoning By-Law applicable to such underlying Districts shall remain in effect, except that where the Water Supply Protection District imposes additional regulations, such regulations shall prevail.

D. District Delineation

1. The Water Supply Protection District is herein established to include all lands within the Town of Worthington lying within the primary recharge areas of groundwater aquifers and watershed area of the Manhan Reservoir which now or may in the future provide public water supply. The map entitled “Water Supply Protection District”, Town of Worthington, on file with the Town Clerk, delineates the boundaries of the district.
2. Where the bounds delineated are in doubt or in dispute, the burden of proof shall be upon the owner(s) of the land in question to show where they should properly be located. At the request of the owner(s), the Town may engage a professional hydrogeologist to determine more accurately the location and extent of an aquifer or primary recharge area, and may charge the owner(s) for all or part of the cost of the investigation.

E. Prohibited Uses

1. Business and industrial uses, not agricultural, which manufacture, use, process, store, or dispose of hazardous materials or wastes as a principal activity, including but not limited to metal plating, chemical manufacturing, wood preserving, furniture stripping, dry cleaning, and auto body repair, or which involve on-site disposal or process wastewaters.
2. Trucking terminals, bus terminals, car washes, motor vehicle gasoline sales, automotive service and repair shops.
3. Solid waste landfills, dumps, auto recycling, junk and salvage yards, with the exception of the disposal of brush or stumps.
4. Underground storage and/or transmission of petroleum products excluding liquified petroleum gas, unless tanks and piping are double-lined in accordance with the latest State regulations.
5. Outdoor storage of salt, de-icing materials, pesticides or herbicides.
6. Dumping or disposal on the ground, in water bodies, or in residential septic systems of any toxic or hazardous material, including but not limited to septic system cleaners which contain toxic chemicals such as methylene chloride, and 1-1-1 trichloroethane, or other household hazardous wastes.

F. Restricted Uses

1. Excavation for removal of earth, sand, gravel and other soils shall not extend closer than five (5) feet above the annual high groundwater table. A monitoring well shall be installed by the property owner to verify groundwater elevations. This section shall not apply to excavations incidental to permitted uses, including but not limited to providing for the installation or maintenance of structural foundations, freshwater ponds, utility conduits or on-site sewage disposal.
 - a. Access road(s) to extractive operation sites shall include a gate or other secure mechanism to restrict public access to the site.
2. The use of sodium chloride for ice control shall be minimized, consistent with the public highway safety requirements.
3. Salt storage areas shall be covered and be located on a paved surface, with berms to prevent runoff from leaving the site.
4. Commercial fertilizers, pesticides, herbicides, or other leachable materials shall be used with all necessary precautions to minimize adverse impacts on surface and groundwater, and shall not result in groundwater concentrations exceeding Massachusetts Drinking Water Standards.
5. Above-ground storage tanks for oil, gasoline, or other petroleum products shall be placed in a building, in a concrete basement, or on a diked, impermeable surface sufficient to contain the volume of the tank plus 10% to prevent spills or leaks from reaching groundwater.
5. To the extent feasible, all new permanent manure pits and animal feed lots shall be designed to restrict infiltration, run-off or other movement of animal wastes or manure to the aquifer or surface water.

G. Drainage

For commercial and industrial use, to the extent feasible, run-off from impervious surfaces shall be recharged on the site by being diverted toward areas covered with vegetation for surface infiltration. Dry wells shall be used only where other methods are infeasible, and shall be preceded by oil, grease and sediment traps to facilitate removal of contamination. All recharge areas shall be permanently maintained in full working order by the owner(s).

H. Special Permit Uses

1. Uses allowed by Special Permit:

The following uses may be allowed by Special Permit obtained from the Planning Board:

 - a. Commercial and industrial uses which are allowed in the underlying District;
 - b. Any enlargement, intensification or alteration of an existing commercial or industrial use;
 - c. The rendering impervious of more than 20% of any single residential lot.

2. Requirements for Special Permit in the Water Supply Protection District:
The applicant shall file six (6) copies of the site plan prepared by a qualified professional with the Planning Board. The site plan shall at a minimum include the following information where pertinent:
 - a. A complete list of chemicals, pesticides, fuels and other potentially hazardous Materials to be used or stored on the premises in quantities greater than those associated with normal household use.
 - b. Those businesses using or storing such hazardous materials shall file a hazardous materials management plan with the Planning Board, Hazardous Materials Coordinator, Fire Chief, and Board of Health which shall include:
 1. Provisions to protect against the discharge of hazardous materials or wastes to the environment due to spillage, accidental damage, corrosion, leakage or vandalism, including spill containment and clean-up procedures.
 2. Provisions for indoor, secured storage of hazardous materials and wastes with impervious floor surfaces.
 3. Evidence of compliance with Regulation of the Massachusetts Hazardous Waste Management Act 310 CMR 30, including obtaining an EPA identification number from the MA Department of Environmental Quality Engineering.
 - c. Drainage recharge features and provisions to minimize loss of recharge.
 - d. Provisions to control soil erosion and sedimentation, soil compaction, and to prevent seepage from sewer pipes.
3. Additional Procedures for Special Permit in the Water Supply Protection District:
 - a. The Planning Board shall follow all Special Permit procedures contained in Section X and Section VIII.C.2.
 - b. The Planning Board may grant the required Special Permit only upon finding that the proposed use meets the following standards and those specified in Section X and Section VIII.C.2. of this By-Law. The proposed use must:
 1. In no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the Water Supply Protection District and;
 2. Be designed to avoid substantial disturbance of the soils, topography, drainage, vegetation, and other water-related natural characteristics of the site to be developed.
 3. The Planning Board shall not grant a Special Permit under this Section unless the petitioner's application materials include, in the Board's opinion, sufficiently detailed, definite and credible information to support positive findings in relation to the standards of Section VIII.C.2. and Section X.

I Non-Conforming Use

Non-Conforming uses which were lawfully existing, begun or in receipt of a Building or Special Permit prior to the first publication of notice of public hearing for this By-Law may be continued. Such nonconforming uses may be extended or altered, as specified in MGL Ch40s6, provided that there is a finding by the Planning Board that such change does not increase the danger of surface or groundwater pollution from such use.

Private Well Regulation for the Town of Worthington

Worthington Board of Health
Town of Worthington, MA
Adopted April 10, 1990

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I. A. Purpose

It is the purpose of these regulations to protect the public health, safety and welfare by ensuring housing units with no access to public water supplies the supply of safe drinking water from private wells and to provide for the protection of the town's groundwater resources.

B. Authority

These regulations shall be effective on and after May 1st, 1990, and so remain until modified or amended by the Board of Health.

They are enacted by the Board of Health under the authority which includes but is not limited to one or more of the following: MassGeneral Laws, Chapter 111, sections 31, 122, 122A, 127, 143, 155, 187, 188; Code of Mass. Regulations (CMR) 11.02, and Mass. General Law Chapter 40, Section 54.

Any and all previous regulations concerning private wells are hereby repealed.

II. Definitions

Abandoned Well: A private well that meets any of the following criteria:

- (1) construction was terminated prior to completion of the well,
- (2) the well owner declares that the use of the well has been permanently discontinued,
- (3) the well is in such a state of disrepair that its continued use is impractical or represents a physical threat,
- (4) the well has the potential for transmitting contaminants into the aquifer and the situation cannot be corrected.

Board or Board of Health: The Board of Health of the town or its authorized agent.

Certified Laboratory: Any laboratory which has full certification by the Department of Environmental Protection as provided in the most recent edition of "Certification Status of Commercial Environmental Laboratories."

Private Well: Any non-public well, serving less than 15 houses and serving fewer than 25 people as defined in 310 CMR 22.02.

Well: A bored, drilled or driven well or a dug hole with a depth greater than its largest surface dimension, or any other source of water.

Well Driller: Any person, association, partnership, company, or corporation that constructs wells and is registered with the Division of Water Resources of the Department of Environmental Management in compliance with the Well Diggers and Drillers Registration, 313 CMR 3.00 (7/13/89).

Water Supply Certificate: A certificate issued by the Board of Health which authorizes the use of a private well as a water supply.

III. Standards for the Location, Construction, Decommissioning, Water Quality and Water Quantity

A. Location of Wells

1) In establishing the location of a well, actual or possible sources of contamination which exist or are proposed to exist within two hundred (200) feet of the proposed well sits need to be identified. Private wells shall be located to avoid all potential sources of contamination.

The following minimum lateral distances shall apply for each listed source of contamination:

<u>Source of Contamination</u>	<u>Minimum Lateral Distances</u>
Subsurface sewage disposal field (in use, abandoned, or reserve area)	150 feet
Cesspool, seepage pit	150 feet
Septic tank	50 feet
Municipal Sewer lines (water tight joints)	25 feet
Property line	30 feet
Public way	50 feet
Driveways	20 feet
Underground fuel storage tanks	200 feet
Utility Rights-of-Way	100 feet
Stables, barnyards, manure piles, manure storage tanks, feedlots	150 feet

2) Where deemed necessary or appropriate by the Board of Health, the above distances may be increased, or reasonable means of protection may be required or both. The Board may impose minimum lateral distance requirements from other potential sources of contamination not listed above. All such special requirements shall be added by the Board as conditions of the well construction permit.

3) The aforesaid notwithstanding no one shall locate, drill or dig a well or cause the same to be done in such a manner as to limit the use or enjoyment of any neighboring property.

B. Well Construction Standards

1) All wells shall be constructed by a registered well driller. A copy of the well driller's Certificate of Registration must accompany application for a permit.

2) All wells shall be constructed in compliance with the sections of the "Private Well Guidelines" of the Department of Environmental Protection's Division of Water Supply, October 30, 1989, that apply to well construction and well decommissioning (pages 22 through 67; and pages 92 to 101) They constitute part of these regulations and are incorporated herein by reference.

3) Well Drillers need to certify in writing that they have complied with the "Private Well Guidelines" as specified above in order to receive the Water Supply Certificate.

C. Well Decommissioning Standards

- 1) A well that is abandoned shall be decommissioned (destroyed) to protect the groundwater supply and to eliminate potential physical hazards.
- 2) All abandoned wells shall be decommissioned in compliance with the “Private Well Guidelines” (10/30/90) (pages 92—101) which constitute part of these regulations and are incorporated herein by reference.
- 3) Well Drillers need to certify in writing that they have complied with the “Private Well Guidelines” in decommissioning the well

D. Water Quality Standards

- 1) No private well shall be used as a water supply and no building permit shall be issued for new construction on the property where the well is located, unless and until the water derived from the well has been tested.
- 2) Chemical and bacteriological analyses shall be conducted by a certified laboratory and shall meet the following minimum standards:

Coliform bacteria	none detected
Sodium (Na)	20 mg/l
Chloride (Cl)	250 mg/l
Nitrate/Nitrogen (N)	10 mg/l
Nitrite/Nitrogen	0.001 mg/i

In addition the following water quality tests and standards will be required to be conducted for the informational benefit of the landowner.

Total Dissolved Solids	500 mg/i
Iron (Fe)	0.3 mg/i
Manganese (Mn)	0.05 mg/l
pH	6.5-8.5
Total hardness	180 mg/i

- 3) Additional or repeated tests may be required by the Board where, in the opinion of the Board, it is necessary for the protection of the public health, safety and welfare.

E. Water Quantity Standards

- 1) Yield test pumping shall be conducted at a rate at least equal to the pumping rate expected during normal well use and shall be conducted for a minimum of four hours.
- 2) The required minimum well yield will vary depending on the depth of the well. The minimum well yield shall conform to the following table:

<u>Depths of water in Well</u>	<u>Gallons /minute for 4 hrs.</u>
0 — 150 feet	4
150 — 200 feet	3
200— 250 feet	2
250 — 300 feet	1
300 and deeper	1/2

In no instance shall the well be permitted to yield less than the amount of gallons per day arrived at by applying the following formula:

(if of bedrooms +1) x 110 gallons x (safety factor of 2) = minimum gallons/day according to DEP Guidelines.

IV. Procedures for Obtaining a Water Supply Certificate and a Well Decommissioning Permit

A. Water Supply Certificate Procedures

1) Well Construction Permit Application

a. An application for a well construction permit shall be submitted by the property owner or his/her designated agent to the Board of Health on a form provided by the Board of Health.

b. The Tax Map and Parcel Number, the location of the proposed well to be constructed and a general written summary of any possible sources of contamination within 200 (see III,A,1) feet shall be submitted to the Board of Health with the permit application.

c. Fee: New—\$35, abandoned—\$15.

d. The application for a well construction permit shall be accompanied by an extended plot plan produced by a Civil or Sanitary Engineer or a Regional Sanitarian which will show distances less than 200 feet from the proposed well site to the following:

- (1) Existing and proposed structures
- (2) Subsurface waters and subsurface drainage courses
- (3) subsurface sewage disposal fields, trenches, or pits and adjoining septic tanks or cesspools
- (4) subsurface fuel storage tanks
- (5) other potential sources of pollution an experienced well driller should reasonably be expected to recognize
- (6) Property lines
- (7) Public ways

For new construction, the plan submitted to comply with Title V requirements will be acceptable for this purpose if it includes the above data for the well.

e. The Board of Health shall charge a fee for a well construction permit to be set by the Board. The fee has to be paid when the application is filed with the Board.

f. Well construction may proceed upon approval of a permit application in the form of a well construction permit issued by the Board.

g. All permits for well construction and decommissioning shall expire at the end of twelve months (12 months) from the date of issuance. Permits may be extended for an additional six months (6 months) if a written request is received by the Board of Health prior to the expiration date. No additional fee shall be charged for an extension, provided there is no change in the plans for the proposed well.

After a permit has expired, a new application and a new fee must be submitted to the Board.

2) Water Supply Certificate

a. The following shall be submitted to the Board of Health to obtain a water supply certificate:

(1) A well construction permit

(2) A copy of the Water Well completion Report as required by the Division of Water Resources/Dept. of Environmental Management to be provided by the well driller within 30 days from completion of the well (see CMR 313,section 3.00)

(3) Water Testing Results

Water samples for analysis shall be collected by an agent of the Board, following well development and disinfection and be submitted for testing to a State certified testing lab.

(4) Certificate of Construction by the well driller that s/be has complied with Department of Environmental Protection's "Private Well Guidelines" sections pertaining to well construction and that are part of these regulations (see III B. 2)

(5) Water Quantity Certification statement from the well driller that the minimum yield has been met.

b. Upon receipt of all the above documents the Board of Health shall determine whether the water supply meets all the water quantity and water quality requirements for private water applies in the town.

(1) Upon an affirmative determination, the Board of Health shall issue a water supply certificate.

(2) Upon a negative determination, or if the Board deems it necessary to protect the public health, safety and welfare, the Board shall issue a water supply disapproval letter which requires additional water quality analysis, or quantity testing or both.

(3) The Board may, at its discretion, issue a conditional water supply certificate. A conditional certificate shall set forth the conditions which the Board deems necessary to ensure fitness, purity and quantity of the water derived from that well. This may include but not be limited to requiring treatment of the water or regular testing.

B. Well Decommissioning Procedures

- 1) The Board encourages the owners of wells that are no longer used for supplying water to declare those wells abandoned and to have them decommissioned. Such action will minimize the risk of pollution of groundwater through abandoned wells and will protect the well owner from any future liability for such pollution. The well owner needs to declare in writing to the Board that the well will no longer be supplying water and is abandoned.
- 2) An application for a well decommissioning permit shall be submitted by the property owner together with the above statement to the Board of Health on a form provided by the Board prior to the destruction of the well.
- 3) No fee needs to be paid to the Board for filing the well destruction permit application.
- 4) The Board will then issue a well decommission permit.
- 5) After the well has been decommissioned, the well driller shall file a report with the Board stating that he has complied with the sections of the “Private Well Guidelines” of the Dept. of Environmental Protection that pertain to well decommissioning and that are part of these regulations.

V. Change of Ownership or Use

Prior to a change in ownership or use, all wells must have their water tested as required in. Proof of water quality testing and a copy of the report(s) must be submitted to the board of health or their agent, as well as to the purchaser, no later than 30 days before a change of ownership of a well, or a change in use.

VI. Administration and Enforcement

A. General Enforcement

The Provisions of Title I of the State Environmental Code (310 CMR, 11.00) shall govern the enforcement of these regulations.

B. Separate Violations

Each day’s failure to comply with any provisions of these regulations shall constitute a separate violation. Each numbered or lettered section or subsection of these regulations violated shall constitute a separate violation.

C. Severability

If any paragraph, section, clause, provision, phrase or work of these regulations shall be adjudged not valid, the adjudication shall apply only to the material so adjudged and the remainder of these regulations shall be deemed to remain valid and effective.

D. Amendments

These regulations or any portions thereof may be amended, supplemented or repealed from time to time by the Board, with notice as provided by law, on its own motion or by petition.

E. Invalidation by State Law

Any part of these regulations subsequently invalidated by a new state law or modification of an existing state law shall automatically be brought into conformity with the new or amended law and shall be deemed to be effective immediately, without recourse to a public hearing and the customary procedures for amendment or repeal of such regulation.

F. Variance

1) The Board of Health may vary the application of any provision of those regulations with respect to any particular case when, in the Board's opinion, both of the following conditions are fulfilled:

a. The enforcement thereof would do manifest injustice.

b. The applicant has proven that the same degree of environmental protection, and protection of the public health, safety and welfare can be achieved without strict application of the particular provision. The alternative means of protection shall be detailed and documented by the applicant to the satisfaction of the Board.

2) Every request for a variance shall be made in writing and shall state the specific variance sought and the reasons therefore.

3) Any variance granted by the Board shall be in writing. Any denial of a variance shall also be in writing and shall contain a brief statement of the reasons for denial. A copy of each variance shall be conspicuously posted for thirty (30) days following its issuance and shall be available to the public at all reasonable hours. No work shall be done under any variance until 30 days elapse from its issuance, unless the Board certifies in writing that an emergency exists.

4) Any variance may be subject to such qualification, revocation, suspension, condition, or expiration as is provided in these regulations or as the Board expresses in its grant of the variance.

A variance may otherwise be revoked, modified or suspended, in whole or in part, only after the holder thereof has been notified in writing and has been given an opportunity to be heard, in conformity with the requirements of Title 1 of the State Environmental Code (CHR 310, 11.00) for orders and hearings.

G. Penalty

Whoever violates any of these rules and regulations shall upon conviction be fined not less than 10 dollars (\$10) and no more than three hundred dollars (\$300) except when otherwise provided by law.

TOWN OF WORTHINGTON

BOARD OF HEALTH

Worthington, Massachusetts 01098



No. _____

Well Construction Permit Application

To dig or drill a well in town requires a well construction permit issued by the Board of Health in accordance with the Private Well Regulations and MGL Chapter 40, Sect. 54.

Date application received: _____ \$ Fee received _____

Applicant: _____ phone: _____

Address of Applicant: _____

Property Owner if different from applicant: _____

Well Driller: _____ Registration # _____

Name of Well Drilling Company: _____

Address of Company: _____

_____ Copy of Driller's Certificate of Registration attached

* * * * *

Location of proposed Well:

Lot identification/Parcel Number/Tax map number: _____

Street address of lot: _____

___ well for new building, ___ for existing building,

___ # of bedrooms, Use: ___ residential, other _____

Consulting Engineer or Sanitarian: _____

License # _____, ___ Civil Engineer, ___ Sanitary Engineer
___ Reg. Sanitarian

___ Map attached of the proposed well location that:

1. is an extended plot plan covering a radius of 200' around the proposed well,
2. identifies lateral distances of items 1 through 11 below
3. has been produced by a registered civil or sanitary engineer or a registered sanitarian.

(Plan submitted per Title 5 requirement will be acceptable if it incorporates the above)

please turn over

Model Floor Drain Regulation

1. Adopt a Floor Drain Regulation either as a General Bylaw or Board of Health Regulation.

Section I. PURPOSE OF REGULATION

Whereas:

- Floor drains in industrial and commercial facilities are often tied to a system leading to a leaching structure (e.g. dry well, cesspool, leach field) or a septic system; and
- Poor management practices and accidental and/or intentional discharges may lead petroleum and other toxic or hazardous materials into these drainage systems in facilities managing these products; and
- Improper maintenance or inappropriate use of these systems may allow the passage of contaminants or pollutants entering the drain to discharge from the leaching structure or septic system to the ground; and
- Discharges of hazardous wastes and other pollutants to floor drains leading to leaching structures and septic systems have repeatedly threatened surface and ground water quality throughout Massachusetts; and
- Surface and ground water resources in the Town of [town] contribute to the town's drinking water supplies; the Town of [town] adopts the following regulation, under its authority as specified in Section II, as a preventative measure for the purposes of:
- Preserving and protecting the Town of [town]'s drinking water resources from discharges of pollutants to the ground via floor drains, and
- Minimizing the threat of economic losses to the Town due to such discharges.

Section II. SCOPE OF AUTHORITY

The Town of [town] Board of Health adopts the following regulation pursuant to authorization granted by M.G.L. c.111 s.31 and s.122. The regulation shall apply, as specified herein, to all applicable facilities, **existing and new**, within the Town of [town].

Section III. DEFINITIONS

For the purposes of this regulation, the following words and phrases shall have the following meanings:

Commercial and Industrial Facility: A public or private establishment where the principal use is the supply, sale, and/or manufacture of services, products, or information, including but not limited to: manufacturing, processing, or other industrial operations; service or retail establishments; printing or publishing establishments; research and development facilities; small or large quantity generators of hazardous waste; laboratories; hospitals.

DEP: The Massachusetts Department of Environmental Protection.

Discharge: The accidental or intentional disposal, deposit, injection, dumping, spilling, leaking, incineration, or placing of toxic or hazardous material or waste upon or into any land or water so that such hazardous waste or any constituent thereof may enter the land or waters of the Commonwealth. Discharge includes, without limitation, leakage of such materials from failed or discarded containers or storage systems and disposal of such materials into any on-site leaching structure or sewage disposal system.

Floor Drain: An intended drainage point on a floor constructed to be otherwise impervious which serves as the point of entry into any subsurface drainage, treatment, disposal, containment, or other plumbing system.

Leaching Structure: Any subsurface structure through which a fluid that is introduced will pass and enter the environment, including, but not limited to, dry wells, leaching catch basins, cesspools, leach fields, and oil/water separators that are not water-tight.

Oil/Water Separator: A device designed and installed so as to separate and retain petroleum based oil or grease, flammable wastes as well as sand and particles from normal wastes while permitting normal sewage or liquid wastes to discharge into the drainage system by gravity. Other common names for such systems include MDC traps, gasoline and sand traps, grit and oil separators, grease traps, and interceptors.

Toxic or Hazardous Material: Any substance or mixture of physical, chemical, or infectious characteristics posing a significant, actual, or potential hazard to water supplies or other hazards to human health if such substance or mixture were discharged to land or water of the Town of [town]. Toxic or hazardous materials include, without limitation, synthetic organic chemicals, petroleum products, heavy metals, radioactive or infectious wastes, acids and alkalis, and all substances defined as Toxic or Hazardous under Massachusetts General Laws (MGL) Chapter 21C and 21E or Massachusetts Hazardous Waste regulations (310 CMR 30.000), and also include such products as solvents, thinners, and pesticides in quantities greater than normal household use.

Use of Toxic or Hazardous Material: The handling, generation, treatment, storage, or management of toxic or hazardous materials.

Section IV. PROHIBITIONS

With the exception of discharges that have received (or have applied and will receive) a Department issued permit prior to the effective date of this regulation, no floor drain(s) shall be allowed to discharge, with or without pretreatment (such as an oil/water separator), to the ground, a leaching structure, or septic system in any industrial or commercial facility if such floor drain is located in either:

- A. an industrial or commercial process area,
- B. a petroleum, toxic, or hazardous materials and/or waste storage area, or
- C. a leased facility without either A or B of this section, but in which the potential for a change of use of the property to a use which does have either A or B is, in the opinion of the Board of Health or its agent, sufficient to warrant the elimination of the ground discharge at the present.

Section V. REQUIREMENTS FOR EXISTING FACILITIES

A. The owner of a facility in operation prior to the effective date of this regulation with a prohibited (as defined under Section IV) floor drain system shall:

1. Disconnect and plug all applicable inlets to and outlets from (where possible) applicable leaching structures, oil/water separators, and/or septic systems;
2. Remove all existing sludge in oil/water separators, septic systems, and where accessible, leaching structures. Any sludge determined to be a hazardous waste shall be disposed of in accordance with state hazardous waste regulations (310 CMR 30.000). Remedial activity involving any excavation and/or soil or groundwater sampling must be performed in accordance with appropriate Department policies;
3. Alter the floor drain system so that the floor drain shall be either:
 - a. connected to a holding tank that meets all applicable requirements of Department policies and regulations, with hauling records submitted to the [town] Board of Health at the time of hauling;
 - b. connected to a municipal sanitary sewer line, if available, with all applicable Department and local permits; or
 - c. permanently sealed. {Any facility sealing a drain shall be required to submit for approval to the Board of Health a hazardous waste management plan detailing the means of collecting, storing, and disposing any hazardous waste generated by the facility, including any spill or other discharge of hazardous materials or wastes. }

{B. Any oil/water separator remaining in use shall be monitored weekly, cleaned not less than every 90 days, and restored to proper conditions after cleaning so as to ensure proper functioning. Records of the hauling of the removed contents of the separator shall be submitted to the Board of Health at the time of hauling.}

C. Compliance with all provisions of this regulation must be accomplished in a manner consistent with Massachusetts Plumbing, Building, and Fire code requirements.

D. Upon complying with one of the options listed under Section V.A.3., the owner/operator of the facility shall notify the Department of the closure of said system by filing the Department's UIC Notification Form {which may be obtained by calling 617/292-5770} with the Department, and sending a copy to the [town] Board of Health.

Section VI. EFFECTIVE DATES FOR ALL FACILITIES

The effective date of this regulation is the date posted on the front page of the regulation, which shall be identical to the date of adoption of the regulation.

A. Existing Facilities:

1. Owners/Operators of a facility affected by this regulation shall comply with all of its provisions within {120} days of the effective date;

2. All applicable discharges to the leaching structures and septic systems shall be discontinued immediately through temporary isolation or sealing of the floor drain.

B. New Facilities:

1. As of the effective date of the regulation, all new construction and/or applicable change of use within the Town of [town] shall comply with the provisions of this regulation.

2. Certification of conformance with the provisions of this regulation by the Board of Health shall be required prior to issuance of construction and occupancy permits.

{3. The use of any new oil/water separator shall comply with the same requirements as for existing systems, as specified above in Section V.B.}

Section VII. PENALTIES

Failure to comply with provisions of this regulation will result in the levy of fines of not less than \$ {200.00}, but no more than \$1000.00. Each day's failure to comply with the provisions of this regulation shall constitute a separate violation.

Note: Effective 1992, maximum fines for health violations increased. Under Chapter 111: Section 31 (violation of health regulation) maximum increased from \$500 to \$1000 and Section 122 (violation of nuisance regulations) maximum increased from \$100 to \$1000.

Section VIII. SEVERABILITY

Each provision of this regulation shall be construed as separate to the end that, if any provision, or sentence, clause or phrase thereof, shall be held invalid for any reason, the remainder of that section and all other sections shall continue in full force and effect.

Appendix B: Hazardous Waste Spills Town of Worthington

Release Tracking Number(RTN)	Release Address	Site Name/Location Aid	Reporting Category	Notification Date	Compliance Status	Date	Phase	RAO Class	Chemical Type	Release Tracking Number(RTN)
1-0014258	1131 HUNTINGTON RD	POLE 48/159	TWO HR	01/11/2002	RAO	03/12/2002		A1	Oil	1-0014258
1-0000314	HUNTINGTON RD	ALBERT FARMS	NONE	10/15/1987	DEPNDS	12/18/1995				1-0000314
1-0000431	JCT RTE 112 AND 143	THE CORNERS GROCERY	NONE	07/15/1988	RAO	08/07/1995		A2		1-0000431
1-0010672	244 KINNIE BROOK RD	RT 112 POLE #4	TWO HR	12/24/1994	RAO	02/01/1995		A1	Oil	1-0010672
1-0010114	24 OLD POST RD	RESIDENCE	72 HR	12/09/1993	RAO	06/30/1995		A2	Oil	1-0010114
1-0014569	R-O-W OFF OLD NORTH RD	POLE 46-24-5	TWO HR	09/11/2002	RAO	11/07/2002		A2		1-0014569
1-0010831	RTE 112	COUNTRY CRICKET INN	TWO HR	04/23/1995	RAO	03/14/1996		A2	Oil	1-0010831
1-0013241	RTE 112	INTERSECTION OF KINNEBROOK ROAD	TWO HR	12/15/1999	RAO	02/14/2000		A2		1-0013241
1-0013696	RTE 112	POLE 48/60	TWO HR	11/22/2000	RAO	01/19/2001		A1		1-0013696
1-0014282	SAM HILL RD AND W ST	RUPTURED TRANSFORMER AT INTERSECTION	TWO HR	02/02/2002	RAO	04/01/2002		A1		1-0014282
1-0012970	51 WILLIAMSBURG RD	NO LOCATION AID	72 HR	06/09/1999	RAO	09/22/1999		A2	Oil	1-0012970

Source: DEP Bureau of Waste Site Cleanup

* RAO – Response Action Outcome – A site/release where an RAO statement was submitted. An RAO statement asserts that response actions were sufficient to achieve a level of no significant risk or at least ensure that all substantial hazards were eliminated.

Appendix C: Private Well Testing Information

Protect Your Family Test Your Well's Water Quality Today

Private Wells

If you have a private well, then water quality testing should be important to you and your family. Some contaminants in drinking water have been linked to cancer and toxicity, posing a risk to human health. Many contaminants often have no taste, odor, or color. Their presence can only be determined by laboratory testing. While there is no state requirement to have your well water tested (although there may be from your mortgage lender or local Board of Health), the Massachusetts Department of Environmental Protection (DEP) recommends that all homeowners with private wells do so, and use a state certified laboratory.

Contamination of Wells

Well water originates as rain and snow that then filters into the ground. As it soaks through the soil, the water can dissolve materials that are present on or in the ground, becoming contaminated. Some contaminants are naturally occurring from features found in the rocks and soils of Massachusetts. These include substances like bacteria, radon, arsenic, uranium, and other minerals. Other contaminants find their way onto the land from human activities. On a large scale, industrial/commercial activities, improper waste disposal, road salting, and fuel spills can introduce hazardous substances to the ground.

However, even typical residential activities, such as the application of fertilizers and pesticides, fueling of lawn equipment, and disposal of household chemicals can contaminate the ground when done improperly. Even an on-site residential septic



system can pose a threat to your well. That is why taking measures to protect your well from contamination is so important.

When to Test

DEP recommends that prospective homebuyers test the water in a home with a private well before purchase. Water quality in wells is generally stable, and if a change is going to occur, it occurs slowly. Thus the interval between water quality tests, once you've purchased the home, can generally be in terms of years (see chart) if a well is properly constructed and located in a safe area. However, the following conditions would prompt more frequent testing:

- Heavily developed areas with land uses that handle hazardous chemicals.
- Recent well construction activities or repairs. DEP recommends taking a bacterial test after any well repair or pump or plumbing modification, but only after disinfection and substantial flushing of the water system.
- Contaminant concentrations above state or federal standards found in earlier testing.
- Noticeable variations in quality like a water quality change after a heavy rain, extended drought, or an unexplained change in a previously trouble-free well (i.e. funny taste, cloudy appearance, etc.).

When taking any sample, DEP recommends that it be taken after a heavy rainstorm. These events tend to highlight conditions of improper well construction or poor soil filtration.

Recommended Tests

The following tests provide only the most basic indicators of a well's water quality. These tests identify some of the common natural and man-made contaminants found in our state's well water. However, you should also consider nearby land uses to decide whether additional tests are appropriate for your well. *It is not necessary to do all of the tests at one time.*

Contaminants & Testing Frequency

Standard Analysis Testing

Frequency

Arsenic
Chloride
Copper
Fluoride
Hardness
Iron
Lead
Manganese
pH
Sodium

Coliform Bacteria

Nitrate/Nitrite

Radon

Gross Alpha Screen (bedrock wells only)

VOCs

Monitor initially for all contaminants, and then at a minimum of once every ten years (except for bacteria and nitrate/ nitrite which should be sampled yearly), or as otherwise required by the local Board of Health.

Standard Analysis

This basic analysis covers the most common contaminants. Some of these contaminants pose health-related concerns, while others only affect aesthetics (taste and odor).

Radon

Radon can be a well water problem in Massachusetts, especially in bedrock wells. Presently, there are no federal or state standards for radon in drinking water, only suggested action levels. [*Note: If Radon levels are elevated in your well water, you should also consider checking your indoor radon levels.*]

Gross Alpha Screen

Radioactive minerals, such as radium and uranium, may be dissolved in well water. A Gross Alpha Screen is a simple test to judge whether further testing for specific radioactive minerals such as radium or uranium might be needed.

Volatile Organic Compounds (VOCs)

The most common VOCs come from gasoline compounds (such as MtBE and benzene) and industrial solvents (such as TCE). MtBE can be found in well water even in remote areas.

Additional Tests

Circumstances relative to your well may require additional testing not described here. For instance, DEP does not recommend frequent testing for things like pesticides, herbicides, or synthetic organic compounds, mainly because of the high cost. However, testing might be warranted if your water has elevated nitrite/nitrate concentrations or significant amounts of pesticide have been applied near the well.

These less-routine tests may not be performed at all state certified laboratories.

What the Tests Tell You

Results will reveal the level at which any of the tested substances were found in your water sample. The mere presence of these contaminants in well water does not necessarily imply that there is a problem. However, when levels exceed state or federal health standards, you should take steps to correct the situation. Several methods are available from commercial contractors to treat contaminated water.

For More Information

As private wells in Massachusetts are regulated at the local level, you should first contact your local Board of Health for your town's private well testing requirements.

For more information about private wells including additional water quality testing recommendations, you should refer to the *DEP Private Well Guidelines*, which are available on the Drinking Water Program's Publication web page. Other information such as the listing of state certified laboratories can also be accessed through the web page.

For additional assistance contact the DEP Drinking Water Program at:

**Massachusetts Department of
Environmental Protection Drinking Water
Program**
1 Winter Street, 6th Floor
Boston, MA 02108
phone: 617-292-5770
www.mass.gov/dep

Private Drinking Water Testing and the Use of DEP-Certified Laboratories

Issued by the Senator William X. Wall Experiment Station and the Drinking Water Program

In response to frequently asked questions by homeowners, Boards of Health and licensed well drillers, the Massachusetts Department of Environmental Protection (DEP) provides the following guidance:

What is the difference between a laboratory that has DEP certification and a laboratory that does not?

DEP certification means that the laboratory has been deemed capable of producing valid data for tests of specified contaminants, such as nitrate, volatile organic compounds (VOC's), fecal coliform bacteria, etc. In order to obtain certification by DEP, the laboratory has demonstrated it is able to perform accurate testing using scientific methods which have been approved by the United States Environmental Protection Agency. A non-certified laboratory does not have to use any particular method in testing, is not regulated by any governmental agency, and, as a result, the test results might not meet standards for accuracy required of DEP-certified laboratories. DEP-certified laboratories in Massachusetts are periodically inspected by DEP; out-of-state laboratories with Massachusetts certification are inspected by their resident states. All certified laboratories must also successfully analyze proficiency test samples; these are special samples with concentrations known to the providers of the test samples, but not known to the laboratories.

If I use a certified laboratory, am I guaranteed to get accurate results?

Using a certified laboratory does not guarantee that your samples will be handled and analyzed properly or that your results will be accurate. Certification means that a laboratory's facilities, personnel, equipment, analytical methods and quality control procedures have been evaluated and found to meet the Department's minimum requirements. A certified laboratory has been deemed **capable** of producing valid data for tests of specified contaminants.

In general, for what chemicals or water quality parameters are there specified tests performed by DEP-certified laboratories?

There are specified tests for all primary drinking water contaminants, meaning those chemicals or water quality parameters for which EPA has identified a health risk from excessive exposure and for which EPA has set an MCL, or Maximum Contaminant Level. The MCL is the maximum concentration of a chemical allowed in public water supplies. Some primary contaminants are coliform bacteria and chemicals such as nitrite, nitrate, volatile organic compounds, lead, copper, arsenic, several pesticides and herbicides, and asbestos. Please note that MCLs have not been assigned to lead and copper; these metals have "action levels" and it is not a violation of regulations to exceed those levels.

There are also specified tests for some secondary contaminants, those contaminants which may present aesthetic problems but which are not generally regarded as a health risk. These water quality parameters include pH and total dissolved solids. Not all secondary contaminants have a specified test. Two very common metals in groundwater, iron and manganese, have no specified tests for determining their concentration in drinking water. This means there are no DEP certification procedures for iron and manganese in drinking water; however, the DEP recommends you use a laboratory certified in at least some other drinking water parameters even when sampling private well water for parameters for which there is no DEP certification.

As the owner of a private well, do I have to test my water?

The local Board of Health may have by-laws requiring testing of private wells. For example, some Boards of Health require testing to determine if a well meets drinking water standards prior to initial use for drinking water. Boards of Health have the authority to require testing of private wells at other times also. Check with the local Board of Health for the requirements. However, homeowners are strongly urged to have their well water tested at least once a year, whether or not their local Board of Health requires it. The Drinking Water Program has published Private Well Guidelines through its Publications page.

Do I have to use a DEP-certified laboratory to test private drinking water?

DEP recommends the use of DEP-certified laboratories for the testing of private drinking water. If the local Board of Health by-laws require that results of testing by a DEP certified laboratory be submitted to them, your report should be rejected if you do not use a DEP-certified laboratory. If you are a homeowner testing for your own purposes, you may use any laboratory you wish; however, since the results might not be reliable, DEP strongly encourages you to use a DEP-certified laboratory for any water quality analysis. If you are a licensed well driller and take the sample of the well water, you must check with the local Board of Health for their requirements. Even in the absence of local requirements, you are strongly urged to have the water analyzed by a laboratory with DEP-certification for drinking water parameters.

How can I find a certified laboratory?

You can access a list of DEP-certified laboratories through the Wall Experiment Station's Publications page. You can contact the Station for a copy of the most recent list.

What does the list of certified laboratories look like?

The official title of this list is "Certification Status of Environmental Laboratories Certified by Massachusetts DEP". You will first see a title page with the effective date of the list. (A new list will be approximately every two weeks and there can be changes from day to day).

The next page is a list of code numbers for the parameters for which there is a DEP certification. Parameters and their code numbers are listed in various groups: non-potable

water chemistry (e.g., sanitary waste discharges), potable water chemistry (drinking water), potable water radiochemistry, and potable water microbiology.

Next, is the list of laboratories alphabetized by laboratory name, followed by the list of laboratories alphabetized by the states and cities in which the laboratories are located; the two-letter postal codes are used for the states. On both alphabetized lists is the laboratory identification number, such as M-MA059. Use this ID number to find the laboratory in the pages of laboratory descriptions which have the laboratory's name, address and the codes for the water quality parameters for which the laboratory is certified to test. The laboratory descriptions are ordered by state. The Massachusetts section of the laboratory description list displays laboratories only certified for microbiology (with laboratory ID numbers such as M-12345), followed by the other Massachusetts laboratories.

How can I get the most recent certification status of a laboratory?

You can ask the laboratory to send you its most recent certified parameter list or you may contact the Wall Experiment Station.

What are some other tips on choosing a laboratory?

- Be aware that laboratories may sell water treatment products or services, or may be affiliated with other companies that do.
- Request price quotes from several DEP-certified laboratories, but do not select a laboratory on price alone.
- Consider sending a quality control sample to the laboratory in addition to your water sample(s). Quality control samples contain one or more compounds at known concentrations. When analyzing the quality control sample, the laboratory should produce a result that is within a statistically derived range of acceptable values. The National Institute of Standards and Technology (NIST), a federal government agency, publishes a list of vendors that may provide these samples for chemical analysis.
- Consider hiring an independent data quality consultant to review the results and raw data for at least some of your samples.

How can I be clear to a laboratory that I want them to use only USEPA-approved methods?

Laboratories may be certified by DEP in any one or more of 132 parameters, analytes or categories. Since a laboratory might not be certified in the tests required or recommended by your local Board of Health, you should put in writing in your contract with the laboratory that it must comply with the requirements of your town's Board of Health. Check the information on the second page of the list of certified laboratories to see if DEP offers certification for the analytes you are concerned about.

If you want your water tested by a certified laboratory even though you are not required to use a certified laboratory, make it clear to the laboratory that you want the test done using USEPA approved methods and according to the DEP's requirements for certified laboratories which are found in Massachusetts regulations at 310 CMR 42.00.

What if the laboratory I want to use isn't certified for everything I need?

Laboratories are allowed to subcontract to another certified laboratory but must indicate on your report that it has done so and give the DEP certification number of the subcontractor.

What if I used a laboratory which later has its DEP certification revoked?

A laboratory may have its certification revoked, in whole or in part, for a variety of reasons. Only in some cases does the DEP recommend retesting water samples. You can contact your local Board of Health or the Drinking Water Program, at the Regional office near you (Boston, Worcester, Springfield, or Lakeville) or the Boston office for recommendations.

Whom should I contact if I have a complaint about the laboratory I or the well driller used to test my water?

Your local Board of Health should be informed of complaints so that it can enforce its own by-laws, or, in the event the Board of Health has no requirements, that they may be made aware of the situation. Whether or not the local Board of Health requires use of DEP-certified laboratories, you should contact the DEP Laboratory Certification Program and discuss your complaints about the laboratory. The DEP becomes aware of certified laboratories that are not performing analyses properly or laboratories who are fraudulently claiming DEP certification through citizen complaints.

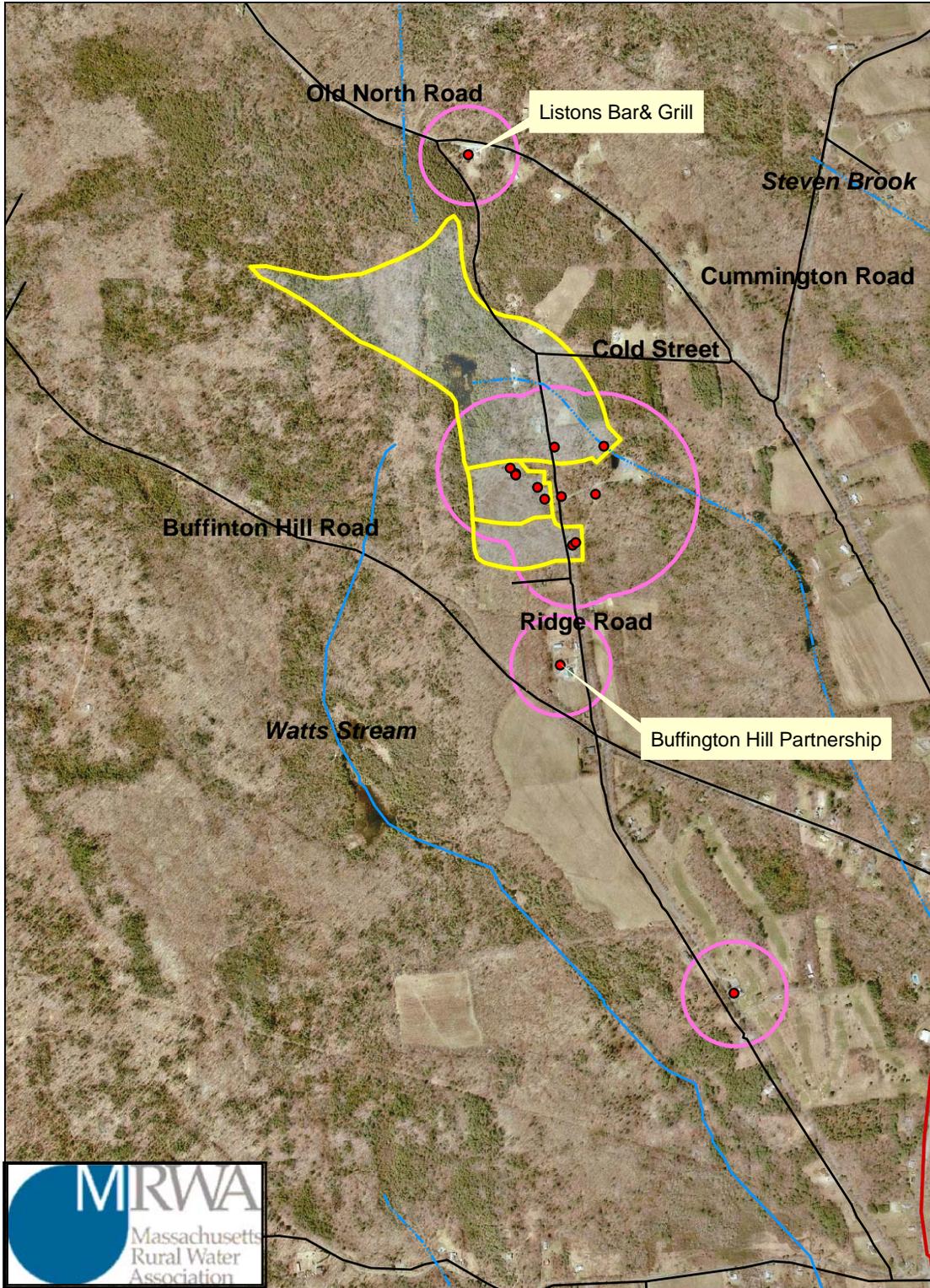
Complaints may also be investigated by these Massachusetts agencies:

- Office of the Attorney General: Consumer Complaint and Information Section
- Office of Consumer Affairs & Business Regulation.

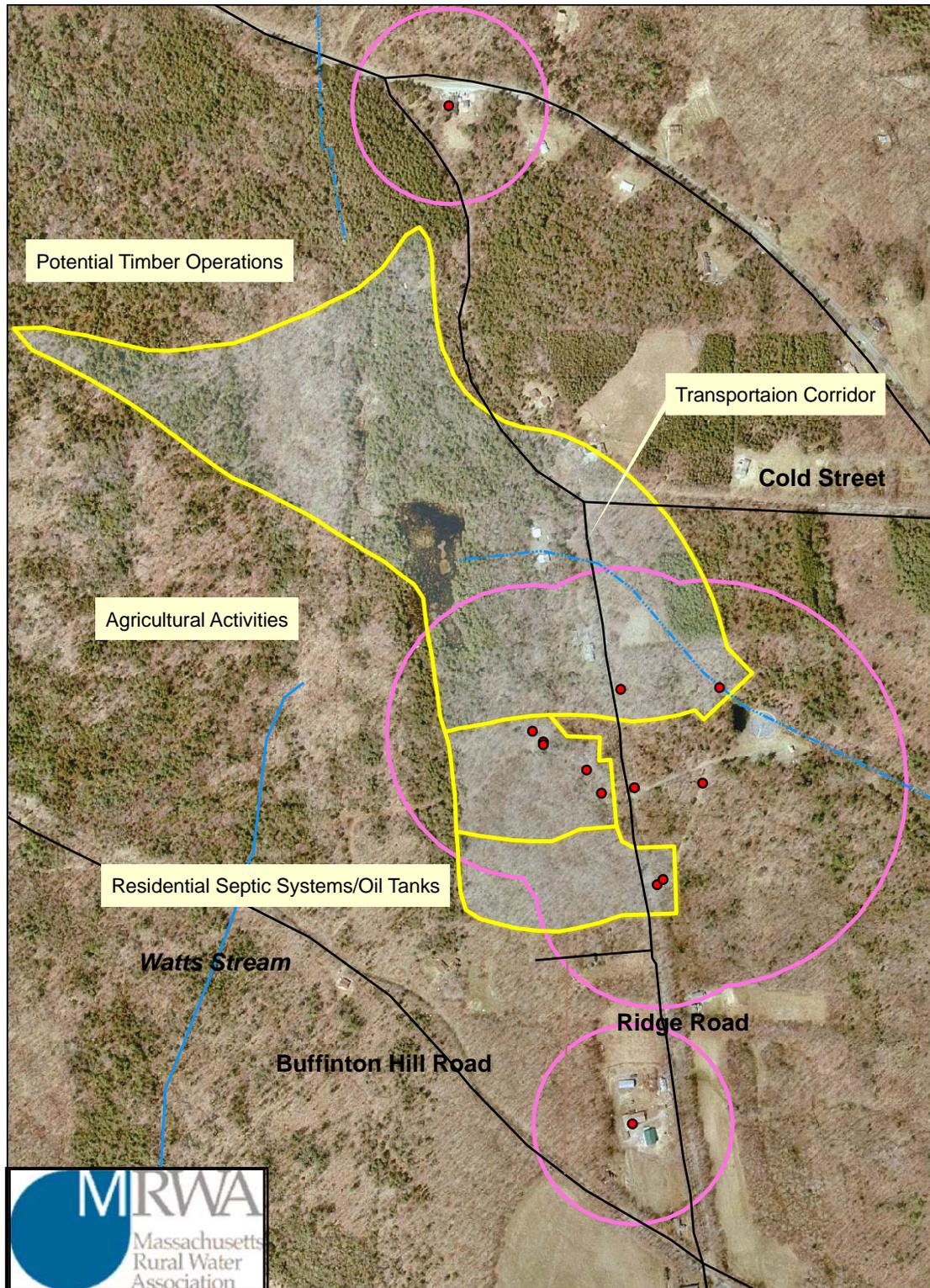
From whom may a Board of Health request assistance in developing regulations requiring water quality analyses or other questions regarding private wells?

For assistance with these and other questions regarding private wells, you may contact the **Drinking Water Program** at the regional DEP office for your town, or DEP headquarters in Boston. You may also visit the DEP Drinking Water Program's Web site at <http://www.mass.gov/dep>.

Worthington Fire District Zone II and IWPA's



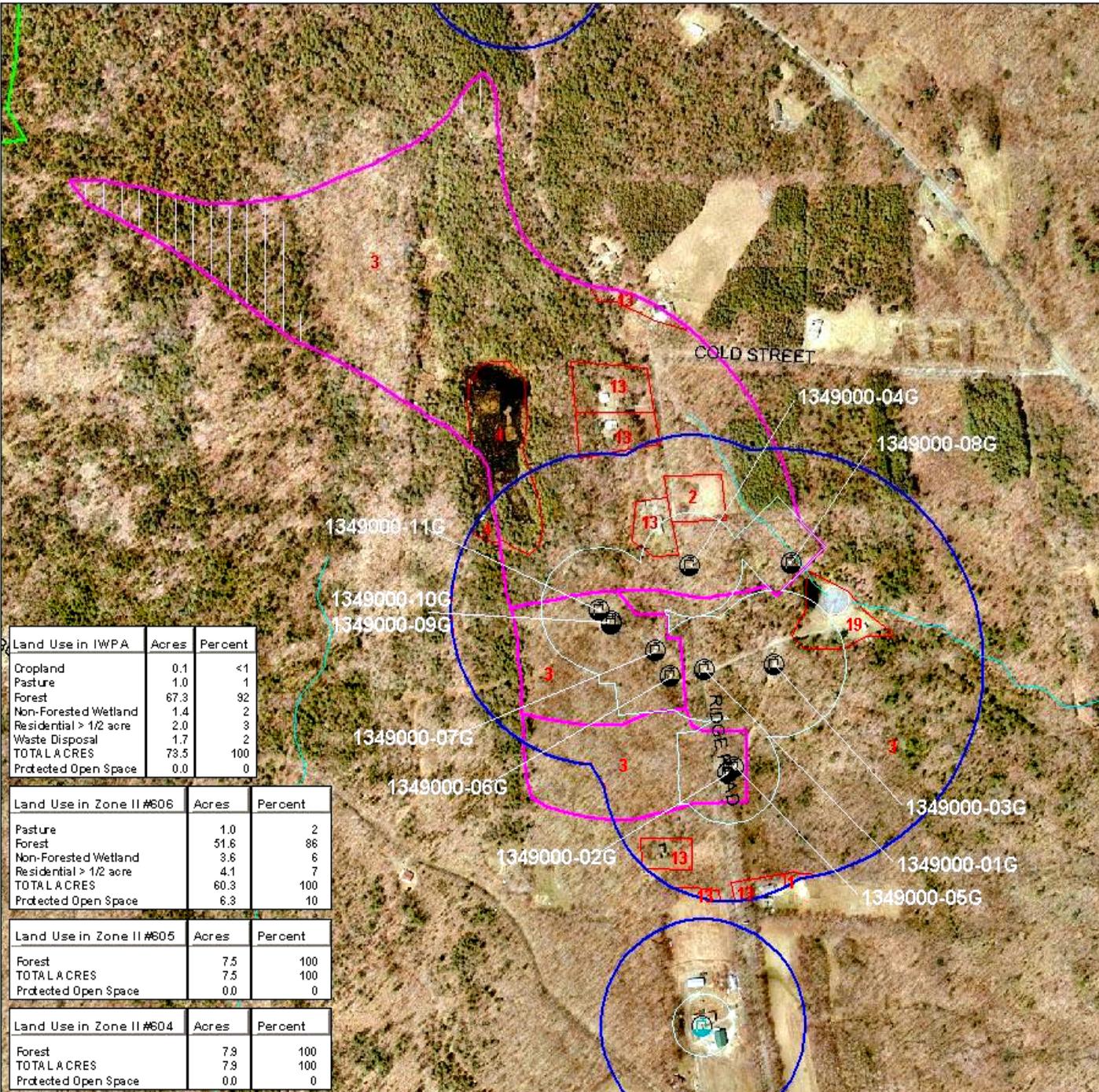
Potential Sources of Contamination



Worthington Fire District

WORTHINGTON

Source Water Assessment Program



Land Use in IWPA	Acres	Percent
Cropland	0.1	<1
Pasture	1.0	1
Forest	67.3	92
Non-Forested Wetland	1.4	2
Residential > 1/2 acre	2.0	3
Waste Disposal	1.7	2
TOTAL ACRES	73.5	100
Protected Open Space	0.0	0

Land Use in Zone II #606	Acres	Percent
Pasture	1.0	2
Forest	51.6	86
Non-Forested Wetland	3.6	6
Residential > 1/2 acre	4.1	7
TOTAL ACRES	60.3	100
Protected Open Space	6.3	10

Land Use in Zone II #605	Acres	Percent
Forest	7.5	100
TOTAL ACRES	7.5	100
Protected Open Space	0.0	0

Land Use in Zone II #604	Acres	Percent
Forest	7.9	100
TOTAL ACRES	7.9	100
Protected Open Space	0.0	0

LEGEND

MA Taxes

- MA Taxes
- TWPA
- Zone I
- Zone II
- Zone A
- Water Supply
- Watershed Boundary
- Solid Waste Landfill
- Protected Open Space

Rivers & Streams

- Streams
- Intermittent Streams
- Transmission Lines
- Railroads

Water Supplies

- Groundwater
- Surface Water
- Distribution Reservoir
- Non-Transmission/Non-Community
- Transmission/Non-Community

Ground Water Discharges

- Car Wash
- Industrial Discharge
- Landfills
- Other
- Restrooms (Cleanup)
- Sanitary Discharge
- Oilwell

DEP Tier Classified Oil or Hazardous Material Release Sites

- Commercial Site

NPDES Major Discharge Points

- NPDES Major Discharge

Land Use

- 1 Crop Land
- 2 Pasture
- 3 Forest
- 4 Non-Forested Wetland
- 5 Mining
- 6 Open Land
- 7 Pasture/Open Rec
- 8 Specular Rec
- 9 Water-based Rec
- 10 Multi-Use Rec
- 11 High Density Rec
- 12 Medium Density Rec
- 13 Low Density Rec
- 14 Solid Waste Wetland
- 15 Commercial
- 16 Industrial
- 17 Urban Open
- 18 Transmission
- 19 Waste Disposal
- 20 Water
- 21 Woody Perennial

Other

- Underground Storage Tanks
- Acute UST
- Bureau of Waste Prevention Regulated Facilities
- Facility with Groundwater Discharge Permit (GWD)
- Facility with Air Operating Permit (AOP)
- Large Quantity Toxic User (LQTU)
- Large Quantity Operator of Hazardous Waste (LQO)
- Hazardous Waste Treatment, Storage and/or Disposal Facility (TSDF)
- Hazardous Waste Recycle (HWR)

Data Sources

SOLID WASTE (SW) FACILITIES: MA DEP-DWP, 1:25,000. Includes only SW facilities regulated since 1971. SW facility boundaries were compiled from USGS quads and annotated by the DEP-Division of Solid Waste (DSW).

MA DEP APPROVED ZONE II MA DEP DWP, 1:25,000. As stated in 310 CMR 22.02, "the area of an aquifer which can draw water in a well under dynamic or steady pumping and recharge conditions can be substantially mapped." Zone II boundaries are annotated from source maps based on USGS 1:25,000 topographic maps. Zone II maps are provided by consultants in collaboration with DEP and are approved by DEP DWP prior to issuance. Zone II data is updated on an annual basis.

INTERMEDIATE WELLS PROTECTION AREAS (IWPA): MA DEP DWP, 1:25,000. Variable width IWPA's, top cover a public water supply (PWS) and its wellhead protection area (WHPA) is approved by DEP DWP. IWPA's are regulated using DEP's PWS standards and pumping rate of maximum provided by DEP DWP. IWPA width is calculated as TWPA radius x (2.3 pumping rate in gallons per minute) / 400, with a maximum radius of 1/2 mile (def. only) for emergency supplies. Non-Transmission/Non-Community (NTNC) supplies have a default TWPA radius of 750 feet, Transmission/Non-Community supplies (TNC) have a default TWPA radius of 500 feet. DEP DWP is not only the provider of increasing pumping rates for all sources with default TWPA radii. As pumping rates are increased, default radii are being replaced by calculated radii.

SURFACE WATER SUPPLY PROTECTION AREA (ZONE A): MA DEP DWP, 1:25,000. Zone A (regardless of the land use) is between the surface water source (SWS) and the upper boundary of the bank, b) the land area within a 400' lateral distance from the upper boundary of the bank of a Class A SWS, and c) the land area within a 200' lateral distance from the upper boundary of the bank of a tributary or associated surface water body. Zone A data is generated by buffering MassGIS 1:25,000 hydrography data according to the above criteria.

SURFACE WATER SUPPLY PROTECTION AREA (ZONE C): MA DEP DWP, 1:25,000. A Zone C top cover the land area not designated as Zone A or B within the watershed of a Class A surface water source, as defined in 314 CMR 4.05(2)(b). Zone C focus is generated by buffering MassGIS sub drainage channel polygons that contribute to a Class A surface water source.

HYDROGRAPHY: USGS/MapGIS, 1:25,000/1:100,000 (relocated). 1:25,000 hydro was generated using USGS 1:25,000 and 1:100,000 DCG data and enhanced with first work digitized from 1:25,000 USGS topographic quadrangles 1997. 1:100,000 hydro generated and modified from USGS 1:100,000 DCG data.

NONFORESTED WETLANDS: UMass Amherst Resource Mapping Project (RMP)/MapGIS, 1:25,000. Extracted from the 1971-1984 Land Use database which was processed by UMass RMP from 1:25,000 source CIR photography. Non-forested wetlands include non-forested freshwater wetlands and salt marshes. Forested wetlands, which make up the majority of Massachusetts wetlands, were not included.

TRAINS AND TRANSMISSIONS: USGS/MapGIS, 1:100,000. Generalized and modified USGS DCG data. Train updated by Cost of Transmission Planning (CTP).

POLITICAL BOUNDARIES: MapGIS/USGS, 1:25,000. Energy for the counties, this database was digitized by MapGIS from aerial USGS quads. The counties was taken from the USGS 1:100,000 hydrography DCG files.

PUBLIC WATER SUPPLIES (PWS): MA DEP DWP. Licensed by US EPA and DEP DWP using several methodologies, including DQPS, USGS topographic map interpretation and photo interpretation. This data is updated quarterly.

LAND USE: UMass Amherst Resource Mapping Project (RMP)/MapGIS, 1:25,000. 21 land use categories, photoregional from 1985-1990 source CIR aerial photography.

UNDERGROUND STORAGE TANKS (UST): US EPA MA DEP. Locations were compiled through collaboration of state and federal agencies. Available information from the MA Department of Public Safety's Division of Fire Prevention.

DISCHARGE TO GROUNDWATER PERMIT LOCATIONS: MA DEP Division of Water Pollution Control (DWPC). 1:25,000. Core discharge data from DEP-DWPC permit applications was compiled into USGS quads and digitized.

PROTECTED AND RECREATIONAL OPENSPACE (OS): MA SOGA MapGIS, 1:25,000. Current Federal, State, county, municipal, non-profit and private conservation land and recreational facilities. Boundaries of various are compiled by local volunteers and SOGA land holding agencies, coordinated and annotated by MapGIS. This database is not only under development and annually updated.

COLOR DIGITAL ORTHOPHOTO (COO) IMAGERY: SOGA MASSGIS, 1:5000. MapGIS 1:5000 COO images were collected at 0.5 acres base resolution. These images were stored the National Map Accuracy Standards (NMAS) in the coverage. 90% of the well defined features fall within 0.5 acres of their true position on the ground under normal viewing scale of 1:5000 (2.5 acres on the ground). Additionally, the maximum displacement of well defined features is less than 5 acres. The 0.5 acres base COO images were compiled into 1-acre resolution. Date of photography: April 2001.

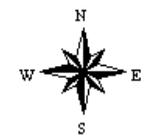
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) Program: Major discharge points generated into the National Pollutant Discharge Elimination system (NPDES). This report data has been quality controlled through field verification and is subject to revision. This is our only draft database.

DEP TIER CLASSIFIED CHAPTER 21E OIL OR HAZARDOUS MATERIAL RELEASE SITES (MOLERS): DEP DWP/USGS, 1:25,000. Two general tier source maps and several refinements from DEP DWP/USGS files. When the refinements were made, DEP updated the tier maps to reflect the tier changes through the changes generated in the course of tier performance reviews. A comparison was conducted using an aerial photography coverage incorporating digital 1:25,000 USGS topographic images and 1:5000 digital orthophoto images to base.

DEP SWP MAJOR FACILITIES: MA DEP, Bureau of Waste Prevention, surveys, site plans, lease maps, files and DEP records, GPS field verification, surveying and knowledge.

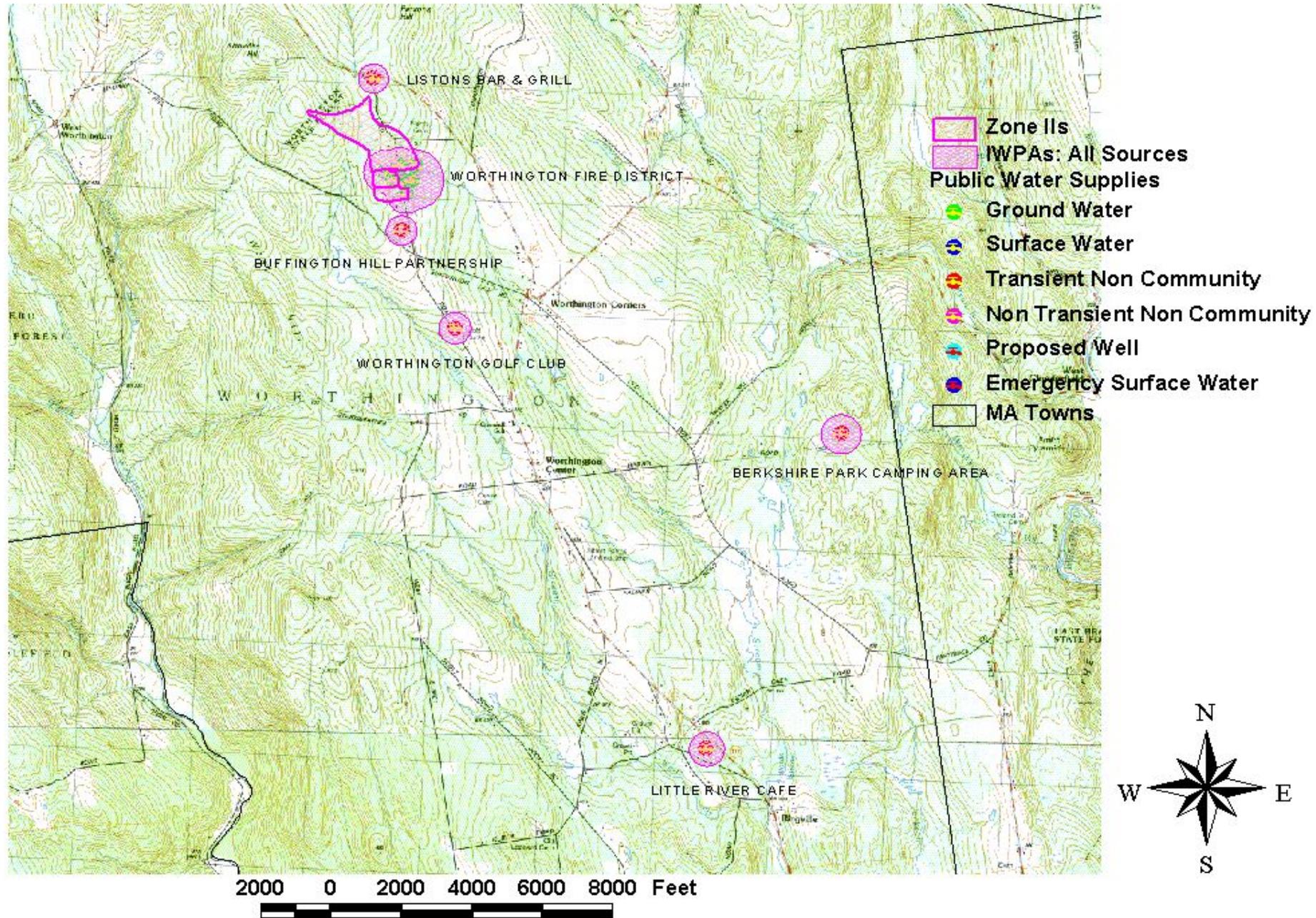
This map is for illustrative purposes only. It represents the best available source data for a given date. There is no warranty, expressed or implied, as to the accuracy or completeness of the data shown on this map because the digital spatial data is not exact. You have questions about any of the data shown on this map, please contact MapGIS at (617) 927-9227.

Map Scale 1:6000



Mitt Romney, Governor
Elen Roy Herzfelder, Secretary

Map of All Sources Public Water Supplies in Worthington, MA.



Resources



Massachusetts Department of Environmental Protection Source Water Assessment and Protection (SWAP) Report for Worthington Fire District

What is SWAP?

The Source Water Assessment Program (SWAP), established under the federal Safe Drinking Water Act, requires every state to:

- ? Inventory land uses within the recharge areas of all public water supply sources;
- ? Assess the susceptibility of drinking water sources to contamination from these land uses; and
- ? Publicize the results to provide support for improved protection.

SWAP and Water Quality

Susceptibility of a drinking water source does *not* imply poor water quality. Actual water quality is best reflected by the results of regular water tests.

Water suppliers protect drinking water by monitoring for more than 100 chemicals, treating water supplies, and using source protection measures to ensure that safe water is delivered to the tap.

Prepared by the
Massachusetts Department of
Environmental Protection,
Bureau of Resource Protection,
Drinking Water Program

Date Prepared:
October 9, 2003

Table 1: Public Water System (PWS) Information

<i>PWS Name</i>	Worthington Fire District
<i>PWS Address</i>	P.O. Box 1000, Division Street
<i>City/Town</i>	Worthington, Massachusetts
<i>PWS ID Number</i>	1349000
<i>Local Contact</i>	Mr. John Sullivan
<i>Phone Number</i>	413-238-5344

<i>Well Name</i>	<i>Source ID#</i>	<i>Zone I (in feet)</i>	<i>IWPA</i>	<i>Source Susceptibility</i>
Well #1	1349000-01G	217	533	Moderate
Well #2	1349000-02G	217	533	Moderate
Well #3	1349000-03G	301	889	Moderate
Well #4	1349000-04G	217	533	Moderate
Well #5	1349000-09G	165	460	Moderate
Well #6	1349000-10G	232	568	Moderate
Well #7	1349000-11G	255	640	Moderate
<i>Spring Name</i>		<i>Zone II GIS ID #</i>		
Spring #1	1349000-05G	291	604	Moderate
Spring #2	1349000-06G	291	605	Moderate
Spring #3	1349000-07G	291	605	Moderate
Spring #4	1349000-08G	291	606	Moderate

Introduction

We are all concerned about the quality of the water we drink. Groundwater sources may be threatened by many potential contaminant sources, including septic systems, road salting, and improper disposal of hazardous materials. Citizens and local officials can work together to better protect these drinking water sources.

Purpose of this report:

This report is a planning tool to support local and state efforts to improve water supply protection. By identifying land uses within water supply protection areas that may be potential contaminant sources, the assessment helps focus protection efforts on appropriate best management practices (BMPs) and drinking water source protection measures. Department of Environmental Protection (DEP) staff are available to provide

What is a Protection Area?

A well's water supply protection area is the land around the well where protection activities should be focused. Each well has a Zone I protective radius and an Interim Wellhead Protection Area (IWPA).

- **The Zone I** is the area that should be owned or controlled by the water supplier and limited to water supply activities.
- **The IWPA** is the larger area that is likely to contribute water to the well.

In many instances the IWPA does not include the entire land area that could contribute water to the well. Therefore, the well may be susceptible to contamination from activities outside of the IWPA that are not identified in this report.

information about funding and other resources that may be available to your community.

This report includes:

1. Description of the Water System
2. Discussion of Land Uses within Protection Areas
3. Recommendations for Protection
4. Attachments, including a Map of the Protection Areas

1. Description of the Water System

Worthington is a small rural “hilltown” community, east of the Berkshire Hills of western Massachusetts. Worthington is primarily a residential and agricultural community that is a natural tourist attraction. The Worthington Fire District provides water for a small section of town, primarily the town center. The District maintains and operates eleven (11) sources of water. The sources are seven bedrock wells (01G-04G and 09G-11G) and four-spring sources (05G-08G); all are located in relatively close proximity to each other in the north central section of town.

During the mid-1990s, the area experienced a dry summer and the District’s sources were inadequate to meet demand. Some of the existing wells were deepened and additional wells drilled to meet the system needs. Wells range in depth from 280 to 550 feet and the springs are bedrock fed springs with collection boxes that have been reconstructed and/or otherwise protected from surface water influences. The bedrock in the area is mapped as the lower Goshen Formation, a carbonaceous schist and phyllite. There is significant bedrock exposure with some area of thin to moderate depth of till overlying bedrock. Although some of the wells are flowing artesian wells, there is no evidence of a significant and continuous protective, confining unit throughout the protection areas. Sources located in aquifers such as this are considered highly vulnerable to contamination from activities conducted on the land surface. Recent experience has shown that activities that cause significant disturbance to the land surface such as logging, on areas within the Zone I and Zone II of spring sources with thin overburden or exposed bedrock, can be negatively impacted by increased turbidity in the water.

The Zone I is the most protected area around a groundwater source. The Interim Wellhead Protection Area (IWPA) is an area that is assumed to contribute recharge to the source until a scientifically determine Zone II, contribution area for a groundwater source. The radii of the Zone I and Interim Protection Area (IWPA) for the wells are based on estimated yields of the wells as determined from pumping tests conducted on each well. The estimated yield of the wells ranges from approximately 2 to 15.5 gallons per minute.

What is Susceptibility?

Susceptibility is a measure of a well's potential to become contaminated due to land uses and activities within the Zone I and Interim Wellhead Protection Area (IWPA).

Table 2: Table of Activities within the Water Supply Protection Areas

Potential Contaminant Sources	Zone I	IWPA/ Zone II	Threat	Comments
Transportation Corridor	01G, 02G, 04G, 05G	All except 06G/07G	Moderate	Limit road deicing materials; monitor and control drainage
Residential	-	All except 05G, 06G, 07G, 08G	Moderate	Provide BMPs to residents
Septic System	-	All except 05G, 6G, 07G, 08G	Moderate	See septic systems brochure in the appendix, relocate septic systems outside of Zone I
Lawn Care/Gardening	-	All except 05G, 06G, 07G, 08G	Moderate	Provide BMPs to residents

-For more information on Contaminants of Concern associated with individual facility types and land uses please see the SWAP Draft Land Use / Associated Contaminants Matrix on DEP’s website - www.state.ma.us/dep/brp/dws/.

Glossary

Zone I: The area closest to a well; a 100 to 400 foot radius proportional to the well's pumping rate. To determine your Zone I radius, refer to the attached map.

IWPA: A 400-foot to ½ mile radius around a public water supply well proportional to its pumping rate; the area DEP recommends for protection in the absence of a defined Zone I. To determine IWPA radius, refer to the attached map.

Zone II: The primary recharge area defined by a hydrogeologic study.

Aquifer: An underground water-bearing layer of permeable material that will yield water in a usable quantity to a well.

Hydrogeologic Barrier: An underground layer of impermeable material that resists penetration by water.

Recharge Area: The surface area that contributes water to a well.

The Zone I for a spring is a square area centered on the source in the direction of flow with the source 50 feet from the downgradient edge of the Zone I. The lengths of the sides of the square are based on the estimated flow from the spring or estimated volume of water used from the source. The USGS was contracted by the DEP to determine the contribution areas (Zone II) to spring sources as part of the SWAP program. Please refer to the enclosed map for the outline of the protection areas for the District's sources. The Zone I, IWPA and Zone II areas are primarily forest with a single dirt road and several residences. Chlorine is added to the water for disinfection prior to distribution. You may request additional, current information regarding the quality of the water, from the local contact listed in Table 1. Please refer to the attached maps of the Zone I, IWPA and Zone II protection areas and Table 2 for additional assessment information.

2. Discussion of Land Uses in the Protection Areas

There are few land uses and activities within the drinking water supply protection areas that are potential sources of contamination.

Key issues include:

1. **Non-conforming Zone I,**
2. **Residential uses, and**
3. **Transportation corridor.**

The sources are located in an aquifer with a high vulnerability to contamination due to the absence of a significant hydrogeologic barrier to prevent contaminant migration. However, the overall ranking of susceptibility to contamination for the system is moderate, based on the presence of at least one moderately ranked land use or activity in the protection areas, as seen in Table 2.

1. Non-conforming Zone I – The District does not own or control the entire Zone I for all of its sources. Although the District owns much of the Zone I areas, the district does not own the entire Zone I for sources 01G, 02G, 04G and 05G. The Zone I area for these sources contains a road. DEP's land control restrictions for Zone I only allow water supply related activities in Zone I or activities that do not pose a potential threat.

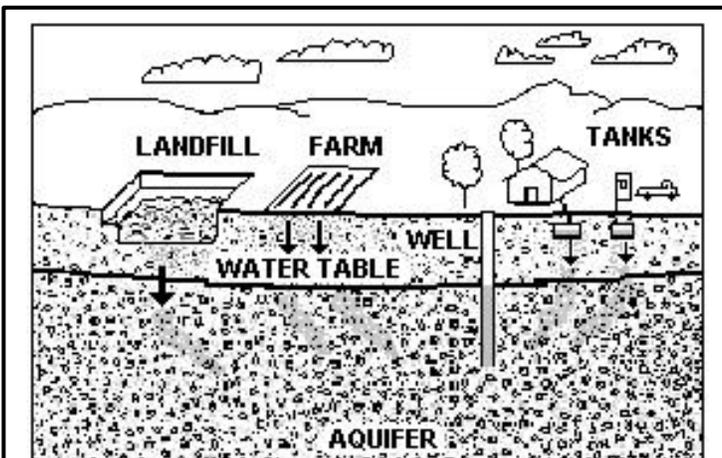


Figure 1: Example of how a well could become contaminated by different land uses and activities.

Systems not meeting DEP Zone I requirements must get DEP approval and address Zone I issues prior to increasing water use or modifying systems.

Recommendations:

- ✓ Do not use or store pesticides, fertilizers or road deicing materials, as is feasible, within the Zone I.
- ✓ Monitor road runoff to ensure that it does not flow toward the well and springs in the Zone I. Continue current efforts in upgrading and maintaining protection of the well and spring heads.
- ✓ Within the long term planning for the system, consider relocating sources adjacent to the road if activities cannot be controlled or water quality is impacted.

2. Residential Land Uses – The residences have on-site septic systems. If managed improperly, activities associated with residential areas can contribute to drinking water contamination. Common potential sources of contamination include:

- **Septic Systems** – Improper disposal of household hazardous chemicals to septic systems is a potential

Additional Documents:

To help with source protection efforts, more information is available by request or online at www.state.ma.us/dep/brp/dws including:

1. Water Supply Protection Guidance Materials such as model regulations, Best Management Practice information, and general water supply protection information.
2. MA DEP SWAP Strategy
3. Land Use Pollution Potential Matrix
4. Draft Land/Associated Contaminants Matrix

For More Information:

Contact Catherine Skiba in DEP's Springfield Office at (413) 755-2119 for more information and for assistance in improving current protection measures.

More information relating to drinking water and source protection is available on the Drinking Water Program web site at: www.state.ma.us/dep/brp/dws/

source of contamination to the groundwater because septic systems lead to the ground. If septic systems fail or are not properly maintained, they could be a potential source of microbial contamination.

- **Household Hazardous Materials** - Hazardous materials may include automotive wastes, paints, solvents, pesticides, fertilizers, and other substances. Improper use, storage, and disposal of chemical products used in homes are potential sources of contamination.
- **Heating Oil/Kerosene Storage** - Private residences within the IWPA may heat with fuel oil or diesel fuel. If managed improperly, Underground and Aboveground Storage Tanks (USTs and ASTs) can be potential sources of contamination due to leaks or spills of the fuel oil/kerosene they store.
- **Stormwater** – Catch basins transport stormwater from roadways and adjacent properties to the ground. As flowing stormwater travels, it picks up debris and contaminants from streets and lawns. Common potential contaminants include lawn chemicals, pet waste, and contaminants from automotive leaks, maintenance, washing, or accidents.

Residential Land Use Recommendations:

- ✓ Educate residents on best management practices (BMPs) for protecting water supplies. Distribute the fact sheet "Residents Protect Drinking Water" available in Appendix A and on www.mass.gov/dep/brp/dws/protect.htm, which provides BMPs for common residential issues.
 - ✓ Promote BMPs for stormwater management and pollution controls.
3. **Transportation corridors** – Even low use, rural residential roads can be potential sources of contamination due to use of deicing materials, leaks or spills of fuels and other hazardous materials during accidents and erosion.

Recommendation:

- ✓ Continue current contacts with local highway department and local emergency responders department to ensure that the protection areas are included in Emergency Response Planning.

3. Protection Recommendations

Implementing protection measures and best management practices (BMPs) will reduce the well's susceptibility to contamination. The Worthington Fire District is commended for current and past protection measures including the development of a protection plan, upgrade of the infrastructure and purchase of land around the sources. With the delineation of the Zone II contribution areas for the springs, the district should review the existing protection plan, update information as appropriate and work with the community in development of additional protection strategies as appropriate.

Please review and adopt the key recommendations listed above and as is feasible.

Zone I:

- ✓ Prohibit any new non-water supply activities from the Zone I.
- ✓ Continue regular inspections of the Zone I. Monitor for evidence of unauthorized access.
- ✓ Monitor activities and if there is evidence of increased activity or access, consider fencing and gating the immediate area around the springs/well

Facilities Management:

- ✓ Control surface runoff around the springs and wells' casings to prevent infiltration. Earthen or concrete berms or collars should slope away from the source and well casings should extend above ground.
- ✓ Monitor deliveries of chemicals to the facility

Planning:

- ✓ Have a plan to address short-term water shortages and long-term water demands. Keep the phone number of a bottled water company readily available and continue assessment of future needs of the system.

Supplement the SWAP assessment with additional local information and incorporate it into water supply educational efforts. Use a potential contaminant threat inventory to assist in setting priorities, focusing inspections, and creating educational activities.

These recommendations are only part of your ongoing local drinking water source protection. Citizens and community officials should use this SWAP report to encourage discussion of local drinking water protection measures.

Attachments

- ❖ Map of the Public Water Supply (PWS) Protection Area
- ❖ Recommended Source Protection Measures Fact Sheet

Transient Non-Community Source Water Assessment and Protection (SWAP) Report

For
BERKSHIRE PARK CAMPING AREA



Prepared by the
Massachusetts Department of
Environmental Protection,
Bureau of Resource
Protection, Drinking Water
Program

Date Prepared:
February 25, 2004

Table 1: Public Water Supply Information

<i>PWS Name</i>	Berkshire Park Camping Area
<i>PWS Address</i>	530 Harvey Rd
<i>City/Town</i>	Worthington, Massachusetts
<i>PWS ID Number</i>	1349003

Table 2: Well Information

<i>Well Name</i>	<i>Well (Source) ID#</i>	<i>Zone I Radius (feet)</i>	<i>IWPA Radius (feet)</i>	<i>Microbial Susceptibility*</i>	<i>Non-Microbial Susceptibility**</i>
Well # 1	1349003-01G	233	570	High	Moderate

* Common sources of microbial contamination include septic systems, wildlife and livestock operations. These types of activities in the source protection area increase your well's Microbial Susceptibility.

** Sources of non-microbial contamination include inorganic and organic chemicals. Inorganic contaminants include metals and naturally occurring minerals. Organic contaminants include fuels, degreasing solvents, herbicides and pesticides.

What is SWAP?

The Source Water Assessment Protection (SWAP) Program, established under the federal Safe Drinking Water Act, requires every state to:

- inventory land uses within the recharge areas of all public water supply sources;
- assess the susceptibility of drinking water sources to contamination from these land uses; and
- publicize the results to provide support for improved protection of sources.

The Massachusetts Department of Environmental Protection (DEP) Drinking Water Program is undertaking this task. The rankings of susceptibility of your well(s) to potential contamination are listed in Table 1.

What is the Purpose of This Report?

This report identifies the most significant *potential contaminant sources* that could threaten your well's water quality. Your susceptibility ranking does not imply poor water quality. Actual water quality is best reflected by the results of your regular water tests.

What is my Well's Source Protection Area?

A well's source protection area is the land around your well where protection activities should be focused. Your public drinking water supply well has a Zone I protective radius and an Interim Wellhead Protection Area (IWPA). The Zone I is the area that should be owned or controlled by the water supplier and limited to water supply activities. The IWPA is the larger area that is likely to contribute water to the well. Refer to **Figure 1** on page 2 for an example of a Zone I and IWPA.

An IWPA is the land located within a fixed radius of the well. The IWPA radius is based upon the average pumping rate of the well. In many instances the IWPA does not include the entire land area that could contribute water to the well. Therefore, the well may be susceptible to contamination from activities outside of the IWPA that are not identified in this report.

What is Susceptibility?

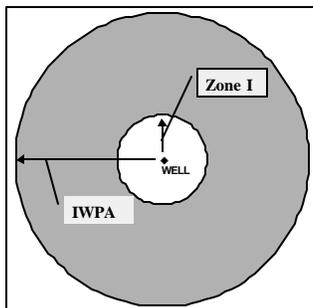
Susceptibility is a measure of your well's potential to become contaminated by land uses and activities within the Zone I and Interim Wellhead Protection Area (IWPA). Please see the enclosed map for your well's Zone I and IWPA areas.

The possibility of a release from potential contaminant sources is greatly reduced if best management practices (BMPs) are used. The susceptibility determination for your well did not take into account whether BMPs are being used.

Susceptibility of a drinking water well does *not* mean a customer will drink contaminated water. Water suppliers protect drinking water by monitoring water quality, treating water supplies, and using BMPs and source protection measures to ensure that safe water is delivered to the tap.

Figure 1: ZONE I/ IWPA EXAMPLE Source Protection Area for Well #1 (1349003-01G)

Zone I = 233 ft.
IWPA = 570 ft.



How Was My Well's Susceptibility Determined?

Your well's **high** susceptibility to potential microbial threats is based on the septic system components within the IWPA. The **moderate** susceptibility to potential non-microbial threats is based on the local roads and camp facilities within the IWPA.

This source water assessment report is based on information provided by you on your Public Water Supply Annual Statistical Report, water quality data and/or from other sources of information. DEP has not verified the accuracy of the information submitted with the report.

Recommendations for your Well

All public water systems with groundwater sources should ensure that only activities necessary for the operation and maintenance of the drinking water system occur within the well's Zone I.

Specific Recommendations:

- ✓ inspect the Zone I and IWPA regularly;
- ✓ work with the Board of Health and other local officials to make sure your well(s) are included in local regulations and inspection efforts;
- ✓ restrict access to the well and post the area with *Drinking Water Protection Area* signs;
- ✓ make certain that a proper sanitary seal is in place for the well (grouted casing and concrete pad);
- ✓ remove oil/hazardous materials storage tanks, and hazardous materials use or storage from the Zone I;
- ✓ do not use pesticides, fertilizers or road salt within the Zone I;
- ✓ address septic system issues in Zone I; remove septic system, relocate well or pursue upgrading options;
- ✓ water systems not meeting DEP Zone I requirements must get DEP approval and address Zone I issues prior to increasing water use or modifying system.

Need More Information?

Additional information or sources of information can be obtained by calling Catherine Skiba at (413) 755-2119 or visiting DEP's Drinking Water Web site at <http://www.state.ma.us/dep/brp/dws>.

Glossary

- *Best Management Practices (BMPs)* are operational procedures used to prevent or reduce pollution.
- *Public Water System* is a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year.

Transient Non-Community Source Water Assessment Program (SWAP) Report

For
WORTHINGTON GOLF CLUB

FINAL



Prepared by the
Massachusetts Department of
Environmental Protection,
Bureau of Resource
Protection, Drinking Water
Program

Date Prepared:
July 15, 2002

Table 1: Public Water Supply Information

<i>PWS NAME</i>	WORTHINGTON GOLF CLUB
<i>PWS Address</i>	RIDGE RD
<i>City/Town</i>	WORTHINGTON, MASSACHUSETTS
<i>PWS ID Number</i>	1349006

Table 2: Well Information

<i>Well Name</i>	<i>Well (Source) ID#</i>	<i>Zone I Radius (feet)</i>	<i>IWPA Radius (feet)</i>	<i>Microbial Susceptibility*</i>	<i>Non-Microbial Susceptibility**</i>
WELL #1	1349006-01G	159	455	High	High

* Common sources of microbial contamination include septic systems, wildlife and livestock operations. These types of activities in the source protection area increase your well's Microbial Susceptibility.

** Sources of non-microbial contamination include inorganic and organic chemicals. Inorganic contaminants include metals and naturally occurring minerals. Organic contaminants include fuels, degreasing solvents, herbicides and pesticides.

What is SWAP?

The Source Water Assessment Program (SWAP), established under the federal Safe Drinking Water Act, requires every state to:

- inventory land uses within the recharge areas of all public water supply sources;
- assess the susceptibility of drinking water sources to contamination from these land uses; and
- publicize the results to provide support for improved protection of sources.

The Massachusetts Department of Environmental Protection (DEP) Drinking Water Program is undertaking this task. The rankings of susceptibility of your well(s) to potential contamination are listed in Table 1.

What is the Purpose of This Report?

This report identifies the most significant *potential contaminant sources* that could threaten your well's water quality. Your susceptibility ranking does not imply poor water quality. Actual water quality is best reflected by the results of your regular water tests.

What is my Well's Source Protection Area?

A well's source protection area is the land around your well where protection activities should be focused. Your public drinking water supply well has a Zone I protective radius and an Interim Wellhead Protection Area (IWPA). The Zone I is the area that should be owned or controlled by the water supplier and limited to water supply activities. The IWPA is the larger area that is likely to contribute water to the well. Refer to **Figure 1** on page 2 for an example of a Zone I and IWPA.

An IWPA is the land located within a fixed radius of the well. The IWPA radius is based upon the average pumping rate of the well. In many instances the IWPA does not include the entire land area that could contribute water to the well. Therefore, the well may be susceptible to contamination from activities outside of the IWPA that are not identified in this report.

What is Susceptibility?

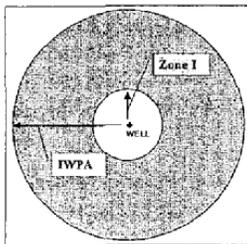
Susceptibility is a measure of your well's potential to become contaminated by land uses and activities within the Zone I and Interim Wellhead Protection Area (IWPA). Please see the enclosed map for your well's Zone I and IWPA areas.

The possibility of a release from potential contaminant sources is greatly reduced if best management practices (BMPs) are used. The susceptibility determination for your well did not take into account whether BMPs are being used.

Susceptibility of a drinking water well does *not* mean a customer will drink contaminated water. Water suppliers protect drinking water by monitoring water quality, treating water supplies, and using BMPs and source protection measures to ensure that safe water is delivered to the tap.

Figure 1: ZONE I/ IWPA
EXAMPLE Source
Protection Area for WELL
#1 (1349006-01G)

Zone I = 159 ft.
IWPA = 455 ft.



How Was my Well's Susceptibility Determined?

Your well's **high** susceptibility to potential microbial threats is based on the presence of septic system components within the Zone I/ IWPA. The **high** susceptibility to potential non-microbial threats is based on the application or storage of fertilizers and pesticides within the Zone I and/or the IWPA. Other moderate threats include local roads and parking areas within the Zone I and/or the IWPA.

This source water assessment report is based on information provided by you on your 2000 Public Water Supply Annual Statistical Report, water quality data and/or from other sources of information. DEP has not verified the accuracy of the information submitted with the report.

Recommendations for your Well

All public water systems with groundwater sources should ensure that only activities necessary for the operation and maintenance of the drinking water system occur within the well's Zone I.

Specific Recommendations:

- ✓ inspect the Zone I and IWPA regularly;
- ✓ work with the Board of Health and other local officials to make sure your well(s) are included in local regulations and inspection efforts;
- ✓ restrict access to the well and post the area with *Drinking Water Protection Area* signs;
- ✓ make certain that a proper sanitary seal is in place for the well (grouted casing and concrete pad);
- ✓ remove oil/hazardous materials storage tanks, and hazardous materials use or storage from the Zone I;
- ✓ do not use pesticides, fertilizers or road salt within the Zone I;
- ✓ address septic system issues in Zone I; remove septic system, relocate well or pursue upgrading options;
- ✓ water systems not meeting DEP Zone I requirements must get DEP approval and address Zone I issues prior to increasing water use or modifying system.

Need More Information?

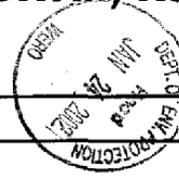
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Glossary

- *Best Management Practices (BMPs)* are operational procedures used to prevent or reduce pollution.
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Transient Non-Community Source Water Assessment Program (SWAP) Report

For
LISTONS BAR & GRILL



Prepared by the
Massachusetts Department of
Environmental Protection,
Bureau of Resource
Protection, Drinking Water
Program

Date Prepared:
January 21, 2002

Table 1: Public Water Supply Information

<i>PWS NAME</i>	LISTONS BAR & GRILL
<i>PWS Address</i>	324 OLD NORTH RD
<i>City/Town</i>	WORTHINGTON, MASSACHUSETTS
<i>PWS ID Number</i>	1349002

Table 2: Well Information

<i>Well Name</i>	<i>Well (Source) ID#</i>	<i>Zone I Radius (feet)</i>	<i>IWPA Radius (feet)</i>	<i>Microbial Susceptibility*</i>	<i>Non-Microbial Susceptibility**</i>
WELL # 1	1349002-01G	111	426	High	Moderate

* Common sources of microbial contamination include septic systems, wildlife and livestock operations. These types of activities in the source protection area increase your well's Microbial Susceptibility.

** Sources of non-microbial contamination include inorganic and organic chemicals. Inorganic contaminants include metals and naturally occurring minerals. Organic contaminants include fuels, degreasing solvents, herbicides and pesticides.

What is SWAP?

The Source Water Assessment Program (SWAP), established under the federal Safe Drinking Water Act, requires every state to:

- inventory land uses within the recharge areas of all public water supply sources;
- assess the susceptibility of drinking water sources to contamination from these land uses; and
- publicize the results to provide support for improved protection of sources.

The Massachusetts Department of Environmental Protection (DEP) Drinking Water Program is undertaking this task. The rankings of susceptibility of your well(s) to potential contamination are listed in Table 1.

What is the Purpose of This Report?

This report identifies the most significant *potential contaminant sources* that could threaten your well's water quality. Your susceptibility ranking does not imply poor water quality. Actual water quality is best reflected by the results of your regular water tests.

What is my Well's Source Protection Area?

A well's source protection area is the land around your well where protection activities should be focused. Your public drinking water supply well has a Zone I protective radius and an Interim Wellhead Protection Area (IWPA). The Zone I is the area that should be owned or controlled by the water supplier and limited to water supply activities. The IWPA is the larger area that is likely to contribute water to the well. Refer to **Figure 1** on page 2 for an example of a Zone I and IWPA.

An IWPA is the land located within a fixed radius of the well. The IWPA radius is based upon the average pumping rate of the well. In many instances the IWPA does not include the entire land area that could contribute water to the well. Therefore, the well may be susceptible to contamination from activities outside of the IWPA that are not identified in this report.

What is Susceptibility?

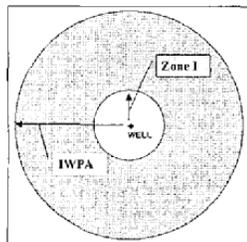
Susceptibility is a measure of your well's potential to become contaminated by land uses and activities within the Zone I and Interim Wellhead Protection Area (IWPA). Please see the enclosed map for your well's Zone I and IWPA areas.

The possibility of a release from potential contaminant sources is greatly reduced if best management practices (BMPs) are used. The susceptibility determination for your well did not take into account whether BMPs are being used.

Susceptibility of a drinking water well does *not* mean a customer will drink contaminated water. Water suppliers protect drinking water by monitoring water quality, treating water supplies, and using BMPs and source protection measures to ensure that safe water is delivered to the tap.

Figure 1: ZONE I/IWPA EXAMPLE Source Protection Area for WELL # 1 (1349002-01G)

Zone I = 111 ft.
IWPA = 426 ft.



How Was my Well's Susceptibility Determined?

Your well's **high** susceptibility to potential microbial threats is based on the septic system components within the Zone I / IWPA. The **moderate** susceptibility to potential non-microbial threats is based on the local roads and parking areas within the Zone I and/or the IWPA.

This source water assessment report is based on information provided by you on your 2000 Public Water Supply Annual Statistical Report, water quality data and/or from other sources of information. DEP has not verified the accuracy of the information submitted with the report.

Recommendations for your Well

All public water systems with groundwater sources should ensure that only activities necessary for the operation and maintenance of the drinking water system occur within the well's Zone I.

Specific Recommendations:

- ✓ inspect the Zone I and IWPA regularly;
- ✓ work with the Board of Health and other local officials to make sure your well(s) are included in local regulations and inspection efforts;
- ✓ restrict access to the well and post the area with *Drinking Water Protection Area* signs;
- ✓ make certain that a proper sanitary seal is in place for the well (grouted casing and concrete pad);
- ✓ remove oil/hazardous materials storage tanks, and hazardous materials use or storage from the Zone I;
- ✓ do not use pesticides, fertilizers or road salt within the Zone I;
- ✓ address septic system issues in Zone I; remove septic system, relocate well or pursue upgrading options;
- ✓ water systems not meeting DEP Zone I requirements must get DEP approval and address Zone I issues prior to increasing water use or modifying system.

Need More Information?

Additional information or sources of information can be obtained by calling Catherine Skiba at (413) 755-2119 or visiting DEP's Drinking Water Web site at <http://www.state.ma.us/dep/brp/dws>.

Glossary

- *Best Management Practices (BMPs)* are operational procedures used to prevent or reduce pollution.
- *Public Water System* is a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year.



Massachusetts
Department
of
ENVIRONMENTAL
PROTECTION

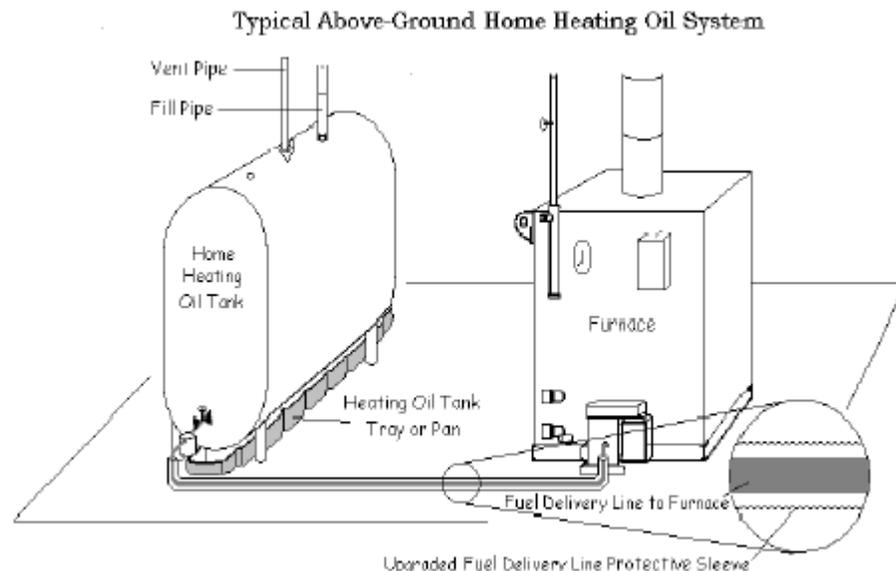
fact sheet

Tips For Maintaining Your Home Heating System: Prevent Heating Oil Leaks and Spills

Cleaning up oil leaks from home heating systems can be very expensive. The average cost can range between \$20,000 and \$50,000, with some cleanups costing significantly more. Here are some ways to save money, help prevent leaks and spills, and protect the environment.

For all heating oil systems:

- Annually:
 - Inspect for leaks. Look at the tank, fuel delivery line, valves, piping, and fittings.
 - Have your oil company:
 - Clean the furnace and repair or replace damaged parts. A well-maintained furnace means lower fuel bills and cleaner emissions.
 - Install an oil **safety valve** or replace the fuel delivery line with one encased in a **protective sleeve**. These are inexpensive upgrades. Contact the fire department to determine if a permit is required for this work.
 - Each fall, inspect the vent pipe to ensure that it is free of obstructions and that an audible signal (whistle) is on the vent. Oil company personnel listen for the whistle to help avoid overfills, a common source of spills.
- At least every 10 years, have the oil tank cleaned out. Over time, water (from condensation) and sludge can cause corrosion resulting in leaks.
- When appropriate:
 - Remove abandoned fill and vent pipes immediately.
 - Clearly mark the location of the tank's fill pipe.
 - Consider upgrading to a modern, fuel-efficient furnace.



- Determine if the underground storage tank is made of steel (common) or fiberglass (rare). Most steel underground storage tanks will last approximately 10 to 20 years. If the tank is older than that or the age is unknown, replace it with an above-ground storage tank. Locate your new tank under a shelter, or inside a basement or garage, to prevent rust, corrosion, or damage.

For outdoor above-ground tanks:

- Ask your oil company to inspect the stability of the above-ground tank. A full 275-gallon tank weighs more than 2,000 pounds! They have metal legs and should sit on a concrete pad. If the legs become loose or the pad cracks, the tank can fall over and rupture.
- Replace an outdoor above-ground storage tank that has been uncovered for 10 years or longer. These tanks rust from the inside out, so cleaning or painting the outside does not usually prolong their life.
- Protect the tank from the weather, such as falling snow and ice, and prevent ruptures by tree limbs.

For indoor above-ground tanks:

- Inspect indoor above-ground storage tanks for signs of pitting and corrosion, particularly at the bottom of the tank. Tanks primarily rust from the inside out, so if signs of aging are present, replace the tank. Indoor tanks do not last more than about 30 years, and often their lifespan is much shorter.
- Consider placing a plastic heating oil tray or pan under the tank. This makes it easier to keep the tank area clean and help identify and contain small leaks.

If your oil company offers to perform a “tightness test,” ask if this could cause a problem. Generally, these tests should NOT be performed on older residential heating oil systems. Because of the pressure used during a tightness test, older equipment can fail, causing a leak or spill. If you have a tank, fuel delivery line, valves, piping, and fittings on which it is inadvisable to perform a tightness test because of age or condition, then it is probably better to replace the equipment that is causing the concern.

Visit our web site: <http://www.mass.gov/dep/bwsc/facts.htm> to review related documents, including “Heating Oil Delivery Lines” (<http://www.mass.gov/dep/bwsc/files/deline.pdf>).

If you suspect an oil leak or spill, **immediately** contact your oil company and fire department for assistance. Leaks or spills of 10 gallons or more must be reported to DEP within 2 hours. To report a leak or spill, call DEP (within 2 hours) and the fire department.

DEP’s 24-hour statewide emergency response number is 888-304-1133.

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Rating Deicing Agents: Road Salt Stands Firm

Watershed managers frequently wonder if there are any practical alternatives to the use of road salt for keeping roads free of ice in the winter. Others are concerned about the impact of chlorides on downstream water quality or on adjacent plants. A Michigan study suggests that despite the development of alternatives, road salt (primarily sodium chloride, NaCl) generally remains a competitive choice based on environmental, infrastructural, and cost factors.

Most northern states have traditionally employed road salt as a primary chemical deicer (Table 1) and sand as an abrasive (for better traction). Although sodium chloride is an inexpensive and effective choice, concerns are frequently raised about its potential negative impacts—particularly from chloride—on human health, the environment, highway infrastructure, and vehicles (see Table 2). Alternate deicing agents are not free of controversy either. For example, some localities employ urea to protect critical infrastructure (such as bridges or airports) from corrosion due to chlorides. Application of urea, however, may increase nutrient loading of waterways. In an era of ever-decreasing budgets, cost is an important factor that will often determine the type of deicer to be used. Lastly, and most importantly, highway departments must be confident that a given deicing agent will provide safe roads in winter driving conditions.

To respond to these concerns, the Michigan Department of Transportation (MDOT) analyzed the comparative performance, environmental impacts, and costs of six deicing agents: road salt (sodium chloride, the most common deicer in Michigan); calcium magnesium acetate (CMA); CMS-B (also known as Motech, a patented product containing primarily potassium chloride and derived as a by-product of beet processing); CG-90 Surface Saver (a patented corrosion-inhibiting salt); calcium chloride; and Verglimit (a patented concrete road surface containing calcium chloride pellets). Sand was also included in the evaluation. The primary components of the selected deicing agents were also compared (Table 3). In addition, MDOT briefly evaluated ethylene glycol, urea, and methanol. Due to their poor performance, environmental and human health effects, or high cost, these three agents were dropped from consideration as practical deicing alternatives.

As might be expected, each deicer has a different combination of performance, costs, and impacts. This suggests that different deicers may be appropriate for different climatic regimes in the country. None of the seven deicers was considered to possess widespread adverse environmental threats; however, they can exert site-specific impacts depending on the deicing agent's runoff concentration. Impacts may be significant for many threatened and endangered species which are already stressed and habitat-limited, small streams and lakes, water supplies, and wetlands and swales. A comparison of the potential impacts of the seven deicing agents (Table 4) can help users choose the deicer(s) most suitable for a particular area.

Table 1: Typical Elemental Composition of Two Road salt Samples (Biesboer and Jacobson, 1994)

Element	Concentration (ppm)
Sodium (Na)	349,714.0
Chlorine (Cl)	539,259.0
Calcium (Ca)	4,573.5
Potassium (K)	187.5
Iron (Fe)	73.9
Magnesium (Mg)	55.7
Aluminum (Al)	27.7
Lead (Pb)	6.7
Phosphorus (P)	4.6
Manganese (Mn)	3.1
Copper (Cu)	2.0
Zinc (Zn)	1.9
Nickel (Ni)	1.7
Chromium (Cr)	1.1
Cadmium (Cd)	0.4

Note: concentrations are typically diluted by one to three orders of magnitude in urban stormwater and streams. Elemental nitrogen was not analyzed.

The study also compared the effectiveness of deicing agents with respect to minimum activation temperatures, corrosion, and estimated cost (Figure 1). Unfortunately, environmental costs are difficult to quantify and are not included. One of the deicing agents, CMS-B, is a new product, and only limited data is available on its performance and cost.

The study did identify some potential alternatives to the use of sodium chloride. For example, calcium chloride applied in pellet or liquid form could be the most attractive deicer for areas where fast melting is a priority. It also causes less corrosion and is only 10 to 15% more expensive per road mile than road salt. Verglimit contains calcium chloride, but has relatively low deicing ability—a result of its significantly lower concentration of the salt and tendency to absorb water, rendering it largely ineffective at lower temperatures.

In regions where the environmental and corrosive effects of deicers are important management issues, CMA may be the preferred choice. However, CMA only works above 23°F, has less deicing ability, and is the most expensive option (Figure 1).

Road salt will probably continue to be an attractive deicing agent because of its high deicing ability, utility at low temperatures, and low cost. The report suggests that corrosive effects from road salt can and have been reduced through design and material modifications to both road structures and vehicles over the past several years. Such developments may make road salt even more attractive as a deicing agent. Consequently, management measures should be taken to minimize runoff containing road salt and other deicing agents into sensitive environmental areas (Table 5). It is important to remember, however, that the study specifically analyzed the usefulness of deicing agents in Michigan; as a result, other regions may wish to evaluate agents in the context of their particular floral, faunal, infrastructural, and economic conditions.

—RLO

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- Massachusetts Audubon Society. *A Low-Salt Diet for the Roads*. Public Service Information Sheet 12. Lincoln, MA.
- Michigan Department of Transportation. 1993. *The Use of Selected Deicing Materials on Michigan Roads: Environmental and Economic Impacts*. Lansing, MI. Prep. by Public Sector Consultants, Inc.

Table 2: Some Impacts of Road Salt (MDOT, 1993)

- Contamination of drinking water supplies
- Corrosion of automobiles (50% of automobile corrosion is due to road salt, although this number is declining due to the increased use of corrosion-resistant materials in vehicles)
- Corrosion of bridges and other infrastructure
- Damage to vegetation within 50 ft. of roadside
- Temporary reduction in soil microbes, followed by summer recovery
- Sensitivity of various deciduous trees (see Technical Note 56)
- Attraction of deer to salts on roadways, increasing the risk of accidents
- Stratification of small lakes, hindering seasonal turnover
- Secondary components (3-5% of road salt composition) include N, P, and metals in concentrations exceeding those in natural waters

Table 3: Primary Components of Selected Deicing Materials (MDOT, 1993)

Deicing Material	Primary components*	Chloride as fraction of total mass
Calcium magnesium acetate (CMA)	Ca, Mg, C ₂ H ₃ O ₂	0%
Calcium chloride	Ca, Cl	>57%
Calcium chloride (Verglimit)	Ca, Cl	2.2 to 4.8%
Sodium chloride (road salt)	Na, Cl	~58%
Corrosion inhibitor (CG-90 Surface Saver)	Na, Cl and Mg, Cl	46% 17%
Potassium chloride (CMS-B/Motech)	K, Cl	Unknown
Sand	Si, O	0%

* Ca = calcium; Mg = magnesium; C₂H₃O₂ = acetate; Cl = chloride; Na = sodium; K = potassium; Si = silicon.

Table 4: Impacts of Selected Deicer Components and Products on the Environment (MDOT, 1993)

	Sodium Chloride (NaCl)	Potassium Chloride (KCl)	Calcium Chloride (CaCl ₂)	CG-90 Surface Saver	CMA (CaMgC ₂ H ₃ O ₂)	Sand (SiO ₂)
Soils	Cl complexes release heavy metals; Na can break down soil structure and decrease permeability	K can exchange with heavy metals, releasing them into the environment	Ca can exchange with heavy metals, increase soil aeration and permeability	Same as NaCl; Mg can exchange with heavy metals	Ca and Mg can exchange with heavy metal	Gradually will accumulate on soil
Vegetation	Salt spray/splash can cause leaf scorch and browning or dieback of new plant growth up to 50' from road; osmotic stress can result from salt uptake; grass more tolerant than trees and woody plants				Little effect	Accumulates on and around low vegetation
Groundwater	Mobile Na and Cl ions readily reach groundwater, and concentration levels can increase in areas of low flow temporarily during spring thaws. K, Ca, and Mg can release heavy metals from soil					No known effect
Surface Water	Can cause density stratification in small lakes having closed basins, potentially leading to anoxia in lake bottoms; often contain nitrogen, phosphorus, and trace metals as impurities, often in concentrations greater than 5 ppm				Depletes dissolved O ₂ in small lakes and streams when degrading	No known effect
Aquatic Biota	Little effect in large or flowing bodies at current road salting amounts; small streams that are end points for runoff can receive harmful concentrations of Cl; Cl from NaCl generally not toxic until it reaches levels of 1,000-36,000 ppm; Cl from KCl may be more toxic; eutrophication from phosphorus in CG-90 can cause species shifts				Can cause oxygen depletion	Particles to stream bottoms degrade habitat

Table 5: Suggestions to Help Reduce Excessive Deicing Agents (Particularly Road Salt) Runoff (Nonpoint Source News-Notes, 1995; MA Audubon Society, and VT Agency of Transportation, 1993)

Storage

- Salt storage piles should be completely covered and handled on impervious surfaces.
- Runoff should be contained in an appropriate area.
- Spills should be cleaned up after loading operations. The material may be directed to a sandpile or returned to salt piles.

Application

- Instead of applying deicers at the same rate on high- and low-volume roads, control measures should be tailored to conditions.
- Trucks should be equipped with ground-speed sensors that automatically control the spread rate of the material.
- Drivers and handlers of road salt should attend training programs to improve efficiency and reduce losses.
- Drivers should avoid plowing snow from treated surfaces into piles or near frozen ponds, lakes, or wetlands.

Additional Suggestions:

- Identify ecosystems such as wetlands that may be sensitive to salt.
- Use calcium chloride and CMA, which are more costly than sodium chloride but may be less environmentally harmful to sensitive ecosystems.
- Apply sand to help traction and reduce salt. However, excessive sanding is an additional expense and poses sedimentation problems.
- To avoid overapplication and excessive expense, choose deicing agents which perform most efficiently according to pavement temperature.
- Monitor the deicer market, which changes as new products are developed, existing ones are developed more cheaply, and more is learned about their application and effects. While the purchase price of road salt alternatives is usually high, their full cost may actually be lower when the cost of contaminated water supplies, corroded vehicles and highways, and roadside vegetation loss is considered.
- Use stormwater practices, such as buffer zones, to further protect sensitive areas.

Figure 1: Comparison of Deicers' Effectiveness and Cost (MDOT, 1993)

	Deicing ability	Corrosion protection	Minimum effective temperature (from lab tests)	Material costs per ton	Total direct cost per E-mile *
Sodium chloride			12°F (-11°C)	\$20 - 40	\$12,741 - 13,818
Calcium chloride			-20°F (-29°C)	\$200	\$13,953-15,057 plus storage and equipment costs
Calcium magnesium acetate			23°F (-5°C)	\$650 - 675	\$25,915 - 32,637
CG-90 Surface Saver		 **	1°F (-17°C)	\$185	\$11,861-12,296
Verglimit			25°F (-4°C)	\$109 - 145 (3X cost of regular asphalt overlay)	Not available †
CMS-B	Unknown	Unknown	-10°F (-23°C)	\$0.40 - 0.50 / gal.	Not available
Sand			Not available	\$5	\$9,508 - 10,215 (Road salt / sand mixture)

* Unless otherwise noted, direct cost includes procurement of materials, personnel, corrosion, storage, and equipment. An e-mile, or "equivalent mile," is one mile of 24-foot-wide (two-lane) road surface.

** Questions have been raised about the longevity of CG-90 Surface Saver's corrosion protection.

† Verglimit is also a road surface; therefore it offers more than deicing alone, making its costs difficult to compare with other deicers.