MUNICIPAL MANUAL

Connecticut's Aquifer Protection Area Program

Conserving, protecting and improving the natural resources and environment of the state.

Connecticut's Aquifer Protection Area Program

Municipal Manual

Connecticut Department of
Energy and Environmental Protection

Bureau of Water Protection and Land Reuse

Hartford, Connecticut

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The Honorable Dannel P. Malloy, Governor
State of Connecticut

Daniel C. Esty, Commissioner
Connecticut Department of Energy & Environmental Protection

Betsey C. Wingfield, Bureau Chief
Bureau of Water Protection and Land Reuse

Robert W. Hust, Assistant Director
Planning and Standards Division

Corinne R. Fitting, Supervisor
Aquifer Protection Area Program

Kim M. Czapla, Environmental Analyst III
Aquifer Protection Area Program

Manual produced by the Department of Energy & Environmental Protection
Bureau of Water Protection and Land Reuse, Planning and Standards Division
Aquifer Protection Area Program

Connecticut's Aquifer Protection Area Program Municipal Manual is available online at:
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Connecticut's Aquifer Protection Area Program Municipal Manual

Water is a vital natural resource, essential to all life on earth. In Connecticut, many of our residents rely on groundwater for their drinking water supply, whether it is from private wells or public water supply wells. Groundwater is extracted through wells from underground water sources known as aquifers. Aquifers can provide a clean, safe, reliable source of drinking water now and in the future, but are vulnerable to contamination from overlying land use activities.

The Aquifer Protection Area Program was developed to protect the state's largest public water supply aquifers. This is a proactive program, intended to prevent contamination of public water supplies by managing land use activities in critical aquifer areas. The program is a three-way partnership between the State, water companies and municipalities. The State provides oversight and technical support to both the water companies and the municipalities. Water companies do the work necessary to map the land areas that need to be protected. Municipalities are responsible for adopting and enforcing land use regulations to minimize the contaminant threats to our aquifers.

The Aquifer Protection Area program balances protection of our public drinking water sources with the needs of continued economic growth. New high-risk land uses are not permitted to locate in Aquifer Protection Areas. Existing high-risk land uses in these areas, while subject to best management practices to minimize contaminant threats, are allowed to continue to operate, change and grow to keep pace with the economy. As the state's primary land use control agents, the Municipal Aquifer Protection Agencies serve as the keystone of the Aquifer Protection Program. This manual provides Connecticut's Municipal Aquifer Protection Agencies with the guidance and reference materials needed to regulate aquifer protection areas.

For more information on the manual or its use, contact:

Connecticut Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Planning and Standards Division
Aquifer Protection Area Program
79 Elm Street
Hartford, Connecticut 06106-5127

Phone: 860-424-3020
Fax: 860-424-4055
Email: deep.aquiferprotection@ct.gov
Web: www.ct.gov/deep/aquiferprotection

Forms, model documents and this manual are available for download at www.ct.gov/deep/aquiferprotection.

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Tatiana Abreu, DEEP

Chris Beauchemin, Town of Bristol

Pat Bisacky, CT Department of Public Health

Linda Bush, Town of Wallingford

Alexis Cherichetti, City of Norwalk

Leslie Creane, Town of Hamden

Christina M. Costa, Town of Old Saybrook

Diana Danenberg, formerly of DEP

Mark DeVoe, Town of Plainville

Lee Dunbar, formerly of DEP

Gabrielle Frigon, DEEP

Caryn Furbush, DEEP

Victoria Green, DEEP

Lauren Jones, DEEP

Robert E. Kaliszewski, DEEP

Art Mauger, DEEP

Steve Messer, CT Department of Public Health

Bea Milne, DEEP

Jessica Morgan, formerly of DEP

Tom Ouellette, DEEP

John Pagini, Town of Bolton

Kent Ritter, Connecticut Valley Hospital

Brad Robinson, DEEP

Terri Schnoor, DEEP

Carol Smith, DEEP

Paul Stacey, formerly of DEP

Howard Sternberg, DEEP

Steve Tessitore, formerly of DEP

Kim Trella, DEEP

Steven Trinkaus, Town of Southbury

Linda Walden, formerly of Town of Killingly

Alan Weiner, Town of Bristol

Darcy Winther, DEEP

Fred Wojick, Town of Putnam

David Wrinn, Office of the Attorney General

Credits

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Foreword

Dear Aquifer Protection Agency Staff and Members:

We commend you for recognizing the value and importance of protecting and preserving the quality of groundwater in our state. As you know, groundwater is a precious resource that requires careful stewardship to ensure an abundant and clean supply. In Connecticut, more than half of the population relies on groundwater for their drinking supply, and this percentage is increasing. As the state's population grows, communities are turning to community wells to meet the demand for water. It is through the efforts of committed people, like you, that Connecticut will succeed in protecting its groundwater and drinking water supplies.

The Connecticut Aquifer Protection Area Program (Connecticut General Statutes [CGS] § 22a-354a through § 22a-354bb) was established for the purpose of identifying critical water supply aquifer areas and protecting them from pollution. By managing land use activities in these areas, we can protect our water supply aquifer areas from contamination.

This manual provides the basic tools necessary for making decisions on regulated land uses and management of the state's Aquifer Protection Areas. It instructs Aquifer Protection Agency Staff and Members how to use these tools and to evaluate and make decisions about land use activities that threaten groundwater quality. The Department of Energy and Environmental Protection supports municipal Aquifer Protection Agencies through education, training and technical assistance.

The Connecticut Aquifer Protection Area Program requires a commitment from state and local government, businesses, water companies and individual residents, but the reward – clean drinking water for now and the future – is well worth the effort.

Thank you for supporting our goal of protecting and improving the quality of Connecticut's groundwater for this and future generations.

Sincerely,

Daniel C. Esty

Commissioner

Connecticut Department of Energy and Environmental Protection (DEEP) | Bureau of Water Protection and Land Reuse
Planning and Standards Division | Aquifer Protection Area Program | 79 Elm Street | Hartford, Connecticut 06106-5127

Phone 860-424-3020 | Fax 860-424-4055 | Email deep.aquiferprotection@ct.gov | Web www.ct.gov/deep/aquiferprotection

Table of Contents

12 MODEL DOCUMENTS

13 STATUTES AND REGULATIONS

14 APPENDICES

15 GLOSSARY OF TERMS

Figures, Charts & Tables

FIGURES

FLOW CHARTS AND DECISION TREES

TABLES

Acronyms

LIST OF ACRONYMS	
APA	Aquifer Protection Area
BMPs	Best Management Practices
CFR	Code of Federal Regulations
CGS	Connecticut General Statutes
DEEP	Department of Energy and Environmental Protection
GIS	Geographic Information Systems
GPS	Global Positioning Satellite
LID	Low Impact Development
MMP	Materials Management Plan
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly Owned Treatment Works
RCRA	Resource Conservation and Recovery Act
RCSA	Regulations of Connecticut State Agencies
RRF	Resource Recovery Facility
SDWA	Federal Safe Drinking Water Act
SPCS	Significant Potential Contaminant Sources
SPDES	State Pollutant Discharge Elimination System
SPPCP	Stormwater Pollution Prevention Counter Plan
SWAP	Source Water Assessment Program
SWMP	Stormwater Management Plan
TSDF	Treatment, Storage or Disposal Facility
UST	Underground Storage Tank

Introduction

Connecticut citizens have long relied on groundwater for drinking water – both from private residential wells and public supply wells. Currently, over two million Connecticut residents rely, at least in part, on groundwater as their source of drinking water. In the late 1970s and early 1980s, many public supply wells were found to be contaminated by various pollutants. In 1987 the Connecticut General Assembly passed Special Act 87-63 that established a Legislative Aquifer Protection Task Force to evaluate the need for a regulatory framework to improve the protection of Connecticut's groundwater resources. The Task Force held numerous meetings and public hearings, conducted research over a two-year period and prepared two reports to the General Assembly concerning aquifer protection. The first Task Force report, dated March 1988, recommended that legislation be enacted to require more comprehensive mapping of groundwater resources contributing to large public supply well fields in stratified drift aquifers. Legislation passed in 1988 required the Department to develop mapping guidelines for Level B (preliminary) mapping and regulations for Level A (final) mapping of Aquifer Protection Areas, and authorized the Task Force to continue its work.

The Task Force continued to meet for another year to consider the need for a regulatory management framework to improve the protection of aquifers. A second Task Force report was subsequently submitted to the General Assembly in February 1989. That report recommended a comprehensive regulatory management framework be enacted to protect Connecticut's largest public supply wells in stratified drift aquifers, including minimum state standards necessary to protect the most sensitive aquifer areas in Connecticut. The Connecticut General Assembly responded to the report in 1989 with unanimous passage of the Aquifer Protection Act (Connecticut General Statutes [CGS] § 22a-354a through 22a-354bb).

The General Assembly found that:

1. aquifers are an essential natural resource and a major source of public drinking water;
2. reliance on groundwater will increase because opportunities for development of new surface water supplies are diminishing due to the rising cost of land and increasingly intense development;
3. numerous drinking water wells have been contaminated by certain land use activities and other wells are now threatened;
4. protection of existing and future groundwater supplies demand greater action by state and local government;
5. a groundwater protection program requires identification and delineation of present and future water supplies in stratified drift aquifers supplying drinking water wells;
6. a comprehensive and coordinated system of land use regulations should be established that includes state regulations which protect public drinking water wells located in stratified drift aquifers;
7. municipalities with existing or proposed public drinking water wells in stratified drift aquifers should designate aquifer protection agencies; and
8. the state should provide technical assistance and education programs on aquifer protection to ensure a plentiful supply of public drinking water for present and future generations.

The Aquifer Protection Act set forth a schedule for implementation, which started with the adoption of the state Land Use Regulations. The Land Use Regulations are a culmination of over 10 years of effort involving the Department, members of the Department's Aquifer Protection Land Use Advisory Committee ("Advisory Committee"), and numerous other interested parties. The Advisory Committee included representatives of businesses, water companies, municipal governments, regional planning agencies and environmental groups. The regulations cover twenty-eight (28) land use activities that pose a threat to groundwater. The regulations which went into effect on February 2, 2004, set deadlines for the appointment of municipal Aquifer Protection Agencies, completion of Level A mapping, delineation of Level A boundaries on municipal zoning maps, and municipal adoption of aquifer protection regulations.

Model Municipal Aquifer Protection Area Regulations were published on June 1, 2005, and revised on January 1, 2006, October 1, 2007, and October 1, 2010. Municipalities with Aquifer Protection Areas are required to adopt land use regulations based on the state's Model Regulations. The timing of local adoption varies depending on the approval of Level A mapping for each well field.

Implementation of the Aquifer Protection Area Program has been gradual. As Level A mapping is completed for each well field by the water company, towns must delineate the Aquifer Protection Area boundaries on local zoning maps and adopt local regulations. The deadline for water companies to complete the mapping was June 2008, although a number of well fields have yet to be completed.

Groundwater Basics

In order for an Aquifer Protection Agency to be effective, they must be knowledgeable about the natural resource they are protecting. A good understanding of the basic concepts of groundwater and how it can become contaminated will provide the Agency the information needed to make important land use decisions as they implement the Aquifer Protection Area Program.

Groundwater Basics

Water is a precious resource, essential to all life on earth. Seventy-five percent (75%) of the Earth's surface is covered with water. However, only a small fraction of the Earth's water is available as fresh water. Unlike energy, which comes in a variety of forms, there are no substitutes for pure, fresh water. We all use water. Water is a basic necessity and is used every day for drinking, washing, cooking and watering lawns. It is also used in large quantities for industry, agriculture, manufacturing, fire protection and energy production. Most of these uses require clean, safe sources of supply.

The Hydrologic Cycle

All water on Earth and in the atmosphere is part of the hydrologic cycle. The hydrologic cycle is the continuous circulation of water from the oceans to the atmosphere to the land and back to the oceans. This complex cycle provides us with a renewable supply of water on land. Water falls from the atmosphere to the land in the form of precipitation (rain, snow, sleet or hail). Once on land, some of the precipitation may accumulate as surface water – in streams, rivers, lakes, ponds, reservoirs, wetlands, and oceans. Some water may seep downward through the soil where it is stored as groundwater. Here the spaces between sand grains and gravel or cracks in the rock are filled with water. Groundwater moves very slowly – measured in feet per day – as compared with the speed of surface water, which is measured in feet per second.

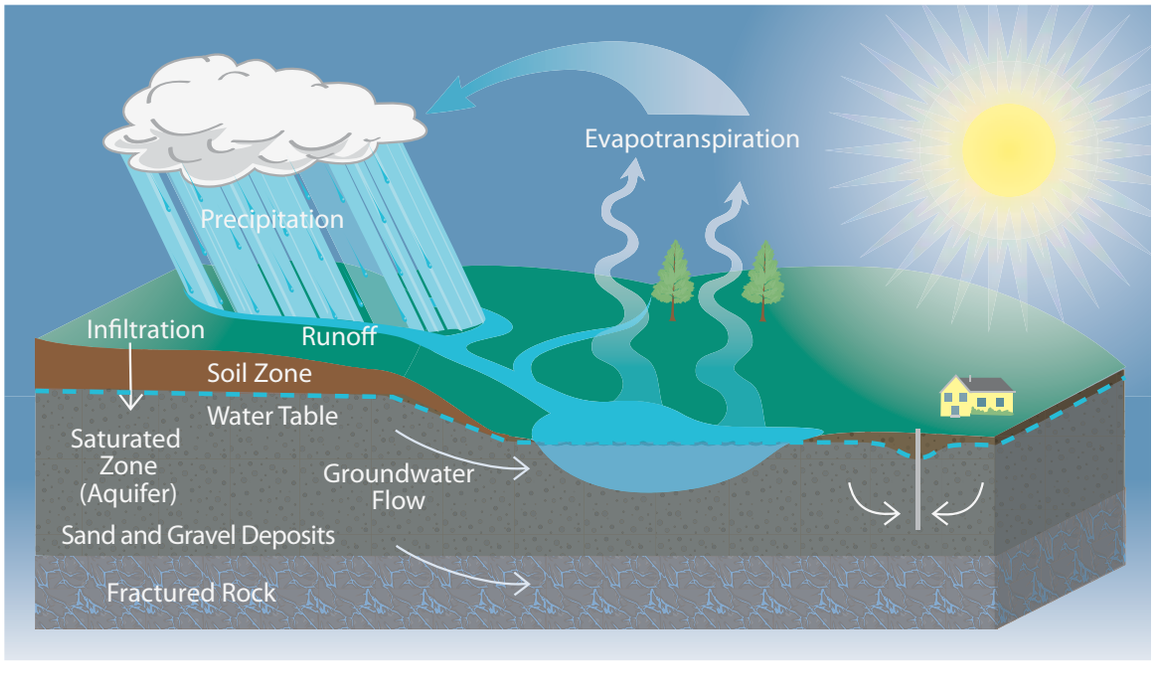


Figure 1. The Hydrologic Cycle

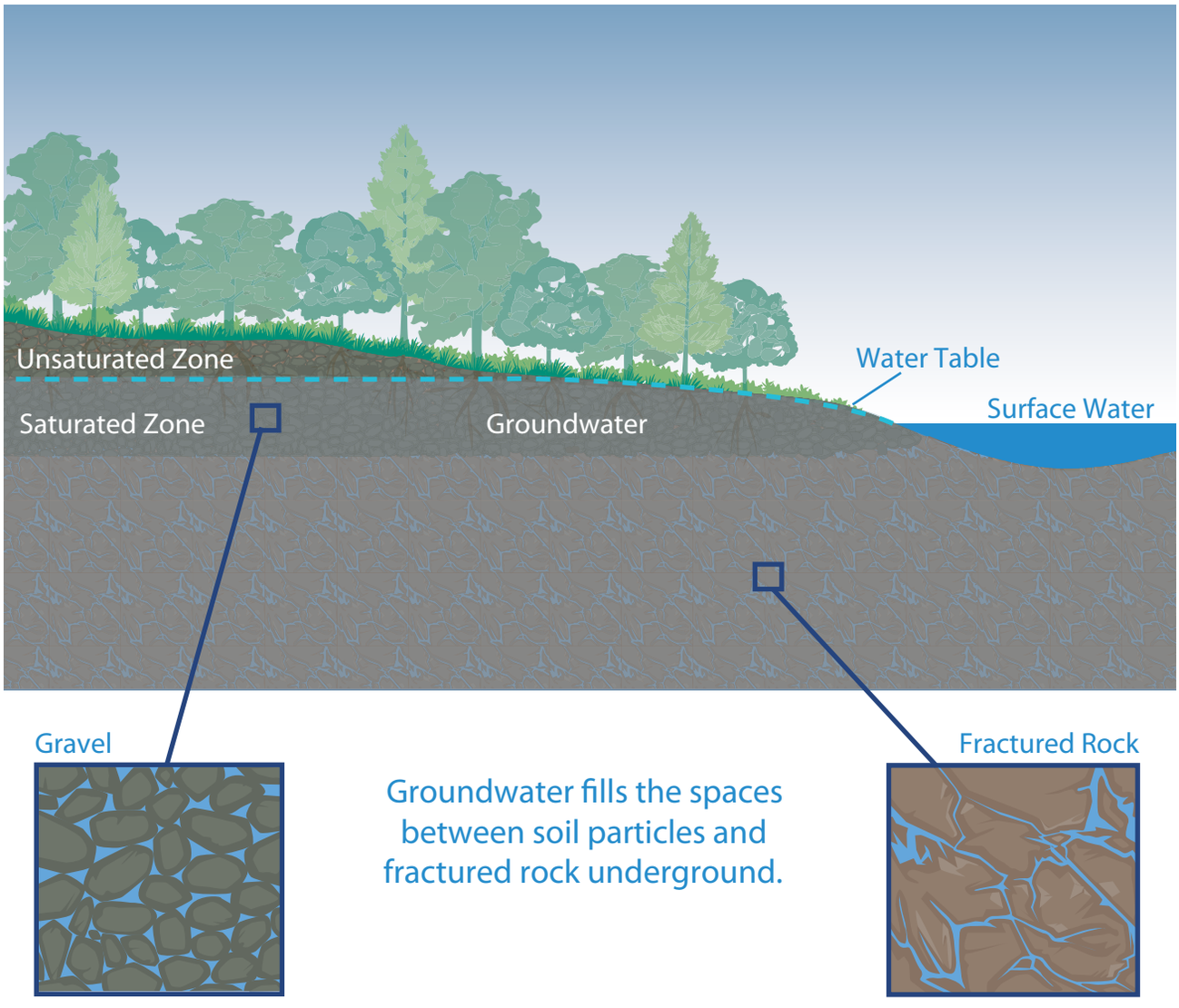
Water cycles from the oceans to the atmosphere to the land and back to the oceans. Once on land, the water may: (1) evaporate from land and re-enter the atmosphere directly, (2) flow into rivers and streams, or (3) seep downward in the soil and become groundwater. Every molecule of water is continuously moving through the hydrologic cycle.

Groundwater Basics

What Is Groundwater?

Contrary to what a lot of people think, groundwater is rarely found in underground rivers or lakes in caverns. Instead, groundwater is water that fills the pores of soil, sand, gravel and cracks in rock that lie beneath the surface of the earth – much the way water saturates a sponge. Groundwater occurs in the zone of saturation in the subsurface where the materials are permeable and have connected spaces that allow water to flow through. Groundwater moves through the soil and rock under the forces of gravity, capillary action, pressure and concentration gradients, and eventually makes its way back to rivers, lakes and the oceans.

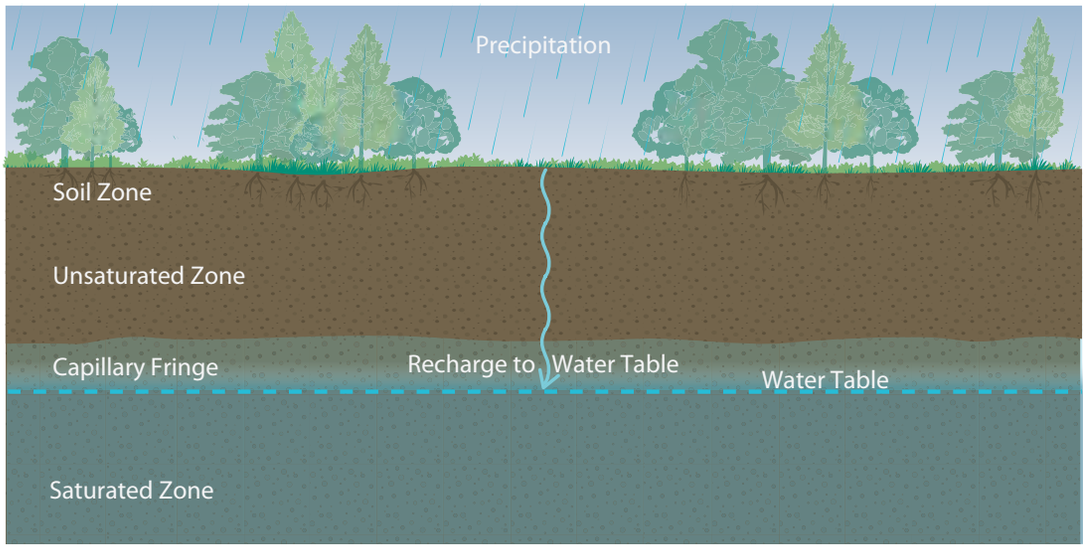
Figure 2. Groundwater



Where Does Groundwater Come From?

Groundwater begins as precipitation that falls onto the ground. Some of it runs off the land, evaporates into the atmosphere, or is taken up immediately by plant roots and transpired. The precipitation that soaks into the ground and makes it beyond the root zone is pulled down by gravity until it reaches the water table. Below the water table, all the pore spaces in the soil are filled with water. This is the saturated zone.

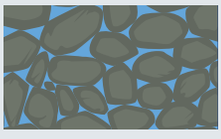
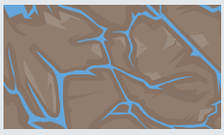
Figure 3. Recharge to the Water Table



How Is Groundwater Stored?

Groundwater is stored in **aquifers**. An aquifer is any soil or rock formation that is capable of yielding usable amounts of water to a water supply well. Connecticut has two main types of aquifers that are capable of supplying water to a drinking water well. These are stratified drift aquifers and bedrock aquifers. Figure 4 summarizes some of the characteristics of these aquifer types.

Figure 4. Connecticut's Aquifers

Stratified Drift Aquifer 	Consists of stratified layers of sand and gravel Most productive aquifers High permeability/moderate porosity Susceptible to pollution
Bedrock Aquifer 	Water is contained within fractures in the bedrock Generally, least productive aquifers Low permeability/low porosity Can yield sufficient volume of water for a private well

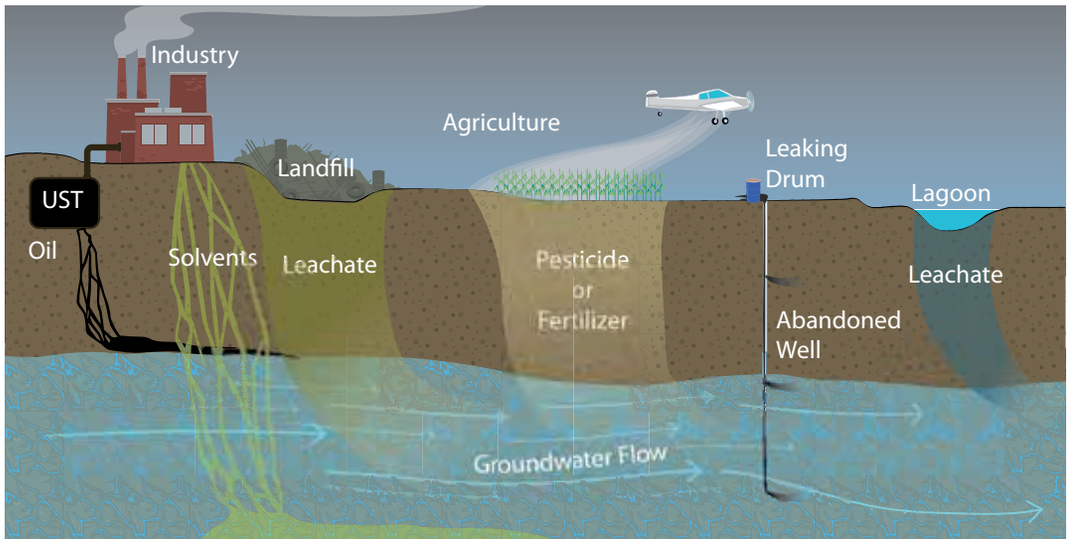
How Can Groundwater Be Contaminated?

As groundwater infiltrates down to the water table, it can pick up contaminants from the ground surface or underlying soil and move the contaminants through the groundwater system. Even though groundwater travels very slowly, contaminants can be transported great distances from their source. The contaminants can form a concentrated plume that follows the groundwater flow path.

What Are the Potential Sources of Contamination?

There are many different potential sources of contamination. Any site that has or uses hazardous materials can be considered a potential source. Some of the commonly known sources are landfills, industries, dry cleaners, underground storage tanks (USTs), chemical leaks and spills, improper waste disposal practices, improper pesticide and fertilizer use, and improper storage of road deicing materials.

Figure 5. Groundwater Contamination



What Are The Effects of Groundwater Contamination?

Groundwater contaminated with chemicals, pesticides, gasoline or oil can cause serious human and animal health problems. Those who drink it or come in contact with it can suffer diseases, nervous system disorders, liver or kidney failure, or cancer. Detection and treatment of contaminated water can be very expensive, much more expensive than taking steps to prevent the contamination from occurring in the first place.

How Is Groundwater Contamination Prevented?

Best management practices can be used to minimize the risk of groundwater contamination. For example, providing secondary containment, using leak detection systems, having an emergency spill response plan and employing waste minimization techniques can lower the risk of contamination. However, siting controls and prohibition of high risk land uses in sensitive areas can be the most effective tool available to reduce the contamination risk.