Calais Lakes and Streams COMMITTEE
SPRING 2015 Ed. 15-01

Groundwater

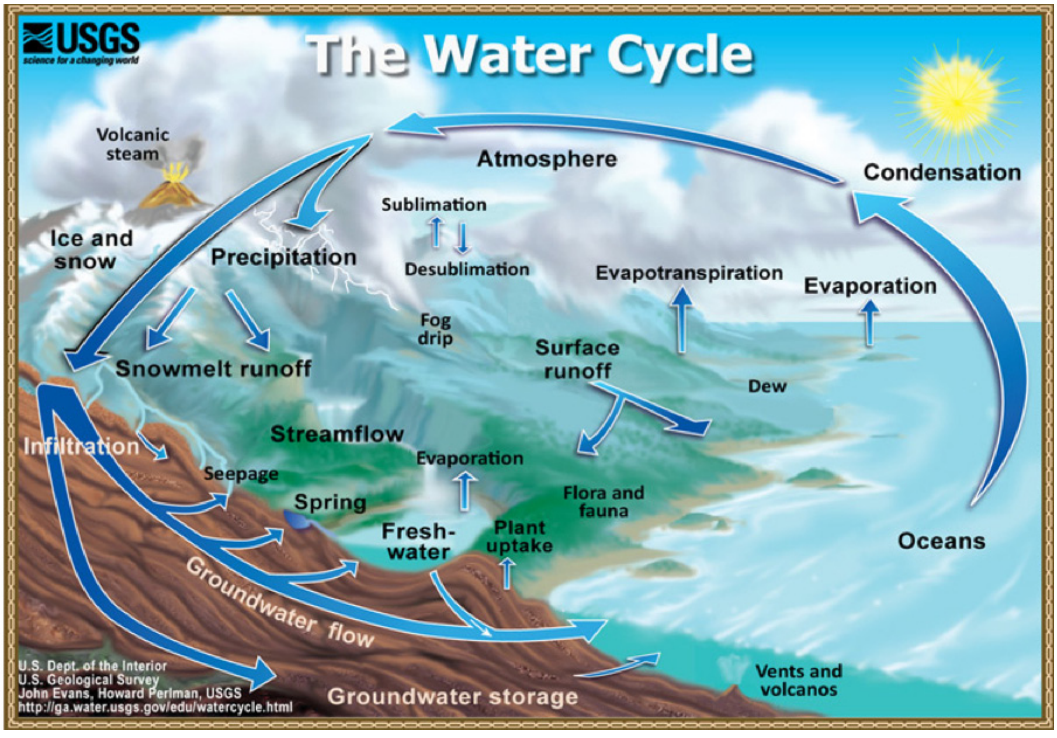
Groundwater is one of Vermont's most valuable and least understood natural resources. It provides the drinking water for nearly all Calais residents, who tap into the groundwater through wells or spring boxes. Keeping our groundwater pure and available is of the utmost importance to the well-being of our community. With so many articles in state and national publications on issues affecting groundwater, including excessive draw-down of aquifers due to irrigation and pollution resulting from fracking and mining operations, it is important to develop an understanding of what groundwater is and what we can do to protect it. Groundwater is an issue that we all need to understand.

What is Groundwater ?

Groundwater is something we seldom consider. It is an invisible resource that flows into our houses whenever we turn on the tap. Being readily available, we often take it for granted.

Walking across our yards and gardens, the solidity of the earth beneath our feet is an accepted certainty. This seems particularly true when one has spent the day digging the garden plot. Yet, what seems so solid is really filled with openings that allow water to flow deeper into the earth or slip sideways to other locales. In fact, beneath our feet, water is constantly moving, flowing between layers and fractures in rocks. Even in winter underneath the ice and snow, water continues to flow in drops, trickles or torrents underground below the frost line.

Groundwater occurs as part of one of the oldest recycling programs. Called the hydrologic or water cycle, it involves the continual movement of water between the earth and the atmosphere through evaporation and precipitation. As rain and snow fall to earth, some of the water runs into lakes, rivers, and the oceans; some evaporates; and some is absorbed by plant roots. The rest of the water soaks through the ground's surface and moves downward through the unsaturated zone, where open spaces in rocks and soil are filled with a mixture of air and water, until it reaches the water table. The water table is the top of the saturated zone, or the area in which all interconnected spaces in rocks and soil are filled with water. The water in the saturated zone is called ground water. The water from oceans, rivers and lakes evaporates into the atmosphere to form clouds, eventually falling back to earth again as rain or snow-thus beginning the cycle all over again.



continued on page 2

Groundwater is stored under many types of geologic conditions. Areas where groundwater exists in sufficient quantities to supply wells or springs are called aquifers, a term that literally means "water bearer." Aquifers store water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks. An aquifer's storage capacity is controlled largely by its porosity, or the relative amount of open space available to hold water. Its ability to transmit water, or permeability, is based in part on the size of these spaces and the extent to which they are connected.

Risks to Calais Groundwater

There are primarily two risks to groundwater: pollution and depletion through excessive withdrawal.

Depletion of Groundwater

Depletion of groundwater occurs when the rate of withdrawal exceeds the rate of replenishment from snow and rain. The causes of depletion are typically commercial, industrial or agricultural uses, not residential ones. Because Vermont has plentiful rainfall, wells that tap groundwater for agricultural irrigation are uncommon and unlikely to threaten groundwater supply; nor are industrial uses common since most of Vermont and all of Calais is rural. However, industrial uses of groundwater could expand in the future. For example, Calais could face the risk of a commercial bottling business which sells water drawn from local groundwater. Fortunately town officials have already recognized this risk and taken action in the draft Town Plan.

Excessive withdrawals would affect the availability of water to residents, to wildlife and have adverse impacts on lakes and streams.

Pollution of Groundwater

Until the 1970s, ground water was believed to be naturally protected from contamination. The layers of soil and particles of rock were thought to act as filters, trapping contaminants before they could reach the ground water. Recent decades have shown this to be untrue. According to the U. S. Environmental Protection Agency, from 1971 to 1985, 245 groundwater-related disease outbreaks, with 52,181 associated illnesses, were reported nation-wide. In addition, approximately 74 pesticides, a number of which are known carcinogens, have been detected in the ground water of 38 states.

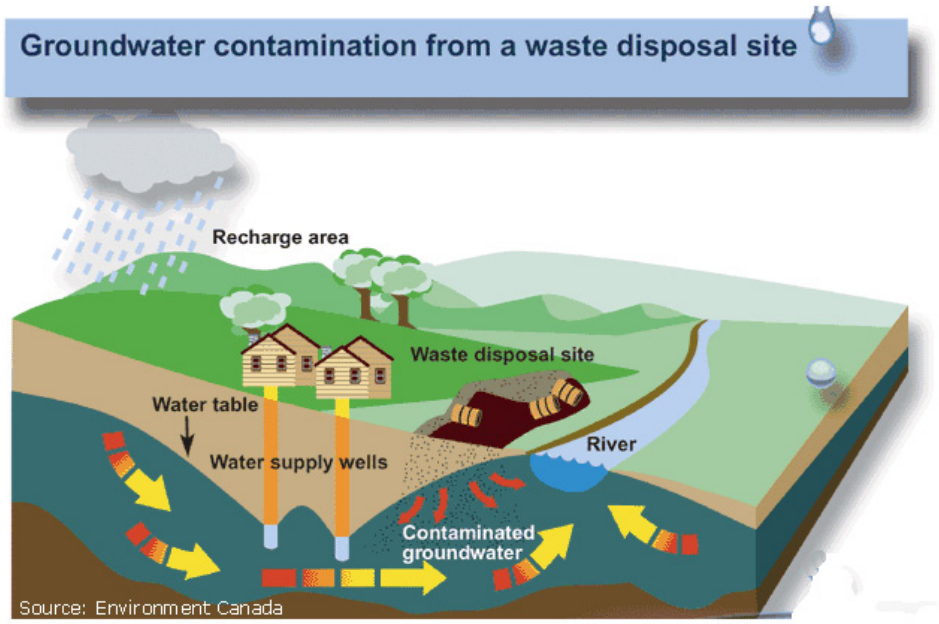
What kinds of substances can contaminate groundwater and what is their source?

CONTAMINANT	COMMON SOURCES
Salt	Highway treatments to de-ice winter roads
Bacteria and viruses	Septic tanks, cesspools and privies; wastewater treatment facilities
Pesticides and Fertilizers	Agricultural activities, residential lawns and gardens, waste water treatment facilities, unlined landfills
Heavy metals and hydrocarbons	Unlined landfills; underground storage tanks for gasoline, fuel oil, and numerous chemicals; accidents involving chemical and petroleum spills
Radon and radioactivity	Naturally occurring substances contained in bedrock that leach into the groundwater

continued on page 3

Having your well water tested for contaminants is worthwhile to protect your family's health. Kits for testing water quality can be obtained from the Vermont Department of Health by calling 1-800-660-9997 or 802-863-7560.

What can be done after contamination has occurred? In comparison with rivers and streams, groundwater tends to move very slowly. Therefore, once the contaminant reaches the groundwater, dilution or dispersion is very slow. Because groundwater is hidden from view, contamination can go undetected for years until it is tapped for use. Cleaning up contamination is a complicated, costly and sometimes an impossible process. In the technically simplest cases, the contaminant can be confined to a small area or treated in place underground. If the contaminant is more pervasive or toxic, then the water is withdrawn and treated before it is used or it is detoxified and returned to the aquifer. Unfortunately there are situations where the aquifer must be abandoned and alternative sources of water found. Communities whose groundwater supply has become contaminated face a technically difficult and costly problem.



What is Vermont Doing to Protect Groundwater?

Protecting groundwater requires knowing the location, quantity and quality of the groundwater and establishing laws that protect its purity and availability for Vermonters.

Groundwater Mapping- Understanding location, quantity and quality

The Vermont Geological Survey of the Vermont Department of Environmental Conservation conducts groundwater studies using geologic mapping and well data. The products of these studies are a group of maps based on a study of a town's bedrock geology, its glacial deposits laid down on top of the bedrock and data about wells, including the yield, depth and material through which the wells were drilled. The resulting maps identify thickness of surface materials, depth to the water table, generalized groundwater flow directions, recharge potential and potential aquifers in the glacial deposits on top of the bedrock. Thick and extensively saturated sand and

continued on page 4

gravel in the material atop the bedrock, as well as open and interconnected fractures in the bedrock, are likely locations with high water yields. Analysis of aquifers in the bedrock leads to an understanding of an area's ability to replenish its groundwater.

Vermont Legislation to Protect Groundwater

In 2008 the state legislature adopted Act 199, which declares that ***groundwater is a public trust resource***. Further, it establishes a groundwater-withdrawal permitting and reporting program. Any proposal to withdraw in excess of 57,600 gallons of groundwater per day must be approved by the Agency of Natural Resources (ANR) based on a determination that the proposal does not adversely affect existing users, public water systems, wetlands, or Vermont water-quality standards and resources. Calais believes that greater protection is warranted and has set stricter standards discussed in the article that follows.

In 2011 the Vermont Environmental Court held that the groundwater public trust is to be broadly interpreted. Accordingly, the state must manage groundwater such that it is protected from both over extraction and pollution.

This was tested in an appeal by neighbors who questioned the solid waste certification issued by ANR to Omya Solid Waste Facility in Pittsford. The residents there raised concerns about groundwater pollution from waste generated by Omya as part of its quarrying operation. In its decision, the court wrote, "Nothing about the language or structure of that statute [Act 199] restricts the public trust to groundwater quantity alone. To the contrary [Act 199] explicitly mandates that the state manage its groundwater resources for the benefit of its citizens, both with regard to groundwater quantity and quality." By this decision the court established a precedent that is highly protective of groundwater.

For more information about Act 199, regulations and permits overseen by the state, contact the Drinking and Groundwater Protection Division of the Vermont Department of Environmental Conservation (www.drinkingwater.vt.gov).

How is Calais Addressing Groundwater?

Recognizing that clean water is our most precious commodity, Calais is taking steps to map its groundwater and create policies to protect it. These will be used to identify new supplies of water and protect existing ones.

Groundwater Mapping in Calais

Under the leadership of Grant Orenstein, local citizens of Calais have been working with the Vermont Geological Survey to secure maps of the Calais groundwater. The first step was to gain knowledge of the bedrock and surface materials. Maps of these materials were completed in 2015. These maps, which are part of the larger Plainfield Quadrant may be viewed on-line at:
http://www.anr.state.vt.us/dec/geo/images/digitalofrs/PlainfieldQuad/PlainfieldSurfGeo.pdf and
http://www.anr.state.vt.us/dec/geo/images/digitalofrs/PlainfieldQuad/PlainfieldQuadBedrockP1.pdf To develop complete groundwater resource maps the materials information must be integrated with water chemistry and well data. To view examples of completed groundwater projects go to:
http://www.anr.state.vt.us/dec/geo/GwaterTownIndex.htm Calais resource maps will be posted to this site when they are complete sometime in 2015.

continued on page 5

Calais Policies to Protect Groundwater

In order to protect its groundwater, Calais relies, to a large extent, on Vermont laws, regulations and permits. However, in some cases, Calais believes that greater protection is needed. Through its Town Plan, which is currently undergoing revision, Calais has established its own goals for protecting, conserving and assuring the availability of water for future growth.

Here are two examples wherein the proposed Calais Town Plan provides greater protection than state laws and regulations:

The extraction of water, from the ground or a body of water, for direct commercial resale as bottled water, flavored or non-flavored, is prohibited.

Extraction of less than 20,000 gal/day is allowed for small current or future businesses that reside in Calais. (State law allows extraction of up to 57,600 gal/day.)

To acquaint yourself with the specifics of how Calais' policies protect and preserved water, go to the "Municipal Services and Resources" chapter of the draft Town Plan which is available on the town's website (www.calaisvermont.gov).

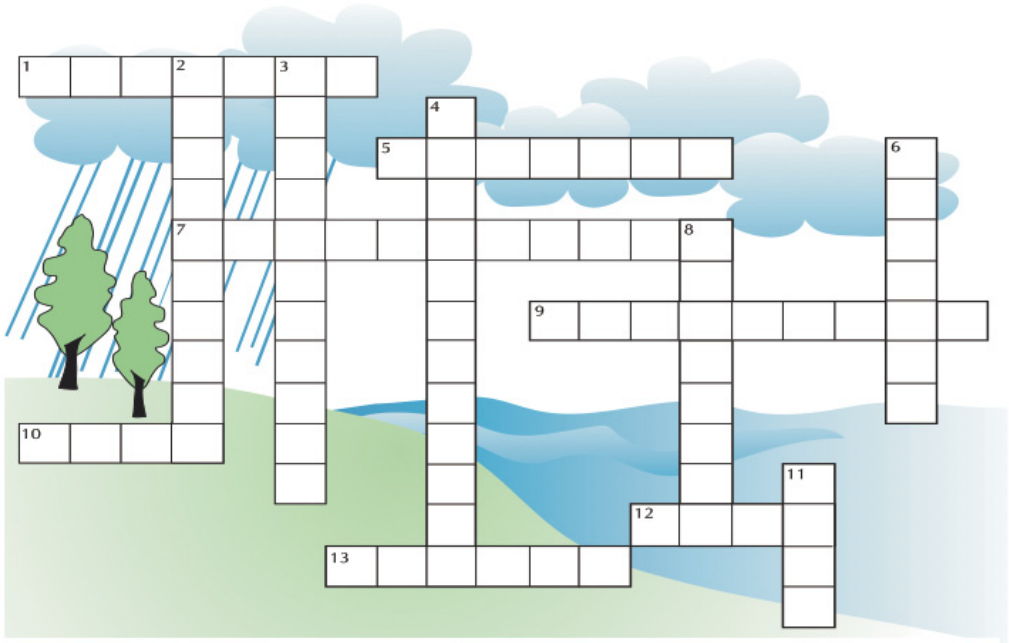
Water Cycle Crossword

Across:

1. Layers of soil, sand and rocks that store groundwater.
5. To contaminate, to become unclean
7. Water that is found underground in the cracks and spaces in the soil, sand, and rocks.
9. Groundwater leaves the ground and enters a lake or stream in a _____area.
10. An example of precipitation
12. A pipe in the ground that is used to extract water from an aquifer.
13. Water on the earth's surface which moves into a lake or streamwithout absorbing intothe soil.

Down:

2. The largest use of groundwater is _____.
3. The stage of the water cycle when water changes to a liquid.
4. Clounds are an example of this.
6. A long period of dry weather could cause a _____.
8. In the water cycle, when water soaks into the soil.
11. The movement of water under ground is called groundwater _____.



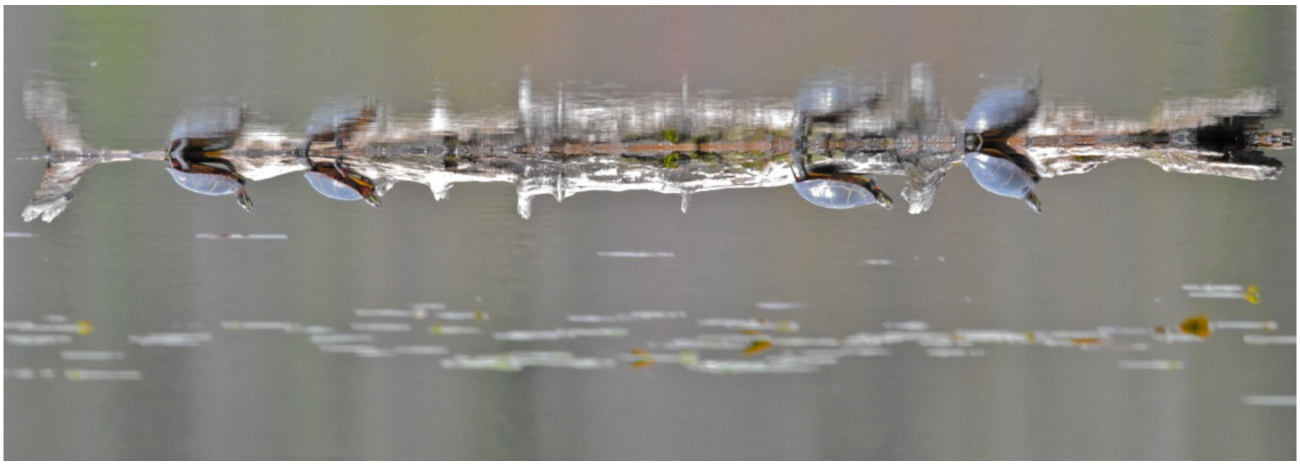
Answers can be found on Calais Town website in the Calais Lakes and Streams Committee section.

Calais Lakes and Streams COMMITTEE

SPRING 2015
Ed. 15-01

To volunteer or for more information, contact:

Colleen Bloom	colleen.bloom@gmail.com	Wilson Hughes	wilson.hughes@yahoo.com
Noreen Bryan	noreen1945@yahoo.com	Victoria King	vkingvt@gmail.com
Laura Brown	454-7723	Ram Verma	rgverma@live.com
Larry Bush	cambs.larry@gmail.com	Clay Whitney	cwhitney@cabotcheese.com
Ginger Clammer	vclammer@aol.com		
David Ellenbogen	pianomath@gmail.com		



Calais Lakes and Streams COMMITTEE
PO Box 63
Calais, VT 05648

FIRST CLASS
PRE-SORT
U.S. Postage
PAID
Montpelier, VT
Permit No. 61

This Newsletter is Sponsored by
The Town Of Calais