Groundwater – An Important Rural Resource: Protecting the Quality of Groundwater Supplies

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This is the third of four Factsheets for Ontario's farmers and other rural residents to learn more about groundwater - natural groundwater quality, common threats to rural groundwater quality and ways to protect groundwater quality.

Other Factsheets in this series include:

- Understanding Groundwater (Order No. 06-111)
- Managing the Quantity of Groundwater Supplies (Order No. 06-113)
- Private Rural Water Supplies (Order No. 06-117)

Groundwater is a precious resource for rural families and businesses. In some situations, it may be the only water source. When living in a rural area, it is important to understand what steps can be taken to help protect the integrity of groundwater supplies.

All natural waters such as rain, surface water and groundwater contain some small amount of dissolved materials. As groundwater seeps into the soil and travels through a geological formation, it may dissolve minerals. The amount and type of dissolved materials contained in groundwater will depend on the type of minerals present in the formation, how long the water is

in contact with those minerals and what other materials were already dissolved in the water before it came in contact with those minerals.

A formation is a layer of underground bedrock or sediment that consists of one or a combination of types of geological materials (e.g., sand, gravel, etc.). An aquifer is a saturated formation that can yield useful amounts of water if pumped. Aquitards are low-permeability materials that hinder the movement of water. Key groundwater terminology is discussed further in the OMAFRA Factsheet Understanding Groundwater (Order No, 06-111).

Ontario's groundwater quality is generally good and suitable for use with little or no treatment. Naturally occurring minerals may occasionally adversely affect the water's aesthetics - its appearance, smell or taste - resulting in hardness, a rotten-egg smell or staining. In a small number of locations, however, dissolved minerals or natural substances (e.g., arsenic, salt or oil deposits) may make the water unsafe to drink. One of the main benefits of drinking groundwater is that it is much less vulnerable to microbiological contamination or pathogens than surface water supplies.

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Well Capture Zones

The area of the aquifer from which a well draws water is called the well's capture zone. In other words, groundwater found in the capture zone will eventually be "captured" and pumped out of the ground at the well. Small domestic wells may have very small capture zones. Large municipal wells usually have large capture zones - greater than one square kilometre in size; this, however, may only affect a small part of the entire aquifer.

A capture zone is an area of land that provides water for a well. Groundwater found in the capture zone will eventually be captured and pumped out of the ground at the well.

Capture zones can change in size and shape in response to changes in pumping rate or recharge to the aquifer. Scientists can use information about a well's construction, well pumping rate, water table elevations, drawdown cones and formations at the well owner's site to determine specific capture zones.

Threats to Groundwater Quality

In a rural setting, there are potential contaminant sources associated with human activity that may affect groundwater quality. These can be point sources where potential contaminants are concentrated or stored in one spot, such as a fuel storage tank. There are also non-point sources where potential contaminants are spread over a wider area, such as applied nutrients or pesticides on agricultural fields. Types and potential sources of contaminants commonly found in rural areas are presented in Table 1, below.

To help assure a clean source of groundwater, it is important to know where aquifers are located so that steps can be taken to protect them - especially those areas that are within the capture zones of drinking water wells.

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Table 1. Potential pathways and sources for materials found commonly in rural areas that can contaminate groundwater.

Material: Pathogens

Potential Sources/Pathways:

- Septic systems
- Surface application of manure and municipal biosolids
- Municipal sewers
- Storage of manure and human wastes
- Poor well seals or construction

Material: Nitrate

Potential Sources/Pathways:

- Lawn fertilizers
- Septic systems
- Surface application of fertilizers, manure and municipal biosolids
- Plowdown legume crops

Material: Pesticides

Potential Sources/Pathways:

- Application to fields
- Leakage from builk storage

Material: Solvents

Potential Sources/Pathways:

- Leakage from workshops and bulk storage
- Discharge of hazardous household or farm wastes to septic systems or onto the ground
- Some septic system cleaners
- Discharge from dumps and landfills

Material: Fuels

Potential Sources/Pathways:

- Leakage from vehicles, workshops and bulk storage
- Leaks from underground storage tanks (USTs) and piping
- Accidental discharge to septic systems

Material: Salt

Potential Sources/Pathways:

- Surface application of winter de-icing and dust suppression chemicals
- Naturally occurring formations

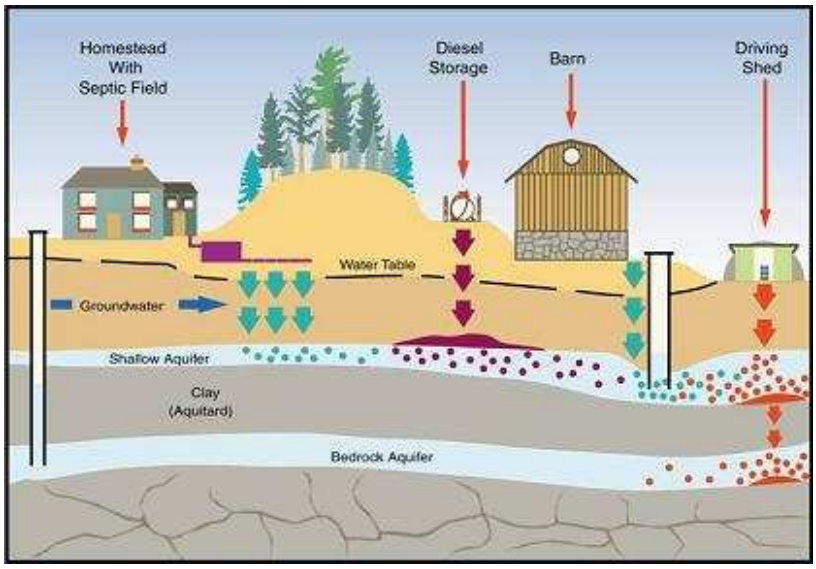

Figure 1. The vulnerability of groundwater is generally related to how rapidly water infiltrates to an aquifer.

Protecting the Rural Groundwater Resource

The vulnerability of groundwater to contamination varies across the landscape. The vulnerability of each aquifer is unique, and determining factors include the type of formation, its depth and whether or not it is protected by a low-permeability aquitard (made of dense materials such as clay).

The effect of different types of formations on groundwater vulnerability is shown in Figure 1, above. As the depth of a protective aquitard increases, the time it takes for water and any

contaminants to move underground increases too. The longer it takes for water to infiltrate, the greater the degree of purification through prolonged contact with soils. For instance, a shallow, unconfined aquifer is usually more vulnerable to potential contamination sources than a deep, confined aquifer. Water may have to pass through an aquitard to reach a deep, confined aquifer.

Best management practices on farm and rural properties can minimize the impact of potential point and non-point contaminant sources. Proper construction and maintenance of a well will help to prevent it from becoming a pathway for surface water and contaminants to reach the groundwater. Similarly, if you decide to no longer use a well, it must be properly plugged and sealed. Landowners have a legal responsibility for the condition of all wells on their property, under the authority of Ontario Water Well Regulation. This regulation is available on the Ontario Ministry of the Environment website, which is listed on the next page.

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Taking Action Now

There are many sources of information for private water well owners in Ontario.

The information kit entitled Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well (Order No. BMP 12K), published by the Ministry of Health and Long-Term Care, provides in-depth guidance on how to maintain private water supplies. It also shows how and when to have water tested, and the acceptable levels of dissolved materials and indicator bacteria counts in drinking water.

Information on different types of wells and the management of highly vulnerable water supplies is provided in the OMAFRA Factsheet Private Rural Water Supplies (Order No. 06-117).

Figure 2. Fuel tanks can be placed in a dike to provide secondary containment in case of a spill.

Improperly stored or applied pesticides and other chemicals pose risks to water quality. The OMAFRA Factsheet Pesticide Contamination of Farm Water Supplies: Recommendations on Avoidance, Cleanup and Responsibilities (Order No. 00-099) is a useful guide to help avoid or deal with spills of pesticides or other chemicals, on the farm or other rural properties.

Other Sources of Information

OMAFRA. Best Management Practices: Water Wells, Order No. BMP 12

OMAFRA Factsheet. Pesticide Contamination of Farm Water Supplies: Recommendations on Avoidance, Cleanup and Responsibilities, Order No. 00-099

Ontario Ministry of the Environment. Well Aware - A Well Owner's Guide (videotape)

Ontario Ministry of the Environment - Ontario Water Well Regulation

Ontario Ministry of Health and Long-Term Care. Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well, BMP 12K

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