Groundwater Management

As population grows, so does the demand for water. In order to manage groundwater supplies sustainably, conservation and efficient use of water will be necessary. Government, industry, and citizens all have a role to play in the wise management of groundwater resources. This fact sheet provides an overview of the responsibilities of government and groundwater users in Alberta.

Provincial Responsibilities

Legislation

Legislation that is in place to protect Alberta's groundwater from overuse and contamination includes the *Water Act* and the *Environmental Protection and Enhancement Act*.

Alberta's *Water Act* regulates the withdrawal, diversion, and use of groundwater. A licence is required to withdraw water for all purposes other than **household** and **traditional agricultural uses**. A licence application can be refused for projects that threaten groundwater resources, or a licence may include conditions that require additional actions for the applicant, such as monitoring and reporting the affect of the groundwater withdrawal on the aquifer.

Approvals for groundwater withdrawals are required for industrial activities that may impact groundwater supplies such as coal mines, coalbed methane development and gravel pits. Applicants are required to assess potential risks to groundwater, and involve the public through notification and input.

Alberta's *Environmental Protection and Enhancement Act* regulates:

- the release of substances that may cause adverse effects on groundwater
- the reclamation or remediation of contaminated groundwater sites
- treatment of groundwater for public drinking water purposes

More information on these Acts is available at: ESRD.Alberta.ca search "water legislation"

Data and Research

Limitations on groundwater knowledge affect the ability to make informed decisions when the demand for groundwater grows. The collection of groundwater information supports water and land use management decisions.

Household use
Albertans living on property under which groundwater exists have the statutory right to use up to 1250 m^3 of water per year (275,000 imperial gallons) for drinking, cooking, washing and sanitation. The average home uses 200 – 250 gallons per day.

Traditional agricultural use
Albertans may also divert an additional 6250 m^3 of water per year (1,375,000 imperial gallons) for raising animals or applying pesticides to crops as part of a farm unit without a diversion licence but they do not have priority of right to that water. When the *Water Act* came into effect in 1999, there was a one-time voluntary opportunity for farmers to register their use. Priority was granted dating back to the time of first use. Registration gives them priority of right and protects their continued use of that water in times of water shortage.

Provincial Groundwater Inventory Program

Alberta Environment and the Alberta Geological Survey partnered in 2008 to create the Provincial Groundwater Inventory Program, to map and inventory provincial groundwater resources. One innovative component of the program is airborne geophysical surveys to help identify and delineate the boundaries of important aquifers.

The Alberta Government supports several initiatives to fill knowledge gaps on key groundwater characteristics and issues:

- **Groundwater Risk Assessment**: To identify potential issues that may impact the quantity and quality of Alberta's groundwater resources now and in the future.
- **Provincial Groundwater Inventory Program:** To enhance our knowledge of provincial aquifers and create tools to assist us in sustainable management of groundwater resources.
- **Groundwater Observation Well Network:** To monitor water levels and quality of groundwater in aquifers throughout Alberta.
- **Alberta Water Well Information Database:** To collect information on the location of water wells, depths of groundwater and groundwater chemistry.

Groundwater Users in Alberta and their Responsibilities

There are many individuals, groups and agencies involved in ensuring Alberta's groundwater supplies are protected and managed sustainably. The following are some common groundwater users and their responsibilities:

Private Well Owners:

Well owners are responsible for ensuring the safety of their water through proper construction, operation, maintenance and decommissioning of their domestic water wells according to *Water Act* regulations.

- The *Water Wells That Last* handbook is a valuable resource for well owners and is available at: WorkingWell.Alberta.ca

- The *Working Well* program provides well owners with the information and tools they need to properly care for their wells and protect their groundwater resources from contamination. Learn more about *Working Well* at: WorkingWell.Alberta.ca

Public Water Systems Operators:

Many rural communities in Alberta rely on groundwater for their drinking water. The quality of the groundwater and the size of the community served determine whether or not health-related treatment is required through an approval under the *Environmental Protection and Enhancement Act* regulations. These regulations set the design, performance and monitoring standards for both treatment and distribution of water to the public.

Public systems that service smaller populations, such as rural schools, campgrounds, resorts, gas stations, small residential developments, community halls, etc., are regulated through Alberta Health & Wellness and must follow the

Environmental Public Health Field Manual for Private, Public and Communal Drinking Water Systems in Alberta to ensure safe, secure drinking water supplies.

The operator of any public water system must obtain a diversion licence from Alberta Environment. The licence may include conditions that require the licensee to regularly submit water monitoring data and the volumes of water diverted, and may also require them to mitigate any problems that develop if their water withdrawal has any impact on nearby groundwater users.

Shallow groundwater wells used as the source for public water supplies must be assessed under the *Guideline for Groundwater under the Direct Influence of Surface Water* (GWUDI) as they are more at risk of contamination by pathogens from nearby surface water or infiltrating precipitation. Health-related treatment similar to that required for surface water sources is generally required under an approval.

High quality groundwater wells completed in deeper aquifers must be registered with Alberta Environment and follow the requirements of the *Code of Practice for Waterworks Systems Using High Quality Groundwater*. Treatment is less stringent because the quality of groundwater already meets or exceeds the physical, chemical and radiological Maximum Acceptable Concentrations for parameters specified in the *Guideline for Canadian Drinking Water Quality* as required for safe drinking water.

Agricultural Operations:
Producers often use groundwater to supplement their overall water needs when surface runoff (dugouts) and surface water supplies aren't sufficient. Groundwater may be used for watering livestock, crop spraying, washing equipment, machinery, barns and storage facilities and for household purposes.

If a producer does not have a registration under the *Water Act* they must obtain a licence from Alberta Environment to divert and use groundwater. The licence may have conditions attached requiring them to monitor and report the affect of their withdrawal on neighbouring users. Any impact would require mitigation and problem solving.

Producers are encouraged to follow best management practices to ensure their activities have minimal impact on groundwater resources, including the environmental standards for manure management and the development of confined feeding operations set out in the *Agricultural Operations Practices Act* related to the protection of groundwater resources.

Water Well Drillers:
In Alberta, water wells must be drilled by certified journeyman water well drillers who hold a current Approval to Drill. This ensures that proper drilling and construction methods are used to access groundwater and prevent contamination of aquifers. The *Water (Ministerial) Regulation* of the *Water Act* sets out drilling and construction standards to protect groundwater. The *Water (Ministerial) Regulation* can be viewed at:
www.qp.alberta.ca

Drillers submit water well drilling reports to assist the government in collecting information on groundwater resources. This information is stored in the Alberta Water Well Information Database that is available publically at:
www.waterforlife.alberta.ca

Alberta Water Well Drilling Association

Is a non-profit organization that promotes and supports the water well drilling industry in Alberta. More information is available at:
http://www.awwda.com/index.html

Oil Recovery Operations:
Alberta's oil industry extracts large volumes of oil using conventional technologies where oil either flows to the surface under its own pressure or is lifted by pumps in the wellbore. Over time, as the oil is removed, pressure in the formations declines so operators must use enhanced recovery methods to recover additional oil. Enhanced recovery often involves pumping large volumes of water into the formation to displace the remaining oil.

In the case of thermal oil recovery, which is used in some oil sands projects in northern Alberta, water is heated to create steam. Steam is injected to heat the sticky oil (bitumen) to make it thinner, enabling it to flow more readily to producing wells.

- Operators must always ensure fresh groundwater located above the **base of groundwater protection** is protected.
- Operators must apply to Alberta Environment for a water diversion licence to use groundwater for enhanced oil recovery and their licence conditions may require them to monitor and report their water use, to ensure their water use has no impact on neighbouring groundwater users.
- Operators must follow the standards outlined in the *Water Conservation and Allocation Guideline for Oilfield Injection (2006)* to prevent excessive use of water during enhanced oil recovery operations and to reduce environmental impacts. This document is available at:
  www.ESRD.Alberta.ca
- Many oil and gas operations already use saline groundwater instead of fresh groundwater. Saline groundwater use does not require a diversion licence.
- Any produced water from operations must be properly disposed of into deep disposal wells. Operators must also carefully manage water transport and disposal to prevent contamination onto ground surfaces.

Base of groundwater protection

In Alberta, groundwater is considered fresh when it has total dissolved solids (TDS) less than or equal to 4000 mg/L. The depth at which groundwater salinity is greater than 4000 mg/L is considered the base of groundwater protection and has been mapped. This information is available at:
https://www3.eub.gov.ab.ca/Eub//COM/BGP/UI/BGP-Main.aspx#

Coalbed Methane Operations:
Coalbed methane is a natural gas found in coal seams. By reducing the natural pressure within a coal seam, gas can be released and will flow towards the surface through a well. The potential for coalbed methane to affect groundwater primarily depends on the depth of the coal seams and whether they are dry or wet.

Standard for Baseline Water-Well Testing for Coalbed Methane/ Natural Gas in Coal Operations (2006) is available at: http://www.environment.alberta.ca/01206.html

In Alberta, coalbed methane development began in 2002. So far development has not had significant associated water production because the coal seams targeted have been dry. When groundwater is present, it must be removed to reduce the pressure within the formation in order to free the gas.

When dewatering is necessary, operators must obtain prior approval from Alberta Environment if the coal seams are located above the **base of groundwater protection**.

Operators must follow the *Standard for Baseline Water Well testing for Coalbed Methane/Natural Gas in Coal Operations (2006)* and collect baseline water quality and quantity information on surrounding water wells, within a specified radius, to refer to and help assess whether any impact of their drilling has occurred if allegations are made.

All coalbed methane wells must be constructed and operated to prevent mixing between groundwater zones of different water quality, to protect aquifers and household water supplies.

Shale Gas Operations:
Gas occurs naturally in very deep shale formations but is difficult to extract because shale formations are generally tight and hold the gas in. However, recent technological innovations have made it possible to extract the gas using long, horizontal wells and intensive hydraulic fracturing. Large volumes of water and sand are pumped into the shale to create fractures so the gas can be released and removed. Shale in Alberta predominantly produces methane, but some formations will produce hydrogen sulphide (H_2S), carbon dioxide (CO_2), ethane and propane.

Currently the volumes of water needed in shale gas operations are much larger than in the conventional gas operations.

Operators must obtain a diversion licence from Alberta Environment when fresh groundwater is used in hydraulic fracturing. Saline groundwater is an option in some operations and its use does not require a licence.

Shale gas development is new to Alberta and the use of fresh groundwater is currently small but it will increase in the future. Well construction and water and other environmental management requirements are currently being

developed to ensure future shale gas operations have minimal impact on groundwater resources.

Open-Pit Mine Dewatering:
Open pit coal and oil sands mines must dewater adjacent aquifers to prevent collapse of the pit walls. Large volumes of groundwater are often diverted and discharged away from these pits to local surface water drainage systems. Mine operators must:

- Ensure any discharged water from their operations meets the *Surface Water Quality Guidelines for Use in Alberta* before it can be released. If the water is too saline it must be stored on-site or disposed of into deep disposal wells.
- Obtain approval under the Water Act and obey conditions, including investigating the extent of formation dewatering and the affect that might have on local groundwater users.

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Last update: August 2011

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