



The drop on water

Ground Source Heat Pumps

What are ground source heat pumps?

Ground source heat pumps are heat pumps that transfer heat to or from the ground and use it for heating or cooling buildings. They are also commonly referred to as geothermal heat pumps, groundwater heat pumps, geo-exchange systems, and earth energy systems.

What are the advantages of ground source heat pumps?

Ground source heat pumps use a renewable, cost-effective, alternative energy source that can help reduce greenhouse gas emissions. They are currently being used in residential, commercial, and institutional buildings in Nova Scotia and elsewhere. The use of these systems is expected to grow because of increasing energy costs and concerns about greenhouse gas emissions.

What are the different types of ground source heat pumps?

A variety of ground source heat pump designs and technologies are available. They can be grouped into two main types of systems: open-loop (see Figure 1) and closed-loop (see Figure 2).

An open-loop system (water well system) pumps groundwater from a supply well, passes the water through a heat pump to transfer the heat, and then discharges the water to a return well or discharge well. This type of system typically uses at least two wells, one for supply and one for discharge.

A closed-loop system has a loop of pipe buried in the ground or installed in a borehole. The system circulates antifreeze fluid through the loop of pipe. The fluid is sealed in a pipe and never comes into direct contact with the ground. These systems do not pump any water out of the ground. A closed-loop system in a shallow trench is called a horizontal loop system. A closed-loop system installed in a borehole, or series of boreholes, is called a vertical loop system.

QUICK FACTS

- Ground source heat pumps transfer heat to or from the ground and use it for heating or cooling buildings.
- The two main types of ground source heat pumps are open-loop and closed-loop systems.
- Ground source heat pumps use a renewable energy source that can help reduce greenhouse gases.
- Ground source heat pumps should be designed and installed by qualified and experienced contractors.
- Follow regulations and best management practices for the installation and operation of ground source heat pumps to minimize environmental impacts.

Ground Source Heat

Are they safe for the environment?

Ground source heat pump systems are environmentally safe when they are designed, installed, and operated properly. Two potential environmental concerns exist:

- Well interference effects – Pumping from an open-loop heat pump may cause the water level to drop in a nearby water well.
- Groundwater contamination – Groundwater may become contaminated either by the accidental release of antifreeze fluids to the ground or by changing the chemical and physical properties of the groundwater.

To avoid these potential environmental problems, ground source heat pumps should be designed and installed by qualified and experienced contractors following the regulations and best management practices described below. Contractors should be CGC Accredited (Canadian GeoExchange™ Coalition Accreditation).

Figure 1 – An Example of an Open-loop Ground Source Heat Pump System

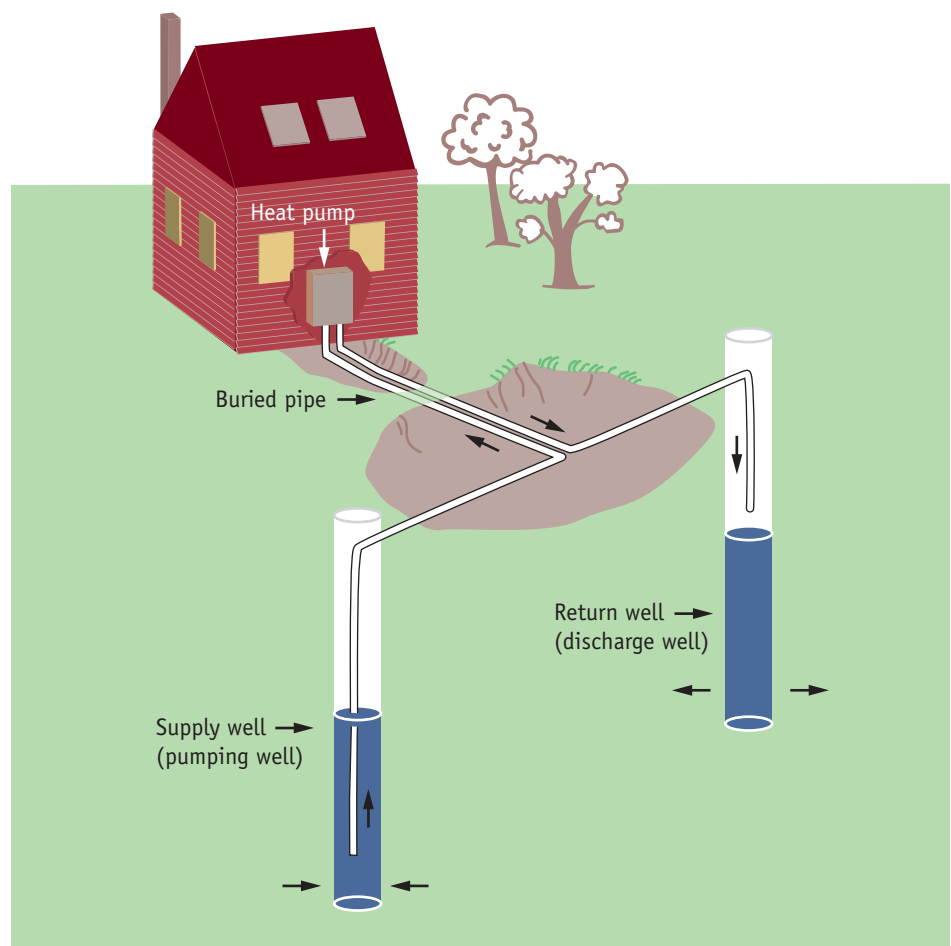


Diagram not to scale.

Heat Pumps

What regulations apply?

Open-loop systems use water wells. Wells must be constructed by a licensed well contractor who follows the Well Construction Regulations. In addition, open-loop systems that pump more than 23,000 L/day from a supply well must have a Water Withdrawal Approval under the Activities Designation Regulations. This approval is needed even if the water is pumped back into the aquifer through a return well.

Closed-loop systems are not currently governed by any specific regulations in Nova Scotia, but we recommend the best management practices listed below.

Figure 2 – An Example of a Closed-loop Ground Source Heat Pump System

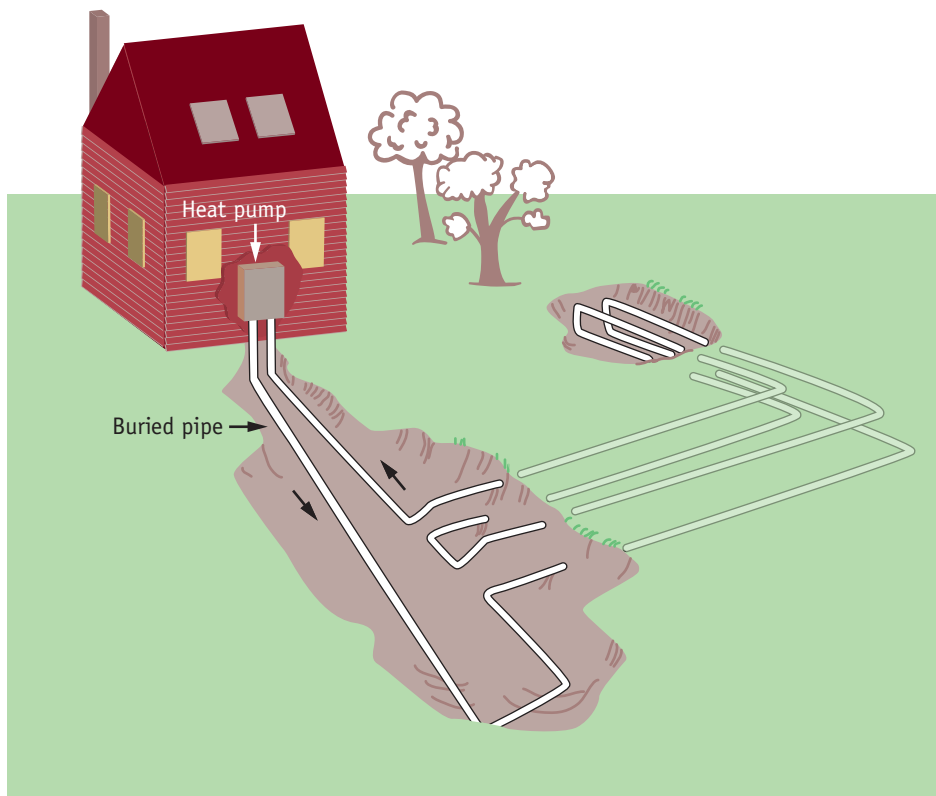


Diagram not to scale.

Ground Source Heat Pumps

What best management practices are used in Nova Scotia?

- Design and install systems in accordance with the CSA standard for Design and Installation of Earth Energy Systems (CSA C448 Series-02).
- Properly seal and backfill wells, boreholes, and trenches.
- Install systems as far away as possible from other water wells and sources of contamination.
- Check with local authorities to see if they have any other specific requirements, such as building codes.
- Record the location and construction details of the underground portions of the system.
- Monitor, maintain, and inspect the system regularly.
- In open-loop systems, return groundwater to the same aquifer. The water quality should be unchanged, except for temperature.
- In closed-loop systems, use antifreeze solutions that meet the CSA standard, such as ethanol, propylene glycol, and methanol.

Where can I get further information?

- The CSA standard for Design and Installation of Earth Energy Systems can be obtained from the Canadian Standards Association at www.csa.ca.
- A Buyer's Guide for Earth Energy Systems is available from Natural Resources Canada at <http://canmetenergy.nrcan.gc.ca/eng/publications.html?ISBN0662-30980-4>.
- Canadian GeoExchange™ Coalition can be contacted through their website at www.geo-exchange.ca.
- A list of contractors licensed to construct water wells in Nova Scotia can be found at www.gov.ns.ca/nse/water/docs/WellDrillersDiggers.pdf.

FOR MORE INFORMATION

Contact

Nova Scotia Environment at
1-877-9ENVIRO
or 1-877-936-8476

www.gov.ns.ca/nse/water/


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