

The drop on water

Surface Water Heat Pumps

What is a heat pump? Is it geothermal?

A heat pump transfers heat from air, earth, or water and uses this to heat or cool a building. The energy produced from this technology is called geothermal because it is produced from earth-related or geological heat sources.

What types of surface water heat pumps exist?

Two types of surface water heat pumps exist: closed-loop and open-loop. Both have advantages and disadvantages. The best choice depends upon environmental circumstances.

A closed-loop surface water heat pump system (see Figure 1) transfers heat to or from a surface water body by circulating a heat transfer fluid in an enclosed pipe. A closed-loop system is immersed in a surface water body, such as a constructed pond.

An open-loop heat pump system (see Figure 2) withdraws water from a surface water supply, passes it through a heat exchanger, and discharges the water to a surface body of water or a storm sewer.

What are the advantages of heat pumps?

Heat sources for geothermal energy production are naturally occurring, plentiful, and environmentally sustainable. These systems can replace the use of fossil fuels, which contribute to greenhouse gas production and global warming. Using geothermal energy can provide an alternative energy source for heating or cooling buildings. It can also be cost-effective if long-term operational costs are considered. Geothermal energy becomes more attractive as the cost of conventional energy sources increases – oil, electricity, propane, and natural gas.

QUICK FACTS

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

Surface Water Heat

Are they safe for the environment?

Surface water heat pumps can be an environmentally safe alternate energy source if located, designed, installed, and operated properly.

Potential environmental concerns

- **Lake mixing interference effects** – Open-loop systems can change natural currents and mixing in lakes. This can release nutrients and contaminants in bottom waters and thus affect water quality. For example, it may stir up nutrients that feed algae, a process called eutrophication.
- **Surface water contamination** – Heat pumps may contaminate surface water either by accidentally releasing antifreeze fluids to surface waters or by pumping poor quality bottom waters to the surface.
- **Temperature effects** – Heat pumps increase surface water temperatures in summer and decrease temperatures in winter. Cumulative effects of many small systems or large commercial or industrial systems can affect aquatic life habitat.
- **Physical obstruction** – Piping in a watercourse can displace fish habitat and recreational water activities.
- **Vulnerability to damage** – Surface water installations can easily be damaged by human and natural forces such as ice, wind, and boating, thereby releasing fluids.

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

Pumps

Figure 1 – Example of a Closed-Loop Surface Water Heat Pump System

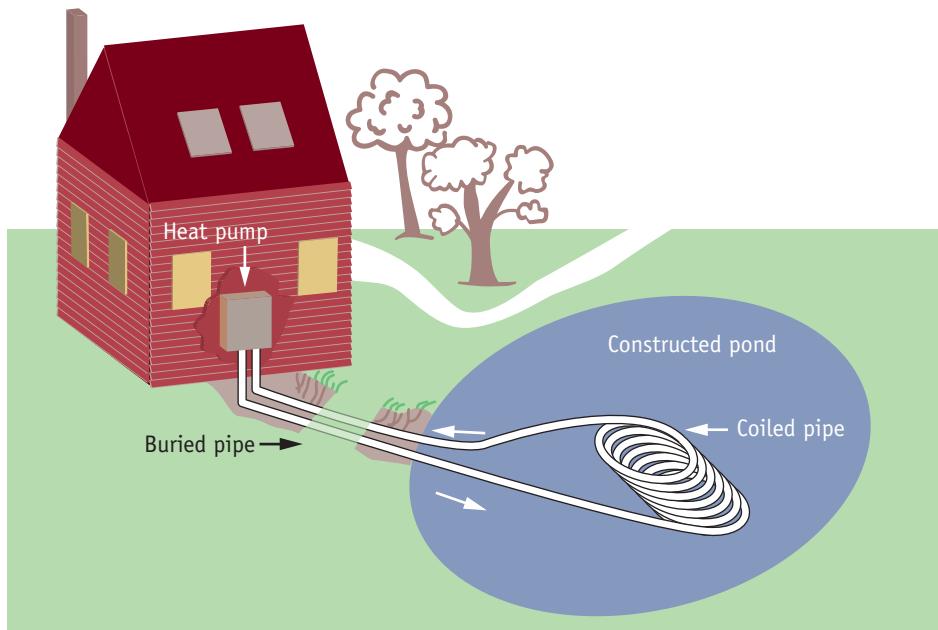


Diagram not to scale.

Surface Water Heat

What regulations apply to surface water heat pumps in Nova Scotia?

Closed-loop systems and open-loop systems involve altering the watercourse bed and bank where the loop system enters the lake or pond. A Watercourse Alteration Approval is required for this activity in accordance with the Activities Designation Regulations.

Open-loop systems that withdraw more than 23,000 L/day from a watercourse must have a Water Withdrawal Approval in accordance with the Activities Designation Regulations. This applies to installations using flowing waters (rivers and streams). Withdrawals from lakes and ponds for this purpose are not recommended.

Wetlands are valued resources in Nova Scotia and are to be protected. You should avoid wetlands when considering heat pump installations. If this is not possible, you need an approval under the Activities Designation Regulations to alter any part of a wetland. Approval conditions require that you prevent the loss of wetland functions. Pre-consultation with the department is strongly recommended.

Pumps

Figure 2 – Example of an Open-Loop Surface Water Heat Pump System

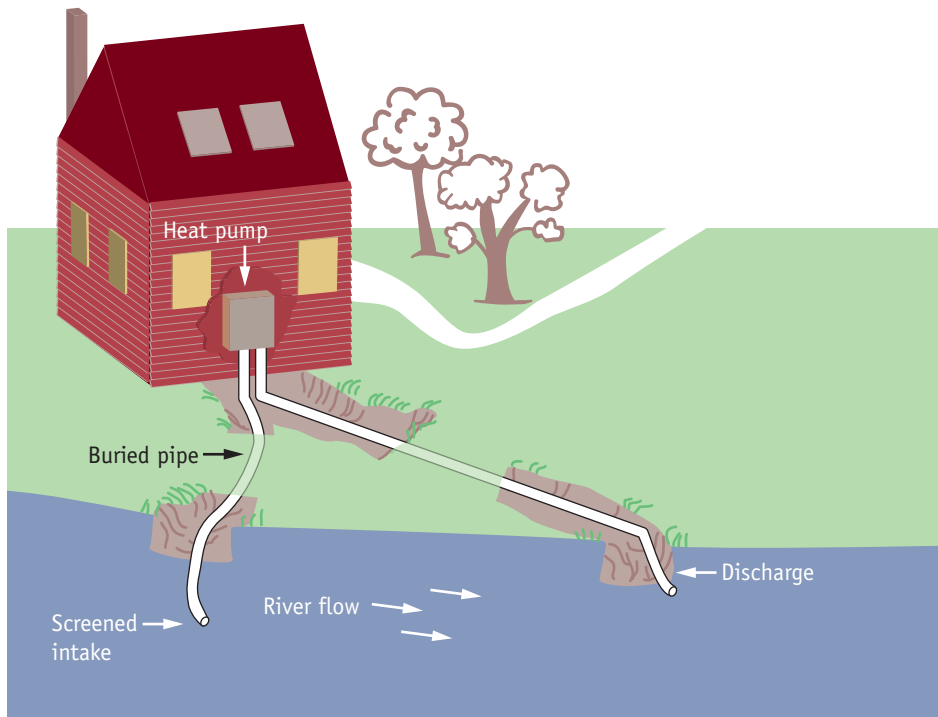


Diagram not to scale.

Surface Water Heat

What best management practices apply to surface water heat pumps in Nova Scotia?

The following best management practices are recommended for open-loop and closed-loop surface water heat pump systems in Nova Scotia:

- Ensure that the technology is applied appropriately – avoid wetlands, sensitive fish habitat, drinking water supplies, and high-use recreational areas.
- Ensure that the system is designed and installed by a qualified and experienced contractor following Industry Best Practices and Standards, such as CSA Standards.
- Use open-loop systems only in dynamic, flowing waters, such as oceans and rivers to prevent water contamination.
- Use closed-loop systems in standing waters only, such as constructed ponds, to prevent water contamination and system damage.
- Use only non-toxic or the least toxic, biodegradable circulating fluids in closed-loop systems. Food grade ethanol or propylene glycol are acceptable, according to the CSA Standard, but methanol is not recommended.
- Equip closed-loop systems with a pressure switch to prevent release of circulating fluids if the loop is damaged or breached.
- Monitor, maintain, and inspect in-watercourse components routinely to ensure the integrity of system components and anchoring system.
- Locate loop system near the building being heated and make sure that it does not interfere with neighboring properties or shoreline use and does not extend greatly into the watercourse.
- Post signs as navigation warnings.
- Ensure that all specific requirements of local authorities are followed, such as building codes.

Pumps

Where can I get further information?

- CSA standards 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.

FOR MORE INFORMATION

Contact

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

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


NOVA SCOTIA
Environment

