



Water & Wastewater Systems in a Changing Climate

Many First Nation communities face existing challenges with water and wastewater infrastructure. Climate change is likely to add additional stress.

How will more precipitation impact water and wastewater systems?

Contaminants

Climate change is expected to increase precipitation in northern Ontario and large rain events (50mm to 150mm in one day) are projected to happen more often. Increased snow loads and heavier rains can cause more runoff (when water flows over the land) and flooding, which can carry contaminants like animal and human waste and oil into waterbodies contaminating drinking water. This can stress water treatment plants.



Attawapiskat water treatment plant.

More precipitation can increase the amount of water entering the wastewater lagoon, requiring infrastructure to cope with larger volumes of water than before. If a wastewater lagoon is too full, it may need to be dumped before the wastewater has been held for the amount of time required for treatment, increasing the risk of contaminating the surrounding ecosystem or drinking water source. Overwhelmed sewer systems can result in sewer backups into homes and buildings that flood and damage basements and may even require evacuations.

Erosion and sedimentation

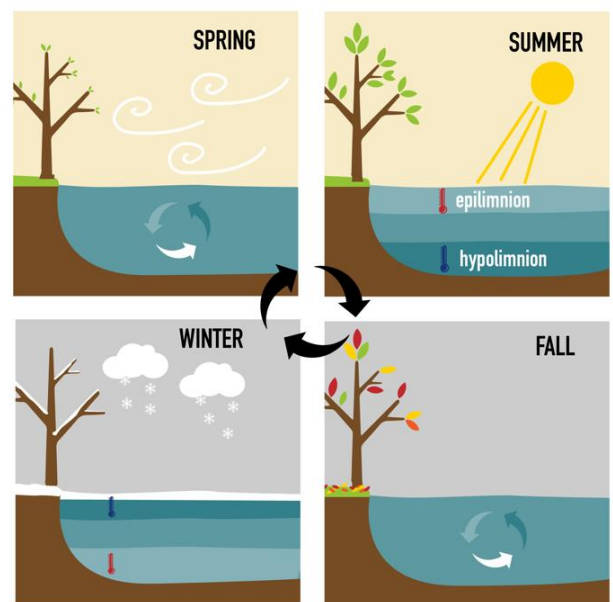
Heavy rains may also lead to erosion, increased sediment entering the waterways as well as water cloudiness (turbidity) that may require more chlorine for water treatment, clog filters, or wear out pumps and turbines, increasing maintenance costs of drinking water systems.

How will higher temperatures impact water and wastewater systems?

Warming Lakes

Lakes go through a yearly cycle of mixing and layering. In spring, after the ice is gone, strong winds mix the water so the entire lake has the same water temperature and quality. In summer, as the sun warms the surface of the lake, the warmer water is less dense and begins to create a layer, the epilimnion, that doesn't mix with the water below, the hypolimnion; this is called stratification. In fall, the water cools and the layering disappears and the whole lake mixes again to then gets iced over in winter.

The top layer in summer, the epilimnion, becomes quite warm and tends to hold onto contaminants that runoff from the land and harbour algae blooms, making it less than ideal for a drinking water intake. Water intakes are preferably placed in the deep hypolimnion where colder, cleaner water makes for easier treatment. Climate change is expected to bring higher temperatures that will warm the waters of lakes and streams. The top layer of warm water in lakes, the epilimnion, will become deeper and therefore water intakes will need to be deeper to access cold, cleaner water.



Yearly lake cycle



How can we prepare?

Advocate for safe drinking water

Clean, safe drinking water is already an issue for many First Nation communities. Communities should continue to push for safe drinking water. In communities that do have drinkable tap water, make sure effective monitoring programs are in place and that the water continues to be safe to drink. During times that water is not safe to drink, communities should have an alerting system to notify members and have alternative water sources available (bottled water, boiled water, different water sources, etc.).

Assessing risk and vulnerability

Planning for infrastructure upgrades will require professional assistance/assessment, but an initial assessment of the current and potential climate change impacts can help identify priorities for adaptation planning. Ecology North developed a protocol to assess the vulnerability of northern water and wastewater systems to climate change impacts for communities in the Northwest Territories that may be useful for communities in northern Ontario. The guide includes a list of questions that will help determine the likelihood of an impact occurring and the severity of that impact to help prioritize action.

Community planning

Community planning can help protect drinking water sources as well as drinking water and wastewater infrastructure. Community planning actions could include:

- Limit building in sensitive areas, like riverbanks or shorelines, that could result in erosion.
- Manage hazardous waste at landfills to prevent contaminated runoff.
- Implement a drainage plan to manage stormwater; a good drainage plan can reduce the chance of flooding, and slow runoff to avoid erosion, sedimentation and contamination.
- Protect and divert water into green spaces like wetlands or ponds.
- Consider moving sewage treatment lagoons if they are upstream from water intake.

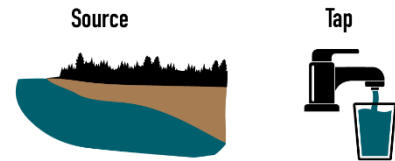
Climate change is likely to add additional stress on infrastructure. Identifying potential climate change impacts can help communities determine what actions should be taken now or in the future.

Resources

- The Northern Infrastructure Standardization Initiative (NISI) Community Systems: From Start to Finish: <https://www.scc.ca/en/nisi/community-systems>
- Protocol to Assess the Vulnerability of Northern Water and Wastewater Systems to Climate Change Impacts (2010): <https://ecologynorth.ca/wp-content/uploads/2020/02/Vulnerability-Assessment-Protocol-03-10-Compressed.pdf>
- Integrating Climate Change Measures into Municipal Planning and Decision-Making: A Guide for Northern Communities (2014): <https://ecologynorth.ca/wp-content/uploads/2020/02/IntegratingClimateChange-book-Lowres-Feb2015.pdf>
- Guidance For Providing Safe Drinking Water in Areas of Federal Jurisdiction: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidance-providing-safe-drinking-water-areas-federal-jurisdiction-version-2.html>

Multi-Barrier Source Water Protection

Ensures safe drinking water throughout its entire journey from source to tap. This approach requires that the entire watershed that feeds the source is protected.



Assessing source water threats should consider regionally projected climate change impacts including potential for:

- increased flooding
- increased erosion
- increased turbidity
- melting permafrost (if applicable)