

# Safe Water for All

Ending the Drinking Water Crisis in First Nations Communities

**SADDLE LAKE**  
CREE NATION



## Saddle Lake Cree Nation

Located almost 200 km northeast of Edmonton, Alberta, Saddle Lake Cree Nation has close to 10,000 members, with just over 6,000 who live on-reserve. The community is the second largest First Nation in Alberta and has been a meeting place for the Cree Nation for over 200 years.

Formed in 1902, a big focus for Saddle Lake's community leaders today is providing strong guidance to young residents so that they become good leaders. Economic development is also a central element of the community's vision, and Chief Eddie Makokis and council consider it a way for all residents to thrive and become 'independent individuals'.

The community is home to Grammy Award winning artists Northern Cree, and Nobel Peace Prize nominee Doreen Spence. Apart from its famous inhabitants, Saddle Lake is similar to many small rural towns in Canada with a police detachment, a fire hall, a training centre, and schools.

Up until recently, the community suffered from years of poor water quality, which too many First Nations communities across Canada continue to experience. However, Saddle Lake's leaders acted to end the crisis and build much-needed trust and faith in their water supply.

### Poor Quality Became Normal

When it comes to lack of reliable and adequate access to drinking water, Saddle Lake is not unique, with nearly two thirds of Canada's First Nations communities facing a similar crisis. As of July 2017, there were 102 long-term (over a year) and 48 short-term drinking water advisories in place at First Nations across Canada; some communities in Alberta have been under such advisories for many years.

For decades Saddle Lake was no exception, suffering from what Indigenous and Northern Affairs Canada (INAC) rated as a high-risk surface water supply. Even after treatment, the water distributed by the old plant was amongst the worst in the country. Community members were so used to the poor water quality that it just became a normal part of life. Nearly half the people in the community required medical attention for gastrointestinal issues.

The community members had also lost trust and faith in the water supply and their own people for failing to make it right. "It was probably a nightmare for all these people with young kids," said Carl Shirt, plant manager at Saddle Lake's water facility. Carl, who grew up in Saddle Lake, has been at the new plant since 2013.

### Wasted Water and an Inadequate Facility

Saddle Lake Cree Nation's old plant required the heavy use of chemicals to treat and disinfect the water. The source water for the community comes from Saddle Lake, and is full of thick blue-green algae that washes up on shore in large quantities. High contamination levels required barrels of chemicals for treatment. This cost more than \$15,000 every month, growing from less than \$1,000 per year when the old plant was first built in 1982.



Most conventional treatment plants ignore the source water quality in rural areas, which tends to be much poorer than in urban areas.

In the end, money was wasted on building a facility that couldn't be optimized for the community's needs and failed to provide safe drinking water. The aluminum levels alone in the tap water were 10 times higher than Health Canada guidelines. In addition to the various chemicals that were used to treat the water, the distribution system itself was also poorly built. Leaky pipes delivering water to houses were a legacy of poor construction and as much as five liters per second was going into the ground for many years.

Both issues are common with obsolete treatment processes as they are not customized to the needs of the community and rarely consider the composition of the source water. The systems can also be quite complex, requiring constant oversight and intervention by operators. It can be an overwhelming task.

"The previous system was very high maintenance, and you were always doing calculations. You had to keep watch," said Carl. Constant monitoring in the plant meant Carl couldn't attend to other issues, such as the poor construction of the distribution system.

### Unique, Rural Challenges

Most conventional treatment plants ignore the source water quality in rural areas, which tends to be much poorer than urban areas. As a result, treating rural raw water with technology designed for cities simply doesn't work. Saddle Lake's source is surface water that comes from a lake, and is considered higher-risk than groundwater.

Given its remote location, transporting supplies and materials to the treatment facility in Saddle Lake presented major challenges and increases costs. In addition, winter weather posed not only safety and logistical risks, but also put stress on the components and operations of a conventional facility.

The isolated location of a community like Saddle Lake means upholding the trust of the community in its water supply is especially important. Plant managers and technicians must be confident in their own skills and knowledge to ensure the treatment facility runs smoothly and without major issues.

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The media used during the biological filtration step in the SIBROM process.

# The Sapphire Solution

In 2011, Saddle Lake Cree Nation in Alberta upgraded its underperforming water treatment system to a Sapphire Integrated Biological Reverse Osmosis Membrane (SIBROM) water treatment system, fed directly from the surface water of Saddle Lake itself. This project replaced the outdated water treatment technology and expanded the facility to provide 10,000 residents with drinkable water, while also ensuring that the environment and watershed were sustainable.

There are three core treatment phases in a SIBROM system: biological filtration, reverse osmosis membrane filtration, and re-mineralization to optimize the pH of the treated water. The SIBROM process successfully removes troublesome contaminants, such as the blue-green algae found in Saddle Lake, producing biologically stable water. Since much of Saddle Lake's distribution system was poorly constructed, having biologically stable water run through the pipes is necessary to decrease the chance of in-pipe contamination.

Parameter	Raw Water Quality	SIBROM Treated Water Quality	Canadian Drinking Water Guidelines
Total Organic Carbon (mg/l)	26.7	<1	<1*
Dissolved Organic Carbon (mg/l)	24	<1	<1*
Turbidity (NTU)	4.79	<0.1	<0.1

\* Health Canada has not established a drinking water quality guideline for dissolved or total organic carbon. Our target limit for these parameters is <1 mg/l. For further technical information, please contact: [sas@sapphire-water.com](mailto:sas@sapphire-water.com).

The installation of the new SIBROM system immediately decreased the amount of chemicals required to make the water safe. With only 20 liters a week of chlorine needed, the plant produces more than enough clean, high-quality water, to meet the needs of the community. The drastic drop in the use of chemicals has also cut operating costs. The new plant is also able to handle tough Alberta winters as it can continue to treat water at just-below freezing temperature, minimizing water heating costs even before treatment can begin.

Carl continues to work with Sapphire Water to optimize the plant as conditions change. The system is designed to make daily operations much easier and intuitive, allowing Carl to focus more of his time on fixing the problems with the poorly laid pipes. Being able to read key plant data over the internet also means updates and routine maintenance can be performed quickly or instantly.

“Compared to the conventional plant, it's night and day. The system is also very resilient,” said Carl, who was integral in implementing SIBROM at Saddle Lake and optimizing plant operations. “It's much simpler and more efficient. And people are now building more trust in the water.”

Carl's experience is that communities must use technology that meets their unique, on-the-ground challenges, especially those specific to their raw water quality. Every community is different and has unique local factors to consider. Applying big city treatment approaches to smaller remote communities is not effective. Addressing the unique challenges of smaller communities ensures economical, long lasting solutions that deliver safe drinking water.

## About Sapphire Water

Sapphire Water International is a Canadian company specializing in the design and implementation of long-term, leading-edge water and wastewater treatment systems for small and remote communities of up to 1,000 in population. Through its SIBROM technology, Sapphire Water delivers water to these communities that exceeds all international water quality guidelines. There are 20 full-scale SIBROM plants in operation and four under construction in Western Canada today.