



CANADIAN CONSULTING ENGINEERING AWARDS 2011

CANADIAN CONSULTING
engineer



PARTNERING FOR SAFE DRINKING WATER

LAC LA RONGE REGIONAL WATER CORPORATION

CLIENT:
LAC LA RONGE REGIONAL WATER CORPORATION

CONSULTANT:
ASSOCIATED ENGINEERING



**Associated
Engineering**

GLOBAL PERSPECTIVE.
LOCAL FOCUS.

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PROJECT HIGHLIGHTS

For many years, the Town of La Ronge, the Northern Village of Air Ronge, and the Lac La Ronge Indian Band in Northern Saskatchewan experienced problems with their respective water systems, all of which were 30 to 40 years old. Problems included inadequate capacity for growing population, aging and failing infrastructure, and the inability to meet new water quality regulations. To meet long term growth projections for their developing communities as well as increasingly stringent drinking water quality standards, La Ronge, Air Ronge, and the Lac La Ronge Indian Band (LLRIB) faced untenable costs to expand and upgrade their individual water systems.

Encouraged by an Associated Engineering/SaskWater Corporation report which identified regional water supply as an option, the three communities decided to collaborate to create a joint utility, the Lac La Ronge Regional Water Corporation, which would be responsible for providing high quality drinking water. By working together, La Ronge, Air Ronge and the Lac La Ronge Indian Band could then meet regional water needs at a cost that they could collectively manage.

The Lac La Ronge Regional Water Corporation retained Associated Engineering to complete the preliminary and detailed design, tendering, construction, and commissioning engineering services of a new regional water system. The project included upgrade to the existing La Ronge raw water intake, expansion and upgrade of the existing La Ronge Water Treatment Plant, a new regional pipeline connecting La Ronge, Air Ronge, and the Lac La Ronge Indian Band community, and converting the Air Ronge Water Treatment Plant to a satellite reservoir and pump station.

The Challenge

Selecting the right water treatment process for the new water treatment plant posed a real challenge for the Associated Engineering team. The existing La Ronge water treatment process relies on coagulation, adsorption clarification, and rapid mixed media sand filtration. This process requires the cold raw water to be heated several degrees for four to six months of the year to provide effective treatment. However, the facility could not consistently meet current water quality standards. The difficulty was consistently removing the high levels of dissolved organic carbon (a result of the decomposition of plant or animal matter) in the extremely low temperature and relatively low pH of the raw water supply. In addition, the treatment plant could not consistently treat the cold lake water to meet turbidity standards, and disinfection efficacy was therefore inconsistent. The team had to develop a robust and cost effective treatment process that could consistently treat the cold lake water.

The Solution

Late 2007, Associated Engineering began preliminary design, which included raw water testing, bench testing, and pilot testing. At the bench testing level, the team evaluated a number of treatment options, including dissolved air flotation, flocculation/coagulation, ion exchange, membrane filtration, and the life-cycle cost associated with each process. Bench tests showed that the ion exchange process had merit, although it had not been used previously in a similar application. To confirm the treatment process and design criteria, the team conducted a four-month pilot-testing program involving two ion exchange processes for dissolved organic carbon removal, as well as microfiltration membrane. The pilot program

confirmed a treatment process including pre-filtration of raw lake water using an automatic self-cleaning filter, ion exchange, ultrafiltration membrane, and chlorine disinfection.

Added Complexity

Facilitating Partnering: Recognizing that the success of the project depended on the three communities being able to reach consensus and make decisions on project issues, early in the project, Associated Engineering facilitated meetings with the three communities to agree on the decision-making approach and philosophy. The communities agreed that the governing philosophy for decisions would be the overall project quality, the ability to deliver high quality water, and maintaining the capital cost within their established budget. All parties agreed that solutions had to benefit all communities – not just one. This basis for decision-making helped parties to reach consensus. As a result, the three communities overwhelmingly supported the final project. This project is an outstanding example of cooperation between neighbours.

Stakeholder Involvement: Associated Engineering worked with several stakeholders including seven federal and provincial funding partners as well as eight regulators to gain consensus and approval on the design of the treatment process and facilities. Facilitation involved in depth discussions and negotiations to reach agreement.

Managing High Capital Costs: At the outset, Associated Engineering recognized that cost was going to be an issue due to the degree of upgrading necessary, the unique treatment process that would be required to meet water quality standards, as well as the higher cost of northern construction. The team optimized the design to stay within budget and assisted the Corporation by working with funding partners to maximize their contributions to the project. The upgraded water treatment plant stayed within the Corporation's budget. The project was completed at a cost of \$12.1 million.

Benefits & Achievements

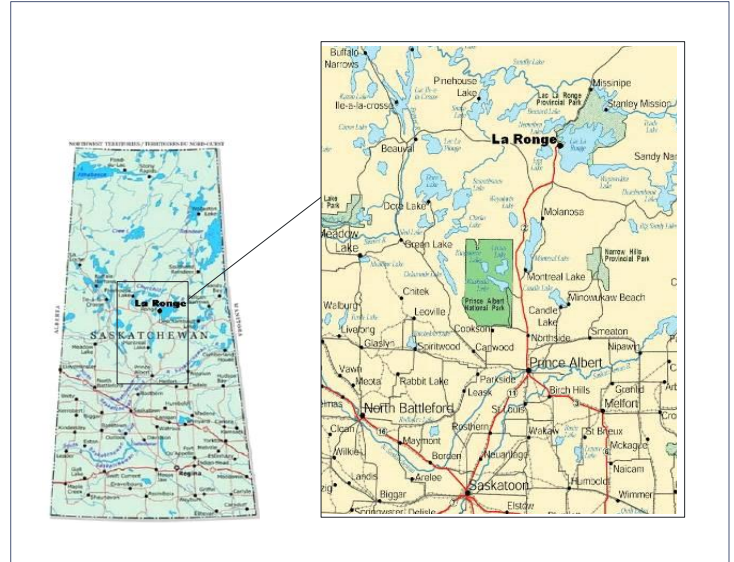
The 7140 cubic metres per day Lac La Ronge Water Treatment Plant is the first application of ion exchange technology as a treatment process for removing dissolved organic carbon and turbidity from potable water in Canada. The new water treatment plant reduces the environmental impacts of water treatment by eliminating the need for boilers to heat the cold lake water for treatment, thus reducing the plant energy requirements, as well as the wastewater generated from the plant.

The project involved a number of other "firsts", including the first project in Saskatchewan for Indian and Northern Affairs Canada where the First Nation is a shareholder in the resulting utility corporation. This regional water system is also the largest service population (10,000) for a water system in northern Saskatchewan or on a Saskatchewan First Nation. The project was also the first to be funded by multiple governments that included a First Nation government, municipal and provincial governments, and three federal government agencies. The cooperation between the Town of La Ronge, the Village of Air Ronge, and the Lac La Ronge Indian Band is an example to communities across Canada of how to work together to cost effectively develop regional water systems with long-term benefits for water quality, sustainability, and economic development.

FULL PROJECT DESCRIPTION

Introduction

For many years, three communities in Northern Saskatchewan, the Town of La Ronge, the Northern Village of Air Ronge, and the Lac La Ronge Indian Band, experienced problems with their aging and failing water systems. Problems to their 30 to 40 years old systems included inadequate capacity for growing population, aging infrastructure, and the inability to meet new water quality regulations. To meet long term growth projections for their developing communities as well as increasingly stringent drinking water quality standards, La Ronge, Air Ronge, and the Lac La Ronge Indian Band faced unacceptable costs to expand and upgrade their individual water systems.



Encouraged by an Associated Engineering/SaskWater Corporation report which identified regional water supply as an option, the three communities decided to collaborate to create a joint utility, the Lac La Ronge Regional Water Corporation. The regional utility would be responsible for providing high quality drinking water to all three communities. By working together, La Ronge, Air Ronge and the Lac La Ronge Indian Band could meet regional water needs at a lower cost that they could collectively manage.

In 2007, Lac La Ronge Regional Water Corporation retained Associated Engineering to provide preliminary and detailed design, tendering, construction, and commissioning engineering services for a new regional water system.

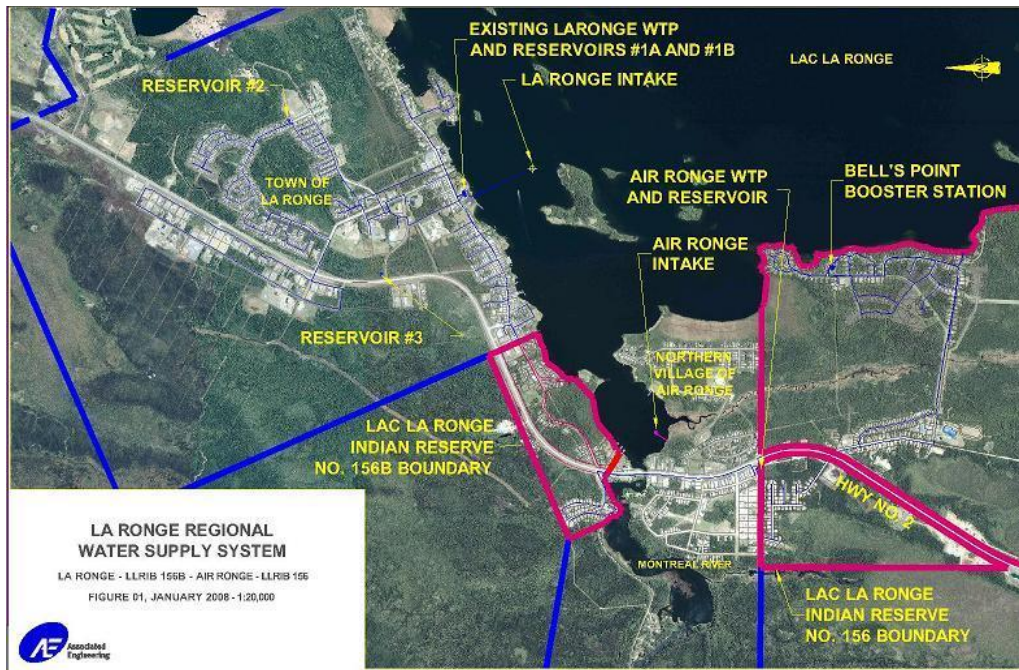
Background

Water infrastructure in the Town of La Ronge and Village of Air Ronge dated back to the late 1960s and late 1970s, respectively. The Lac La Ronge Indian Band had extensive municipal infrastructure as well, developed over a similar time frame by Indian and Northern Affairs Canada (INAC). The water infrastructure in the area included:

- Town of La Ronge: Lake intake, treatment, storage, and distribution system
- Village of Air Ronge: Montreal River intake, raw water pump station, treatment, storage, and distribution system
- Lac La Ronge Indian Band: Storage, re-chlorination, and distribution system through reserve 156 with water supplied from the Village via pipeline.

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Lac La Ronge Regional Water Corporation



Due to high costs of construction, there was previously no water service to the Lac La Ronge Indian Band Reserve 156B located between the Town and the Village.

The new regional system required a number of upgrades and alterations to the existing systems, including:

- Upgraded raw water intake for increased capacity and to meet new requirements of the Department of Fisheries and Oceans
- Upgraded treatment and distribution at the expanded La Ronge water treatment plant
- New regional pipeline connecting the La Ronge and Air Ronge systems, including potable water service to the previously un-served Indian Band Reserve 156B
- Conversion of the Air Ronge plant to a re-pump and re-chlorination facility
- Control system upgrades at a total of five facilities to allow regional operation.

The Challenge

Unique Treatment Process Needed: The existing La Ronge and Air Ronge treatment processes were not capable of removing the high levels of dissolved organic carbon (DOC) from the cold, low turbidity lake water. The existing La Ronge process relied on coagulation, adsorption clarification and rapid mixed media filtration. This process required the raw water to be heated several degrees for four to six months of the year to provide effective treatment, but resulting in high utility costs. Current treated water quality from the plant is characterized by periods of high levels of trihalomethanes, a disinfection by-product (>0.1 mg/L), high filtered water turbidity (>0.3 NTU) and inconsistent chlorine residuals, translating to poor disinfection, throughout the system.

Degree of Difficulty: The team had to develop a unique treatment process for the cold raw water supply that could consistently meet water standards.



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The project team's challenge was to develop a process that could consistently remove the high levels of dissolved organic carbon in the extremely low temperature and relatively low pH of the raw water supply and also meet turbidity and disinfection standards. The new treatment process had to accommodate continued use of free chlorine as a primary disinfectant without the previous issues related to disinfection by-products and inconsistent chlorine residuals.

Facilitating Consensus: The success of the project depended on the three communities being able to reach consensus and make timely decisions on project issues. Associated Engineering's challenge was to work with all three communities to communicate this and help build consensus.

Stakeholder Involvement: Success also depended on approval from key stakeholders which including funding partners and regulators. Associated Engineering worked on behalf of the Corporation to gain approvals for the design.

Managing High Capital Costs: Associated Engineering recognized that cost was going to be an issue due to the degree of upgrading necessary, the unique treatment process that would be required to meet water quality standards, as well as the higher cost of northern construction.

Approach

The preliminary design for this project consisted of gathering data, investigating and analyzing existing conditions, determining regulatory requirements, establishing the design criteria, and developing a number of options that would meet those design criteria. The team conducted bench-scale tests to determine viable treatment options and then pilot tested a short list of options to confirm the treatment process and design criteria.

Project management, and, in particular, communication played an important role in helping the Regional Water Corporation to reach consensus on design and to gain approvals from funding partners and regulators.

Project Management

Facilitating Consensus: Associated Engineering challenge was to advance the project while balancing the objectives of all three communities. Early in the project, the communities agreed that the governing philosophy for decisions would be the overall project quality, the ability to deliver high quality water, and maintaining the capital cost within their established budget. All parties agreed that solutions had to benefit all communities – not just one. This basis for decision-making helped parties to reach consensus. As a result, the three communities overwhelmingly supported the final project. This project is an outstanding example of cooperation between neighbours.

Excellent Communication: Our team facilitated consensus between client, funding partners, and regulators and contributed to the project's success.

Stakeholder Involvement: Associated Engineering worked with several stakeholders including federal and provincial funding partners as well as regulators to gain consensus and approval on the design of the

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treatment process and facilities. Facilitation involved in depth discussions and negotiations to reach agreement.

Funding partners consisted of many levels of government including Indian and Northern Affairs Canada (INAC), Infrastructure Canada, Western Economic Diversification (WED), and the Province of Saskatchewan through the Northern Municipal Trust Account (NMTA). Overall project management was being provided by SaskWater Corporation.

Regulators included the following agencies, some of which have overlapping responsibilities:

Federal	Saskatchewan
Environment Canada	Ministry of Environment - Environmental Protection
Fisheries and Oceans	Ministry of Environment - Fish and Wildlife Branch
Transport Canada	Ministry of Highways
Indian and Northern Affairs	Watershed Authority

Managing High Capital Costs: The Associated Engineering team optimized the design to stay within budget and assisted the Corporation by working with funding partners to maximize their contributions to the project. The upgraded water treatment plant stayed within the Corporation's budget. The project was completed at a cost of \$12.1 million.

Identifying Treatment Options

The preliminary design of the project began in December 2007. The team conducted raw water testing, including lake sampling off the ice. Following this, we conducted bench testing of treatment options including dissolved air flotation (DAF), flocculation, coagulation, ion exchange, carbon, media filters, membrane filtration, chlorination, and chloramination. Options were compared based on performance and life cycle costs.



Short-listed processes were evaluated during a four month pilot testing program through the summer of 2008. Pilot testing included two ion exchange processes for organics removal along with membrane filtration.

Confirming Treatment Process

Pilot testing confirmed the design criteria for the treatment process as follows:

- Raw lake water is pre-filtered to 40 micron using automatic self-cleaning filter
- Ion exchange
- Ultra filtration membrane
- Disinfection by chlorine (allowance for future UV).

Application of Existing Technology:

Using ion exchange technology for removing dissolved organic carbon in drinking water is a first in Canada.

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The plant was designed with a capacity of 98 L/s (7140 m³/day), doubling the existing capacity. The building's footprint was expanded 600 m².

Implementation

Risk Management: Preselecting equipment helped to minimize risks associated with long equipment delivery times.

Following pilot testing, in December 2008, the team tendered proposals from vendors for the ion exchange and membrane filtration equipment. Preselecting equipment allowed the team to design the upgrade according to the selected equipment, which minimized changes during construction.

The detailed design of the 2.15 km regional pipeline was completed and tendered in 2008, with construction completed in spring of 2009. The water treatment plant and other parts of the project were completed in October 2010. The total cost of the new Regional Water Supply System was \$12.1 million, meeting the client's budget.

Lac La Ronge Regional Water Corporation has contracted SaskWater to operate the plant.



Reducing Environmental Impacts

Environmental Benefits: New water treatment process reduces plant energy requirements and wastewater generated.

The new water treatment plant has a number of environmental benefits over the previous treatment facility. The new water treatment process eliminates the need for boilers, which were required in the old treatment process to heat the cold lake water to a warmer temperature to improve treatment efficiency. Eliminating the boilers not only reduced the plant energy requirements, but also reduced the wastewater generated from the plant.

Partnering for Safe Drinking Water

Lac La Ronge Regional Corporation's new regional water system provides safe drinking water for a design population of 10,000 people in the Town of La Ronge, Village of Air Ronge, and Lac La Ronge Indian Band. The project met the Corporation's requirements for producing a high quality drinking water, on budget, to the agreed upon schedule, and reducing environmental impacts. This regional water supply project exemplifies that successful partnerships can be achieved between communities so that they can cost effectively achieve a high quality water supply that will help to sustain growth and economic development in their communities.

Social & Economic Benefits: Provision of high quality drinking water for the region will help sustain growth and promote economic development.

The design and implementation of the Lac La Ronge Regional Water System achieved many firsts:

Partnering for Safe Drinking Water

Lac La Ronge Regional Water Corporation

- First use of ion exchange technology for dissolved organic carbon removal from potable water in Canada
- First INAC project in Saskatchewan where the First Nation is a shareholder in the utility
- Largest service population for a water system in Northern Saskatchewan or on a Saskatchewan First Nation
- Funding and assistance provided by seven partners: two municipal governments, a First Nation government, a provincial government, and three federal government agencies.

The regional cooperation between all levels of government on this project is a model for others to follow.

