

INDUSTRY LEADERSHIP

Working Partnerships with Alberta Environment and Parks/Advice and Support to Industry

In 2017, EPCOR continued to provide expertise and advice to provincial government agencies and the water and wastewater treatment industry in Alberta. Examples include:

- EPCOR continued its participation in the AEP-led Capital Region-Industry Heartland Water Management Framework initiative and sat on the Advisory Committee and Modelling Sub-Committee. Through this committee, EPCOR provides stakeholder feedback on AEP's initiative to develop a total loading management system for the stretch of the North Saskatchewan River between Devon (upstream of Edmonton) and Pakan (downstream of Edmonton and the Industrial Heartland). More information on this initiative can be found on [AEP's website](#).
- We continued to be involved in the Alberta Drinking Water Laboratory Technical Advisory Committee that is providing advice to the government on matters related to drinking water testing and development of new drinking water testing requirements.
- On an international level, EPCOR continued support of Bob Sandford as the EPCOR Chair for Water and Climate Security at the United Nations University Institute for Water, Environment and Health.

Laboratory Accreditation

The quality of the water testing data produced by EPCOR Water Laboratory adheres to the international management system standard ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories." The accreditation ensures that water quality testing results produced by the water laboratory are reliable and technically and legally defensible.

The EPCOR Rossmore Water Laboratory has been accredited to ISO/IEC 17025:2005 since 2001 by the Canadian Association for Laboratory Accreditation (CALA). It successfully retained accreditation in October 2017 after CALA completed an assessment as part of the biannual audit cycle. Our next full external assessment is scheduled for October 2019. In the meantime, the Rossmore Water Treatment Plant operations lab will be assessed in October 2018 to become part of the scope of the accreditation. This will provide us with another lab facility where we can produce accredited water testing results. In addition, EPCOR will be transitioning our quality management system to meet the new ISO/IEC 17025:2017 standard.

As part of our commitment to CALA, several EPCOR employees volunteered as laboratory assessors and were involved in 10 assessments of other laboratories in 2017. In addition to assessing other laboratories, our Senior Manager of Analytical Operations currently sits on the Board of Directors for CALA as a representative of the Prairies (private sector laboratories) and serves as CALA's Vice Chair.

Watershed and Source Water Protection Programs

EPCOR's Watershed Protection Program has two primary goals:

- To provide a safe, secure drinking water supply through source water protection principles.
- To ensure minimal effects from our operations on water quality and aquatic ecosystem health in receiving water bodies.

EPCOR recognizes watershed-wide environmental planning is necessary and is best achieved by openly collaborating with all stakeholders. In 2017, EPCOR updated its three year rolling Strategic Watershed Protection Plan and completed initiatives under four broad categories: watershed planning, monitoring and research, implementation and education and awareness.

1. Watershed Planning

EPCOR recognizes the importance of working within multiple initiatives and/or frameworks to help meet its commitment to safeguard the health of customers from a source water protection perspective and to minimize the effect of its activities on local water quality and aquatic ecosystems. Planning initiatives and/or frameworks that EPCOR continued to support in 2017 include:

- **Source Water Protection Plan:** A major milestone was the completion and publication of EPCOR's updated [Source Water Protection Plan](#), which has the goal of protecting source drinking water. Highlights of the updated plan include detailed water quality and quantity research summaries, comprehensive land use maps and inclusion of the source risk assessment completed through the Drinking Water Safety Plan process.

In 2017, mitigation plans for the key risks outlined in the Source Water Protection Plan and Drinking Water Safety Plan were developed. Key risks that remained with action items in the Drinking Water Safety Plan included forest fires, climate change, source contamination from spills/releases from upstream oil and gas facilities or spills from an upstream bridge. Work is underway to better understand how forest fires contribute to poor water quality, to develop a climate change adaptation strategy and to develop a Geographic Response Plan in partnership with AEP if a spill in the river should occur upstream of Edmonton.

- **North Saskatchewan Watershed Alliance (NSWA):** EPCOR provides both financial and in-kind support to the NSWA. In 2017, EPCOR employees were involved in the NSWA Headwaters Sub-Watershed working group that involved projects to assess the condition of riparian areas on Modeste Creek and Strawberry Creek. EPCOR employees were also involved in the governance of the NSWA by serving on the Board of Directors and Executive Committee.
- **Capital Region-Industrial Heartland Water Management Framework:** AEP has continued to lead this framework through 2017 and EPCOR was directly involved through the Advisory Committee. This work will set environmental outcomes (including water quality) for the area just upstream of Edmonton to downstream of the proposed industrial development area. The framework includes Maximum Acceptable Loads for about 20 water quality parameters of concern. In 2017, EPCOR presented to the Advisory Committee on the proposed Monitoring Program for the North Saskatchewan River.
- The **North Saskatchewan Regional Plan** is being developed by AEP under their Land Use Framework initiative. EPCOR has been engaged in the development of the plan since the beginning, including participation in the Phase I consultation workshops, the Regional Advisory Council and the Environmental Quality Management Framework stakeholder engagement sessions. In early 2018, EPCOR also provided feedback on the Regional Advisory Council's final recommendations.

- EPCOR, through representation on **Watershed Planning and Advisory Councils** and the **Alberta Lake Management Society**, is involved with numerous teams that are making recommendations for management and policy to the Alberta Water Council and, ultimately, Alberta Environment and Parks. In 2017, EPCOR co-chaired the Source Water Protection working group. In addition, an EPCOR employee acted as an alternate board member representing the Lake Conservation sector.

2. Implementation

In 2017, EPCOR continued financial support of **Clear Water Landcare**, which implements agricultural Beneficial Management Practices (BMPs) in the North Saskatchewan River basin, such as 'off stream' watering systems and fencing-off of streams, as well as educational stewardship events. In 2017, Clear Water Landcare co-hosted a digital story workshop that combined storytelling and digital media to share individual connections on land and water that are shown to be part of behaviour change. Clear Water Landcare also distributed copies of the *Our Backyard* children's activity book while Sasquatch & Partners discussed activities in the headwaters. EPCOR supported the implementation of Leduc County's BMP program through monitoring support and providing information on where to target BMPs in the Strawberry Creek Watershed.

3. Research and Monitoring

EPCOR continued collaboration with AEP, NSWA and the City of Edmonton in 2017 to develop an integrated, efficient and effective **water quality monitoring program** that meets the needs and interests of major stakeholders in the basin. Beginning in 2018, EPCOR is contributing \$1 million per year for the next four years towards funding and supporting this program, with monitoring to begin this year. The funds will be used to equip a network of tributary monitoring stations throughout the basins. The group is planning to have the network in operation by the end of 2018.

In 2017, EPCOR provided funding to ALUS Canada and the NSWA to support research on evaluating the health and importance of riparian areas as part of the Modeste Watershed Pilot Project. In 2018, work on this project will extend to include the Strawberry Creek Watershed. These two creeks are located in the lower headwaters upstream of Edmonton and they have a significant impact on water quality in the river in Edmonton at certain times of the year.

In 2017, EPCOR continued an enhanced monitoring program for 13 select tributaries upstream of Edmonton. As part of an effort to better characterize water quality in the headwaters, Clear Water Landcare, Leduc County and Parkland County took additional samples during storm events for EPCOR, as data for high flow events were sparse. As part of this work, a pilot project on Strawberry Creek, which began in 2014, continued and more frequent and widespread sampling was completed on the creek (at 11 locations) in an effort to understand water quality drivers on a smaller scale. This multi-year project on a sub-watershed that experiences intensive agricultural activity will provide information on the effectiveness of best management practices.

EPCOR contributed funding for Year One of the **NSERC Network for Forested Drinking Water Source Protection Technologies**, otherwise known as the ForWater Network. This network of researchers from across Canada will provide new knowledge on the impact of different forest management strategies on drinking water source quality and treatability and will assess their suitability for source water protection across the major ecological/forest regions of Canada. This initiative is led out of the University of Waterloo and is funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) under its Strategic Partnerships Grants for Networks program.

Last year, EPCOR began work on a **North Saskatchewan River Climate Change Adaptation Strategy**. Additional details about this strategy and an overview of the climate change research that is being supported by EPCOR can be found in the Research on Impacts of Climate Change on Source Water section.

EPCOR continued to partner with the City of Edmonton's Drainage Services (EPCOR Drainage as of September 2017) to support their Environmental Monitoring Program through assessment of water quality samples and assistance in monitoring plan development. Quarterly monitoring also continued for pharmaceuticals and personal

care products in the raw and treated water at both the E. L. Smith and Rossdale Water Treatment Plants. As well as providing information relevant to drinking water quality and public health protection, this monitoring program also provided environmental water quality data that was useful for the AEP-led Capital Region Industrial Heartland Water Management Framework.

4. Education and Public Awareness

In 2017, EPCOR sponsored Alberta RiverWatch, which is a science-based education program for secondary students. As a corporate sponsor of RiverWatch, EPCOR subsidizes the fees for disadvantaged students so they can participate in a guided river-study along the North Saskatchewan River.

EPCOR is also a proud partner of the City of Edmonton's North Saskatchewan River Clean Up. This program works with various groups to help keep garbage and debris out of the river.

In the past year, EPCOR staff also served on the Board of Directors for the Alberta Lake Management Society and Red Deer Watershed Alliance. Our professionals also spoke at the NSWA's Water Quality Forum and the Partners for the Saskatchewan River Basin Flowing Waters Conference and gave several presentations on Source Water Protection Planning. As well, EPCOR gave its 8th annual guest lecture at the University of Alberta to engineering students on watershed and land use management.

Distribution System Upgrades

EPCOR undertakes a number of annual capital and operating programs to maintain and continually improve water quality in the distribution system and to minimize unplanned customer disruptions. In 2017, the following water assets were replaced:

Water Asset	Number Replaced
Main Line Valves	273
Hydrants	196

Water Main Replacement

EPCOR has replaced more than 50% of cast iron water mains in Edmonton's distribution system since 1986. The ongoing replacement of the most deteriorated sections of cast iron pipe has led to continued improvements in overall system reliability and resulted in low numbers of water main breaks from 2015 to 2017. In 2017, **12.8 km of water mains were replaced** in Edmonton, as shown in the graph below.

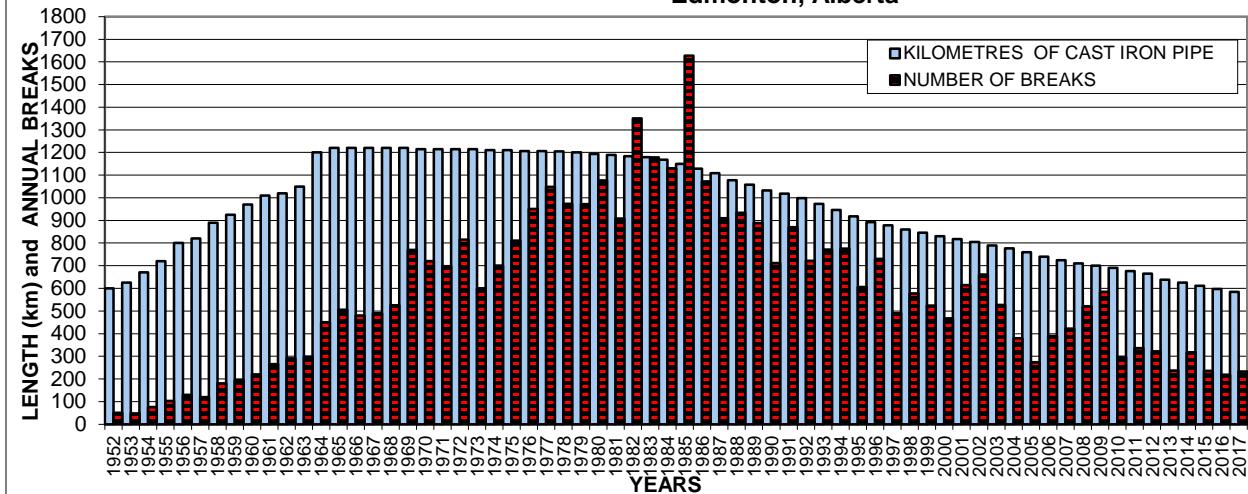
More than 80% of all water main breaks occur on the cast iron portion of the distribution system, declining from 90% over the past decade. Despite this success, it is important to maintain the rate of water main replacements to keep up with Edmonton's aging water infrastructure. As the distribution system continues to age, asbestos cement (AC) mains will present an increasing challenge. In some European and American cities, AC mains currently surpass cast iron mains in break frequencies. The estimated useful lives of AC mains range from 60 to 70 years and a significant portion of Edmonton's AC mains will begin reaching this age within the next decade. Increased levels of main breaks continue to be experienced on both cast iron and AC pipes when extreme winter events occur.



REMAINING LENGTH AND BREAKS OF CAST IRON WATER MAINS

1952 to Present

Edmonton, Alberta



1952 to Present, Edmonton, Alberta

Water Main Cathodic Protection

In 2017, cathodic protection was implemented in water main distribution main piping as follows:

Water Asset	Length Protected (Km)
Cast Iron Distribution Mains	30
Steel Transmission Mains	2.7

Transmission Main Blow-Offs

Historically, it was standard practice to connect transmission mains to the sanitary or combined sewer system in order to drain the water main as needed for maintenance work. In 2007, there were more than 200 locations identified as potential "blow-off cross-connections" within Edmonton's water network, which could present a cross-contamination risk if certain conditions occur (for example, if a system depressurization occurs at the same time that a nearby sewer is surcharging due to high rainfall). In 2008, a program to systematically remove these connections from the water network was implemented. EPCOR had committed to Alberta Environment to eliminate all high, medium and low-risk blow-off cross connections, plus all negligible-risk cross connections discharging to sanitary sewers, by April 2016. In 2013, it was identified that five low-risk cross connections were in the direct path of the west leg of the future planned LRT, and Alberta Environment and Parks approved a proposal to wait until such time that the water mains are relocated or abandoned to complete this work. All other negligible risk cross-connections were to be removed on an opportunistic basis as the mains qualify for replacement or rehabilitation. The number and type of blow-offs remaining at the end of 2017 are described below.

Transmission Main Blow-Offs Cross Connections Remaining at the end of 2017

Risk Score	Characteristics	Number of Chambers	
		End of 2007	End of 2017
High	Combined sewer that is in close proximity to a water treatment plant and a known surcharge area	7	0
Medium	Combined sewer that is in close proximity to a water treatment plant or a known surcharge area	34	0
Low	Combined sewer that is not in close proximity to a water treatment plant or a known surcharge area	84	5*
Negligible	A sanitary sewer that is not in close proximity to a water treatment plant or a known surcharge area	96	46
	Total	221	51

* The five remaining low risk cross-connections were not removed by April 2016 because they are in conflict with the future west LRT expansion. These blow-offs will be abandoned when the water main is relocated to accommodate the track construction.

Main Break Repair

In 2017, Edmonton experienced 256 water main breaks as reported in the final 2017 Performance Based Regulation (PBR) progress report to City of Edmonton. This was an increase of 14 main breaks compared to 242 in 2016. This increase was mainly due to variations in weather conditions between the years.

Despite the year-to-year variation, we have seen the number of main breaks generally decrease for the past 30 years. Most of the main breaks (229) occurred in cast iron water mains. Since 1985, EPCOR has had an aggressive program of renewal and cathodic protection of these cast iron mains. The long-term trend of a reduction in the number of breaks in the cast iron system since the mid-1980s directly reflects the effectiveness of these programs. EPCOR also has a performance target to repair 93.7% of main breaks within 24 hours. In 2017, 96.21% of the 212 breaks affecting water supply to customers were repaired within 24 hours of the water being shut off, exceeding the target.

Unidirectional Flushing and Hydrant Maintenance

Each year, water mains throughout Edmonton are flushed to remove sediment build-up and biological growth. In 2017, EPCOR continued with the Unidirectional Flushing (UDF) program and flushed 30% of the distribution system. There were 19,805 fire hydrants in the public water system at the end of December 2017. The operation of all fire hydrants located in public right of ways is checked at least twice annually, once as part of the summer UDF\Hydrant Purging program and once as part of the winter check program. This ensures that the hydrants are functional in the event of a fire and the system is compliant with fire code recommendations. EPCOR also has performance measures limiting the amount of time a hydrant can be out of service (no more than 90 days) and limiting the total number of hydrants that can be out of service on any one day (no more than 120). In 2017, one hydrant was out of service for more than 90 days and 50 hydrants were out of service for more than 30 days. The maximum number of hydrants out of service on any one day was 68. The maximum number of days out of service for any one hydrant was 365.

Lead Response Program

A service pipe is the piece of pipe that connects the home or business to the municipal water main beneath the street or alley. There are two sections to the service pipe: the section between the water main and the property line is the responsibility of EPCOR and the section from the property line to the home is the responsibility of the property owner. About 1.5% (or 3,700) of the 250,000 homes and small businesses in Edmonton have water service pipes made of lead. These homes and buildings were mostly built before 1950.

In 2008, EPCOR proactively initiated a program to address residences and small businesses in the City of Edmonton serviced through lead service pipes. This program includes:

- annual notification to Edmonton customers with lead service pipes;
- offer of testing for lead concentration in the tap water for those customers;
- offer to provide customers with point-of-use filters that remove lead;
- prioritized lead service pipe replacement of the EPCOR section; and
- public education on the issue of lead in tap water.

In 2017, we continued with our annual notification to customers with a known lead service. As well as sampling water from homes and small businesses with lead service lines, EPCOR has also sampled homes in older neighbourhoods where we believe there is no lead service pipe in response to customer requests.

The table below summarizes the results of testing of water samples collected at the tap from homes and businesses that are supplied through lead service pipes for the years 2008-2017. Approximately 5,000 samples have been collected and tested from the 1.5% (or 3,700) homes in the city with lead service pipes in that time period. All samples were collected using a sampling protocol that is designed to measure the impact of lead service pipes on lead levels measured at the tap. This involves collecting a 4 L sample after no water in the home for 30 minutes.

At-the-Tap Lead Test Results from Homes with Existing Lead Pipes (2008-2017)

Number of Samples Collected and Tested	5038
% where lead concentration was greater than 0.010 mg/L	31.3%
% where lead concentration was greater than 0.030 mg/L	5.7%
50th percentile lead concentration (mg/L)	0.007
90th percentile lead concentration (mg/L)	0.026

To compare, the **Health Canada Guideline for Canadian Drinking Water Quality** health-based Maximum Acceptable Concentration (MAC) for lead is **0.010 mg/L**. The lead concentration has been **less than the MAC in the majority 68.7% of the approximately 1.5% of homes with lead pipes** that were tested. The lead concentration has exceeded the MAC in 31.3% of samples collected. That represents about 1,160 homes in Edmonton. Of those tested, 5% (or about 190 homes) have concentrations greater than 0.030 mg/L. EPCOR provides information for homeowners and small businesses that are impacted by lead service pipes, including recommendations for maintaining good water quality, on our [website](#).

In 2015, EPCOR introduced the Random Day Time (RDT) sampling program to assess the level of lead at the tap in all homes in Edmonton, not just those with lead service pipes. Building plumbing components, such as older solder used to join copper pipes and brass fittings, may also contribute to lead in drinking water at the tap. EPCOR will use the data from this program to help us determine ways to reduce lead leaching of lead from lead service pipes and plumbing components.

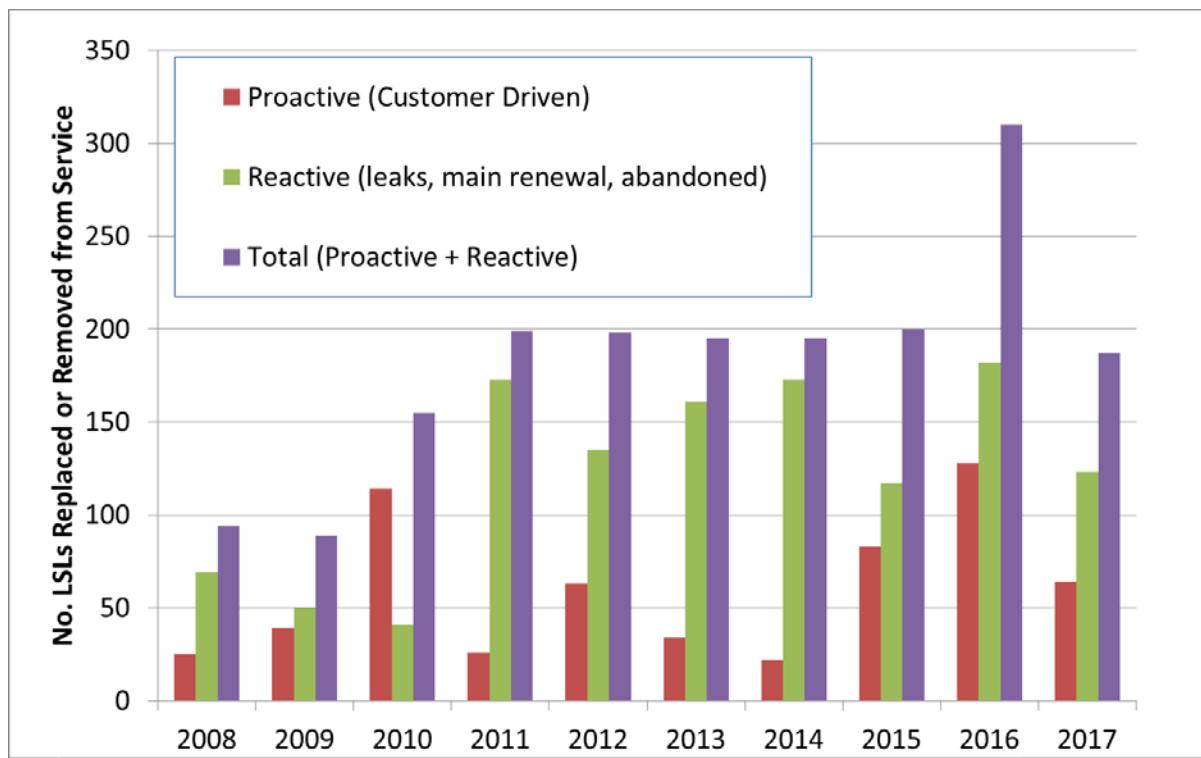
In 2017, EPCOR collected RDT samples from 165 homes. The results of the 2017 study are shown in the table below along with the results since the program began. The results indicate that lead concentrations may exceed the Health Canada Guideline in some homes that do not have lead service lines due to lead release from internal plumbing fixtures, lines or connections on private property. This study will be continued in 2018 with a goal of collecting samples from more than 300 randomly selected addresses across the city to better understand lead release from plumbing in homes.

Results of Random Daytime Lead Testing	2015	2016	2017
No. Tested	187	316	165
Mean Pb (ug/L)	0.7	1	0.2
90 th ile (ug/L)	10	6	3
% < 10 ug/L	90%	94%	97%
% > 30 ug/L	3%	2%	2%

Comparing Customer Driven Replacements to Maintenance Driven Replacements

There have been 1,822 lead services removed from service since 2008; of those, 598 were replaced proactively as part of the lead program, 1,224 were replaced reactively (due to leaks and other emergency repairs or as part of water main renewal programs) or were otherwise removed from service. At the end of 2017, approximately 3,032 Edmonton homes still had lead service pipes. See figure below.

EPCOR is avoiding partial service pipe replacements, where the EPCOR piece is replaced but the owner's lead piece is left in place. Studies have shown that these partial replacements are not effective for reducing lead at the tap and may even result in a temporary increase in lead concentration. As a result, we proactively replace the lead service lines on the EPCOR side only when customers have replaced the lead piece on their end. These are "customer driven" replacements. The priority for these customer driven replacements is based on the concentration of lead measured at the tap and the presence of high-risk individuals in the home (children under five years old or expectant mothers).



In 2018, EPCOR will be continuing with a neighbourhood approach to lead service line replacement. We will notify residents of planned activity in their neighbourhood in order to coordinate lead service line renewal. For infill developments, EPCOR will be requiring that service line piping material must meet current standards.

Lead service pipe replacement is progressing slowly and is determined by the rate of customer-driven replacements and the rate of infill development. The results of the RDT samples show that lead can be present at the tap even in homes without lead service lines; therefore, EPCOR will be evaluating treatment additives at the water treatment plants that will help reduce lead concentrations at the tap. Treatment additives have been effective in other communities to reduce lead concentration at the tap and further protect public health not only in homes with lead service pipes but also in homes with other sources of lead such as solder and brass. EPCOR has been testing drinking water additives for lead reduction since early 2017 in a small, closed pipe-loop test facility. We expect this testing to be completed by the end of 2018.