Healthy Waters:

EPCOR's Integrated Watershed Management Strategy

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INTRODUCTION

As Edmonton's trusted water utility, EPCOR is dedicated to delivering safe, reliable drinking water while effectively managing the impacts of wastewater and stormwater. Recognizing that the most efficient and sustainable approach to water resource management lies in a comprehensive, watershed-wide strategy, EPCOR focuses on cumulative effects management across the entire water cycle.

This Healthy Waters: Integrated Watershed Management Strategy (IWMS) focuses on:

Source water protection: protecting the City of Edmonton and the region's drinking water supply, the North Saskatchewan River (NSR), through collaborative watershed management.

Stormwater management: managing the environmental impact of stormwater on the NSR and creeks as the City of Edmonton grows.

Wastewater management: managing the environmental impacts on the NSR from Gold Bar's wastewater treatment plant effluent, combined sewer overflows, and WTP's wastestreams.

This unified and coordinated strategy provides the optimum environmental benefit and the best value for the Edmonton rate-payer. This strategy is grounded in improving NSR and tributary health, outcomes which are set through regulation, partnership commitments, and EPCOR's environmental policies.

The importance of an integrated strategy cannot be understated as Edmonton is fast growing and has ambitious targets to densify in the core as well as expand outward. Development leads to increased hard surfaces and stormwater runoff which, without stormwater management, can increase flood risk and impacts to the North Saskatchewan River and urban creeks. Population growth also results in increased wastewater generation, that must be safely treated before it's reintroduced back to the NSR.

For the watershed upstream of Edmonton, climate change impacts including change in flow and fire regimes, risks of pipeline breaks, resource extraction, changing water demand, and dam operations all impact source water quality and supply and must be managed through collaborative watershed principles to protect Edmonton's drinking water source.

By integrating these critical elements into a cohesive strategy, EPCOR ensures a sustainable, resilient, and adaptive approach to watershed management - preserving Edmonton's water resources for future generations while supporting the City's ongoing growth and EPCOR's environmental commitments.

EPCOR'S WATERSHED RESPONSIBILITIES AND RISKS

PROVIDE HIGH QUALITY DRINKING WATER BY MANAGING THE SOURCE WATERSHED

MANAGE OUR IMPACTS TO PROTECT THE WATERSHED: FLOODING, CREEKS, AND THE NORTH SASKATCHEWAN RIVER

EPCOR employs a risk management framework to understand and mitigate risks that affect our ability to meet our core responsibilities: providing safe and high-quality drinking water and minimizing our impact on the ecosystems in which we operate. Environmental and operational risks are managed at multiple scales across EPCOR and include both regulatory and non-regulatory approaches. EPCOR not only meets all federal and provincial regulatory requirements, but through this IWMS takes it a step further by ensuring that we are anticipating, actioning, and adapting to changes in our source water and managing our long-term cumulative impact.

SHORT-TERM: EPCOR's Environmental Management System (EMS) addresses short-term operational risks (one day to 3 months) to the environment. These risks have specific controls and mitigative actions in place guided by the ISO 14001 Standard and are short-term spills or environmental incidents.

LONG-TERM: Long-term environmental risks are managed through regulatory Approvals and longer-term planning documents including this IWMS. This IWMS informs integrated resource plans for EPCOR's water treatment plants (WTPs), stormwater collection system, and the sanitary collection system including the Gold Bar Wastewater Treatment Plant.

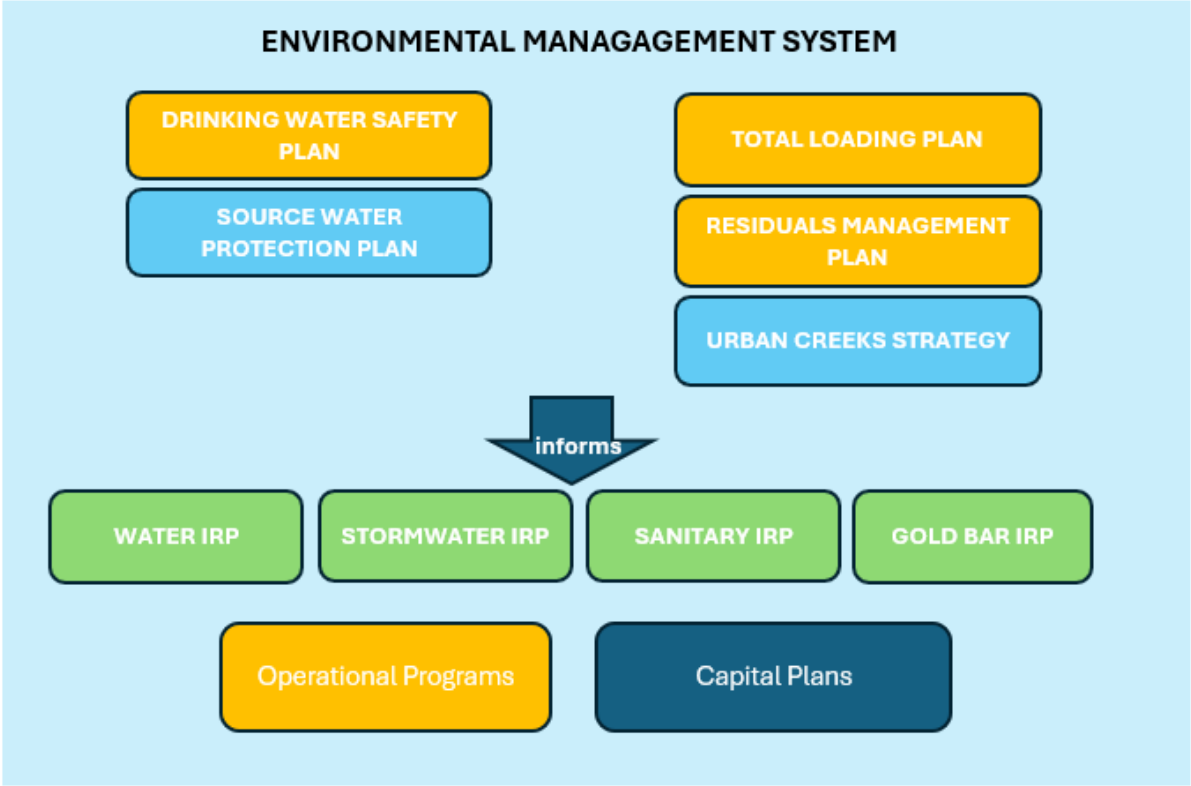
INTEGRATED WATERSHED MANAGEMENT STRATEGY

MANAGING THE UPSTREAM WATERSHED

RISK 1: River water quality and quantity changes and impacts EPCOR's ability to treat and deliver drinking water

MANAGING OUR IMPACTS TO PROTECT THE WATERSHED

RISK 2: River or creek health degrades and overland flooding increases because of EPCOR's actions



REGULATORY

INTEGRATED RESOURCE PLAN

NON-REGULATORY PLANS

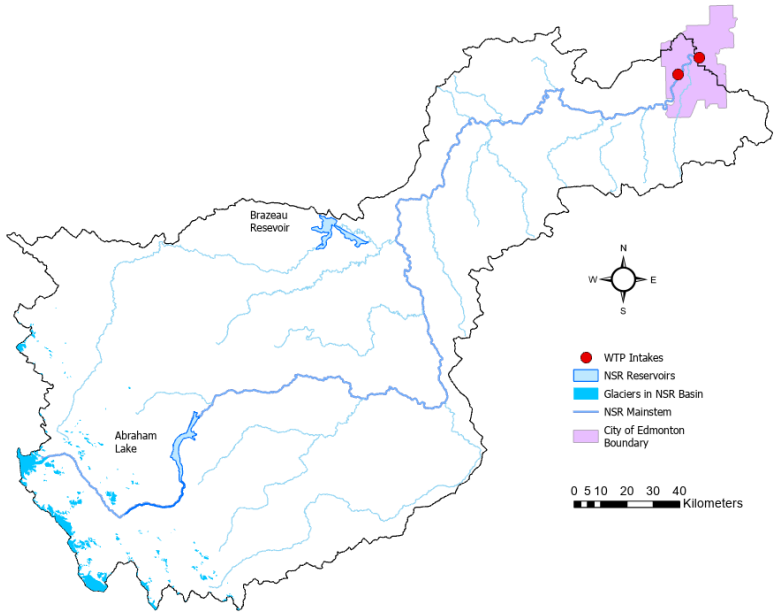
MANAGING THE UPSTREAM WATERSHED

Source Watershed

The source watershed is the 28,000 km^2 land area upstream of Edmonton that feeds the North Saskatchewan River (NSR), the source of drinking water for over 1 million Edmontonians and regional customers. EPCOR's Source Water Protection Plan and accompanying Drinking Water Safety Plan are the planning documents that ensure programs are in place to understand and adapt to changes in the NSR, including impacts from climate change. The overall approach to managing the upstream watershed is collaborative because EPCOR does not own or manage the land upstream. It involves working with watershed groups, municipalities, and other land users to achieve the shared outcomes of a healthy watershed and river.

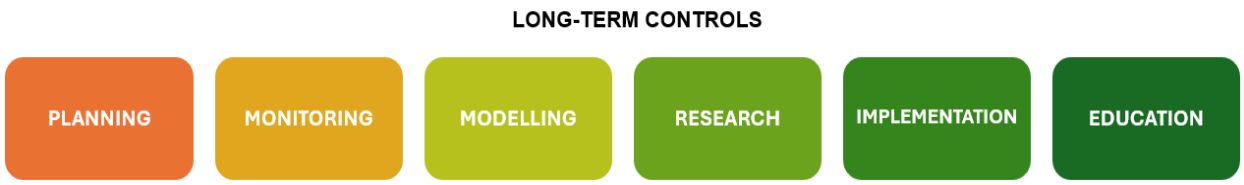
PROVIDE HIGH QUALITY DRINKING WATER BY MANAGING THE SOURCE WATERSHED

Most of the water in the NSR comes from the publicly owned rocky and forested headwater areas. These areas are considered the water towers of the basin, storing water as snow and releasing it slowly over the summer. Much of this supply is managed by two dams, the Bighorn which forms Abraham Lake, and Brazeau which fill over the summer months as snow melts. Over 80% of the annual flow of the NSR passes through these two dams so they are important determinants of water supply. Lower agricultural areas between Drayton Valley and Edmonton contribute only a small proportion of the annual flow to the NSR but can impact water quality in the NSR during spring runoff. During this time, flow in the NSR is low and local melt can double NSR flow for a week while flushing organics and sediments into the river. Activities in the upper watershed such as forestry, mining, urban development, and recreation are minimal, and impacts are largely localized. The largest risk to source supply is the risk of a significant hydrocarbon spill from the many pipelines that cross the river and its tributaries.



Risk 1: River water quality and quantity changes and impacts the ability to treat and deliver drinking water

RISK STATEMENTS	RISK RANKING	ACTIONS & PLANS
Short-Term (1 day to 3 months)		
Catastrophic Spill: Large pipeline break or significant spill on bridge	Medium-High	Emergency Response Plans
Intentional contamination at source intakes	Medium-Low	
Long-Term (multi-year)		
Watershed Land Use Changes • Cumulative impacts on watershed health • Increased timber harvesting and wildfires • Increased intensity of agricultural activities • Increased coal mining • Higher stormwater runoff loads due urbanization	Low	Source Water Protection Plan & Drinking Water Safety Plan
Emerging Contaminants • Contaminants of emerging concern including PFAS, microplastics • Accidental sanitary connection into storm system from infill development	Medium-High	
Climate Impacts (30+ years)		
Forest Fires: Greater severity and larger wildfires **Low flow conditions in the NSR**	Low	
Rainfall: Prolonged wet conditions leading to change in raw water chemistry **Local Drought:** challenging water production	Medium-Low	Drought Resiliency Plan
Higher flood magnitude: inundating plants	Medium-High	Flood Mitigation Project



The risk table above describes the general watershed hazards and risks to source water supply and quality, including those modified by climate. The subsequent section summarizes each risk and EPCOR's individual controls and plans that manage that risk. Long-term strategies and controls are discussed at the end of the document.

SHORT-TERM (1 day to 3 months)

Catastrophic spill

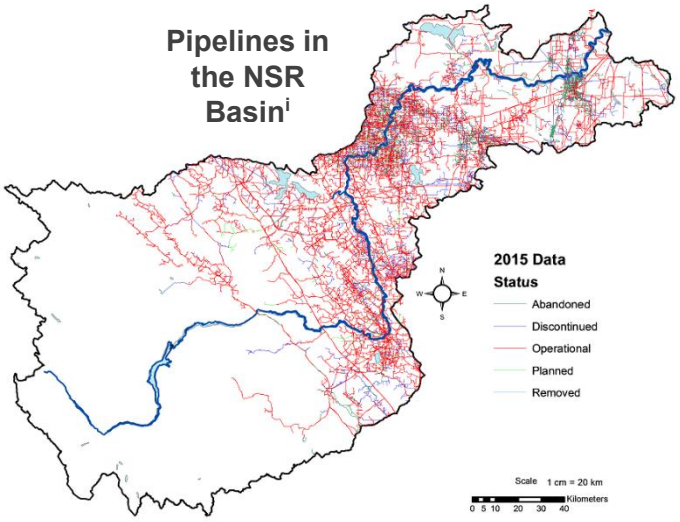
RISK RANKING

Medium-High

If a pipeline breaks, it could release large amounts of oil or related substances into the North Saskatchewan River (NSR). This could significantly affect the river's water quality - sometimes for days or even weeks - and may make the water unsafe to treat and use. Pipeline density in the NSR watershed is relatively high compared to other watersheds and therefore the risk is medium-high.

About 380 pipelines run near or across the river and its nearby streams upstream. Of those crossing the river, some carry higher risk materials that can persist in the environment. These include liquid waste from oil wells (11%), crude oil (6%), and heavy fuels like diesel (1%). The remaining pipelines contain gas products such as natural gas, propane, and methane, that volatilize and pose less risk to water quality.

Pipelines in the NSR Basin[i]



How is EPCOR managing the risk?

Short Term Actions

Water treatment plant intakes are underwater, which helps reduce how much hydrocarbon material could get pulled into the plant.

Alberta Emergency Response protocols are in place to inform the Water Treatment Plants when a spill occurs.

EPCOR has a Spill Emergency Response Plan that outlines actions to take in the event of a spill in the NSR or one of its tributaries. These include shutting off water treatment plant intakes for up to 3 days; adding powder activated carbon to treat contaminated raw water; and implementing EPCOR's Demand Management Plan.

Long-Term Planning

EPCOR has verified that pipeline companies have emergency plans to quickly respond to spills and that they have active spill detection monitoring.

EPCOR supports and summarizes ongoing research to identify better ways to clean water affected by oil or fuel spills and avoid spills from getting into intakes.

EPCOR runs emergency response drills to test communication lines and response should a major spill occur.

EPCOR regularly assesses historical spill frequencies, pipeline densities, and analyses spill response lesson learned documents to inform spill risk and mitigation.

Intentional contamination of source intakes

EPCOR maintains two raw water intakes in the NSR which draw in water continuously from the river, treat it, and distribute it to Edmontonians, and regional customers. These intakes are on public land in the middle of the river and are at risk of direct contamination.

RISK RANKING

Medium-Low

How is EPCOR managing the risk?

Short Term Actions

Intakes are monitored by WTP operators in the control room for water quality and by remote camera.

EPCOR has an Emergency Response Plan that outlines actions to take should contamination occur. These include:

- Water treatment plant intakes can be shut off for up to three days to allow the contaminant to pass, while relying on reservoirs.
- A state-of-the-art laboratory is on-site to test raw and treated water prior to distribution.
- Powder Activated Carbon is available and can be used at the water treatment plants to help treat contaminated water in some cases.
- EPCOR has a Demand Management Plan which addresses short and longer-term drinking water supply interruptions.

Long-Term Planning

EPCOR is scoping the feasibility of an AI warning system that is embedded into the remote cameras.

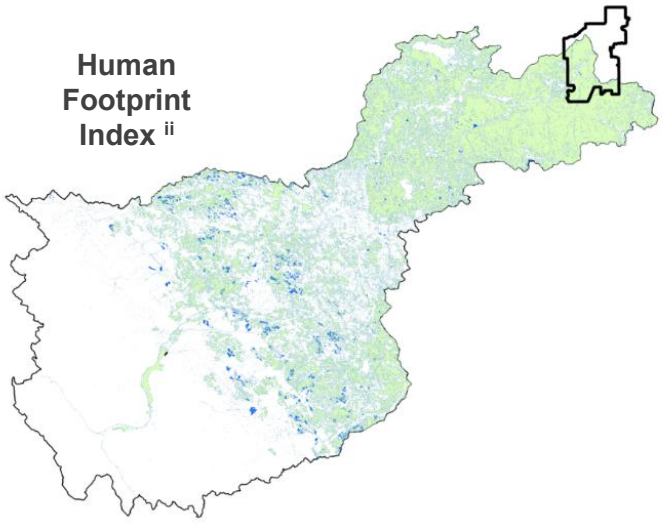
LONG-TERM (multi-year)

Cumulative impacts on watershed health

RISK RANKING

Low

Watershed health - defined by the integrity of ecosystems that supply clean, raw water - is a key early indicator of potential declines in both the quantity and quality of water in the North Saskatchewan River (NSR). The Alberta Biodiversity Monitoring Institute tracks human impact through its Human Footprint Index, which maps all visible, human-caused changes to the landscape, including roads, pipelines, agricultural activity, forestry operations, urban development, and other industrial features. This data shows that the NSR watershed remains largely unimpacted, with only about 30% of its area having a human footprint. These impacts are mostly in lower reaches that contribute little runoff and have less of an effect on quality. Parks and protected areas offer additional protection from human footprints, covering 17% of the watershed further safeguarding the headwaters where much of the water comes from. The basin's high ecological intactness and low human footprint keeps impacts on source water quality at a low risk level. Specific impacts of select human footprints are covered in the sections below but it is important to be aware of cumulative impacts which are done through the human footprint index.



How is EPCOR managing the risk?

Short Term Actions	Watershed scientists review spatial data on the human footprint index annually as well as individual footprints to determine if particular risk is changing.
Long-Term Planning	EPCOR collaborates closely with watershed groups who advocate for expansion of protected areas in the headwaters. We fund and steward the SaskWatch watershed-scale monitoring program to detect changes in quality and flow that may be impacted by the cumulative human footprint. EPCOR supports State of Watershed Reporting by the North Saskatchewan Watershed Alliance which gauges change through time and set targets for protected areas that limit disturbance.

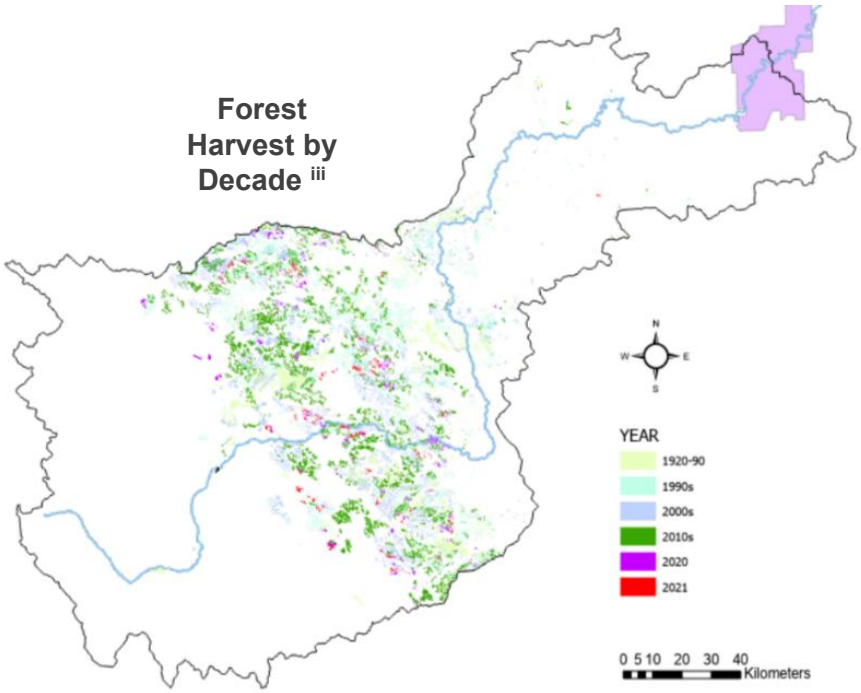
Forestry

RISK RANKING

Low

Forestry practices such as timber harvesting and road construction can significantly influence source water quality by increasing erosion, nutrient and organic matter export, and overall runoff volumes. About 36% of the upstream watershed is designated for timber harvest, which if harvested at high rates could have a significant impact. However, harvest rates are low and over the last decade an average of 75 km² (0.25% of the watershed) has been harvested annually. These areas are re-planted within a few years. Low harvest rates and prompt reforestation minimize changes in runoff and sediment delivery, so forestry remains a low-risk activity from a source water quality perspective.

Forest Harvest by Decade [iii]



How is EPCOR managing the risk?

Short Term Actions

EPCOR's watershed scientists review spatial data on harvest rates annually to evaluate increasing trends that might significantly affect water quality.

Long-Term Planning

EPCOR's watershed scientists update and complete literature reviews on the effect of forestry on treatability and raw water conditions as new information is published.

They also review 100-year harvest plans by forestry companies to understand long-term impacts and try to influence policy change if they see a trend that would have long-term consequence on water quality.

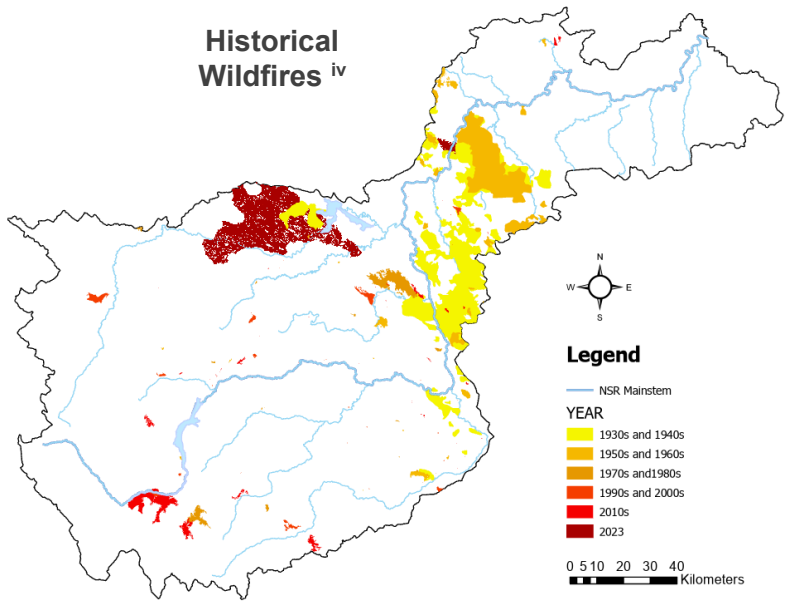
EPCOR participates in the forWater Network which is a Canadian interdisciplinary research initiative focused on protecting drinking water security in the face of climate change, forestry, and natural disturbances like wildfires.

Wildfires

RISK RANKING

Low

Wildfires can degrade source water quality by increasing sediment, ash, and nutrient runoff, and disrupting natural filtration. Since 1970, most fires in the NSR basin have been small (<20 km²), with total burned area under 100 km² per decade. Before fire suppression efforts in the last 100 years, large wildfires were likely more frequent and were part of the natural forest cycle. In 2023, an ~800 km² fire upstream of the Brazeau Dam (3% of the watershed) occurred making it the largest burn in the last 50 years. Despite its size monitoring showed that it had no measurable impact on NSR water chemistry in Edmonton. Studies indicate that more than 20% of the watershed would need to burn before water treatment is affected, so wildfire impacts are considered a low risk. Climate change may alter fire frequency and intensity: warmer temperatures will lead to drier soil moisture conditions in the basin and an increase in the potential for larger fires, particularly in the spring. This natural cycle combined with drier conditions will start to push the boreal forest boundary further north and grasslands ecosystems may replace parkland forests. This change is considered during source risk assessments.



How is EPCOR managing the risk?

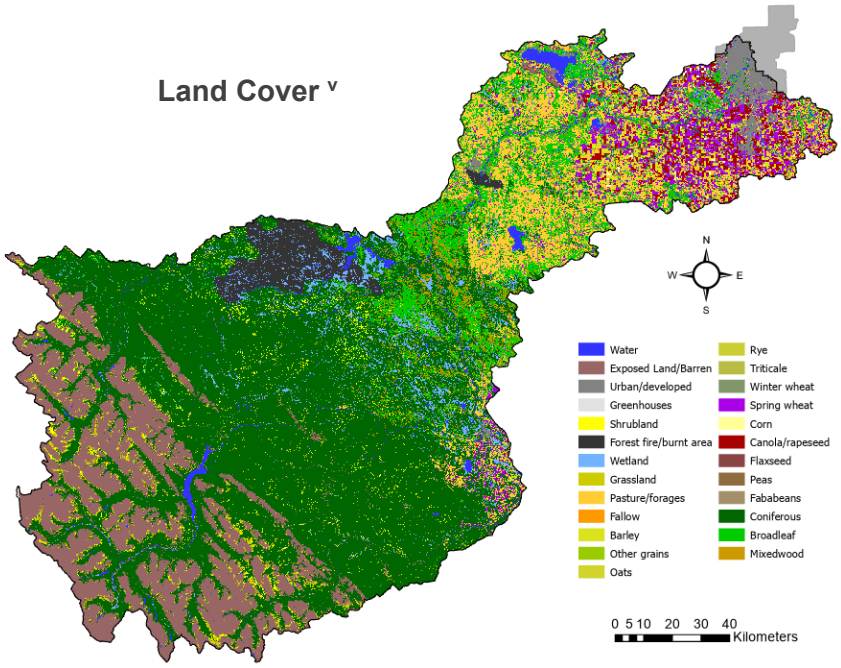
Short Term Actions	EPCOR's watershed scientists review daily wildfire reports during wildfire season and alert operations if there is a large fire. They also initiate water quality sampling downstream of burned areas.
Long-Term Planning	Watershed scientists complete post-fire water-quality monitoring downstream of major burns for indicator parameters. This was most recently done for the 2023 Elk River burn. They also complete and update annual literature reviews on the effect of wildfire on treatability and raw water conditions. EPCOR is also an active participant in the forWater Network which investigates wildfire impacts on drinking water treatability. The information and research from this network is compiled in the SWPP.

Agriculture

RISK RANKING

Low

Agricultural activities can impact source water quality by introducing nutrients, pesticides, and sediments into waterways through runoff, potentially leading to contamination and ecosystem disruption. The predominately agricultural lands in sub-watersheds between Drayton Valley and Edmonton contribute intermittent spring and summer runoff - sometimes up to 50% of river flow - that is high in nutrients, organics and sediment. These can be challenging times for treatment, but EPCOR is well adapted and WTPs have been designed to treat raw water that is high in organic material. Overall, the agricultural land base has already been established. Crop cover is not increasing, and livestock numbers are not changing, and creek water chemistry has been consistent over the last 30 years. EPCOR's treatment processes already handle elevated organic loads from these areas, keeping agricultural impacts at low risk.



How is EPCOR managing this risk?

Short Term Actions

Water Treatment Plant Operations Team uses adaptive raw-water treatment protocols during spring-runoff periods where agricultural creek flow has the greatest impact on water quality in the NSR.

Long-Term Planning

EPCOR watershed scientists monitor flow, nutrients, and organic concentrations in agricultural tributaries to understand change through time.

They also review census data for trends in livestock numbers and crop cover and publish in the Source Water Protection Plan.

EPCOR supports organizations that focus on engagement with farmers on off-site watering, riparian improvements, and wetland retention.

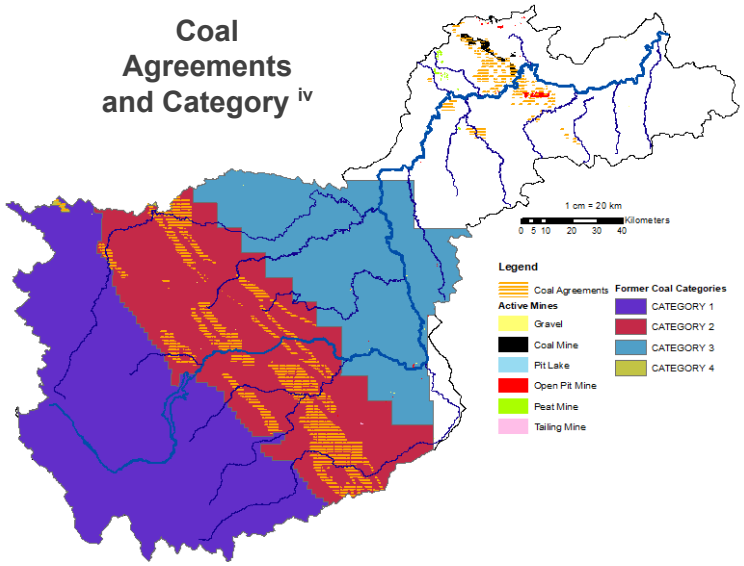
Coal mining

RISK RANKING

Low

Coal mining can impair water quality by releasing mine drainage and exposing rocks that are high in heavy metals like selenium, arsenic, and nickel that runoff into nearby rivers and groundwater, often exceeding safe ecological thresholds and posing long-term risks to aquatic life and human health. There are no active coal mines in the NSR headwaters and former mines near Wabamun Lake have been decommissioned. Based on our literature review, if new permits covered the 5% of the watershed where coal agreements exist, selenium levels, which is a parameter of concern downstream of mining, would likely still be well below drinking-water guidelines. This is also true for other coal associated contaminants. Coal-mining impacts are therefore classified as low risk for drinking water supply. We do note that aquatic life is much more sensitive to selenium and other metals and guidelines are regularly exceeded downstream of coal mining in other areas of Alberta.

Coal Agreements and Category [iv]



How is EPCOR managing this risk?

Short Term Actions	EPCOR conducts ongoing policy reviews to anticipate and manage future coal policy changes and potential coal mining impacts to drinking water supply.
Long-Term Planning	EPCOR's watershed scientists complete literature reviews of coal mine effects in other areas to understand risk. EPCOR has created a process to adapt monitoring parameters and locations for early detection of water-quality shifts downstream of future mining. EPCOR coordinates with the North Saskatchewan Watershed Alliance to communicate risks to watershed health and drinking water supply.

Stormwater impacts from urbanization

RISK RANKING

Low

EPCOR is responsible for managing stormwater runoff from the collection system within Edmonton. There are currently only two storm sewer outfalls located upstream of the E.L. Smith WTP; however, further growth of the City of Edmonton may result in additional storm sewer outfalls being built upstream. There are 29 storm sewer outfalls that drain directly to the NSR, and an additional 17 storm sewer outfalls located in ravines or creeks that drain into the NSR upstream of the Rossdale WTP with a total drainage area of 234 km^2. Other municipalities upstream comprise 60 km^2 of area that also discharges stormwater to the NSR or its tributaries. Stormwater typically has elevated concentrations of sediments, nutrients, pathogens, metals and pesticides from urban runoff and at times can make upwards of 10% of the flow in the NSR at Rossdale. Despite this, the WTPs can effectively treat raw water and have not had to alter treatment because of the location. For that reason, stormwater is currently at a low risk.

How is EPCOR managing the risk?

Short Term Actions

There are a total of 133 stormwater management wet facilities within the stormwater collection system upstream of Rossdale which slow stormwater and improve water quality.

Low impact development features are being constructed across the City through EPCOR's RainWise program, in collaboration with the City of Edmonton's neighborhood renewal and building great neighborhoods programs, along roadways and at industrial/commercial sites.

Outfalls are being monitored for bacteria to ensure only stormwater enters the river.

Long-Term Planning

EPCOR will continue to invest in a mixture of grey and green infrastructure to manage stormwater within Edmonton as part of its Stormwater Integrated Resource Plan, promoting green infrastructure and minimizing grey.

New growth at the southern border of the City and infill in mature neighborhoods is occurring but EPCOR is committed to managing these loads to not alter water quality in the NSR from baseline conditions through its Total Loadings Plan.

Emerging Contaminants

RISK RANKING

Medium-High

Contaminants such as pesticides, pharmaceuticals, and other trace organics are low in the NSR. That said, contaminants are always changing and being introduced to the environment and risk assessments must be ongoing. A new contaminant source that has been identified is from accidental connections of sanitary into the stormwater system. Although this is a stormwater risk it is included here because it is a known point source rather than general stormwater runoff issue.

How is EPCOR managing this risk?

Short Term Actions

EPCOR monitors and reviews data on pharmaceuticals, pesticides and contaminants of emerging concern. A summary of our emerging contaminant monitoring and results are in the SWPP.

EPCOR will add monitoring for microplastics once a standard method is developed.

EPCOR is using bacterial source tracking to identify and fix illegal sanitary connections to the stormwater system.

Long-Term Planning

EPCOR is part of industry working groups that identify contaminants of emerging concern, and we adjust intake monitoring when new parameters of concern are identified. For example, 6-PPE-quinone, such as polycyclic aromatic hydrocarbons (PAHs) and perfluoroalkylated substances (PFAS) have recently been added to our testing program.

EPCOR scientists also scan Long-Term River Network data to determine if there are detections of emerging contaminants and we ensure that tributary monitoring programs adjust parameters as needed.

Completing root cause analysis of how sanitary to storm connections are occurring and developing a mitigation plan.

Climate Change Impacts (30+ years)

Climate change impacts on supply and water chemistry

	RISK RANKING
SUPPLY	Low
CHEMISTRY	Medium-Low

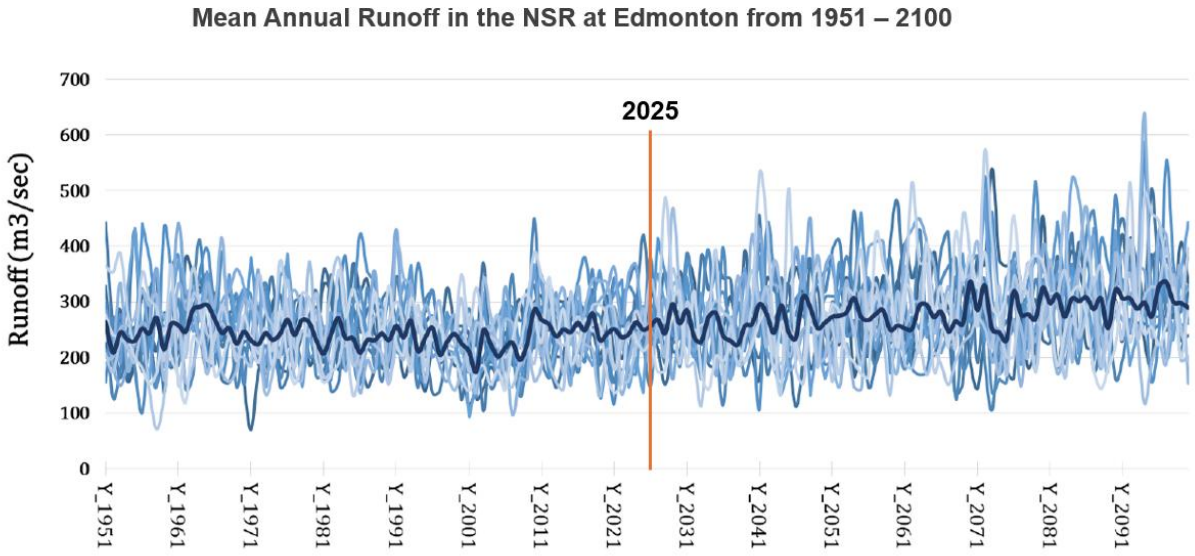
Climate change happens when human activities add extra greenhouse gases into the atmosphere, trapping more heat around the planet. This shift leads to warmer temperatures, changing precipitation patterns, and more extreme weather.

In our part of Alberta, models show that we can expect:

- Hotter summers and milder winters.
- More overall precipitation, intense rainstorms, and sudden downpours.
- Longer stretches of local drought due to reduced soil moisture.

Together, these changing patterns affect how much water - and what kind of materials (sediment or organic matter) - enters the North Saskatchewan River. That, in turn, can impact water treatment processes and supply. It can also modify the frequency of wildfires (covered in the section above).

Because climate change is expected to bring heavier rainstorms, it is expected more sediment and natural organic material will runoff into the NSR, making it harder and more expensive to treat. EPCOR rates this as a medium-low risk because the treatment plants are already well adapted to treat a range of raw water quality conditions. On the supply side, overall river flow is projected to rise by about ~8%, meaning that with reservoir storage and low overall river use, not having enough supply from the river is a low risk. However, warmer temperatures mean local droughts will be more common, increasing outdoor watering demand, and potentially straining the ability for treatment plants to meet that peak demand.



Source: vi

How is EPCOR managing this risk?

Short Term Actions	Optimizing water treatment plant operation to handle a wider range of water quality conditions. Implementing our Drought Resiliency Plan and demand management protocols to manage demand during drought. Watershed scientists conducting spring water-supply forecasts to understand annual drought risk.
Long-Term Planning	Partnering on ongoing climate research and actions with the City of Edmonton and the Prairie Adaptation Research Collaborative. Participating in Alberta Water Council's Drought Planning including 'Updating the Guide for Building Resiliency to Multi-Year Drought in Alberta Project'. Implementing our Drought Resiliency Plan to manage demand over the long-term through stormwater management.

Increased river flooding from climate change

RISK RANKING

Medium-High

EPCOR's two water treatment plants (WTPs) are located within the North Saskatchewan River (NSR) floodplain, exposing them to both direct and indirect flood impacts. High water levels, elevated organic loads, and suspended sediments can curtail or halt potable-water production, even if physical infrastructure remains intact. Unmitigated floods at or above the 1:100-year return period pose a high risk of significant damage; 1:50-year floods can cause shorter-term disruptions by preventing clarifier drainage. Climate change is a modifier that increases the risk of naturally occurring floods and therefore floods are classified as a medium-high risk.

Snowmelt from the Rocky Mountains drives river flow which peaks in late May or early June. Typically, floods in the NSR are driven by widespread heavy rainfall (>100 mm) over several days across the upper watershed.

- Bighorn Dam offers minimal flood reduction for Edmonton's major events due to minimal watershed rainfall.
- Brazeau Dam can hold back flows, but reservoir capacity limits mean only ~10–15% peak attenuation on average.
- Regional studies project a 35% average increase in flood magnitudes, driven by more intense and widespread precipitation events.
- Dams are operated by TransAlta for electricity and are not operated for flood attenuation.

NSR Flows and Climate Impacts [viii]

Return Period	Naturalized Flow (m^3/s)	Regulated Flow (m^3/s)	Estimated Climate Impacts on Regulated Flow (m^3/s)
2	1,300	1,070	1,264
10	2,910	2,260	2,868
20	3,580	2,790	3,604
50	4,470	3,540	4,659
100	5,130	4,140	5,512
200	5,800	4,790	6,440
500	6,670	5,710	7,763
1000	7,330	6,460	8,847

How is EPCOR managing this risk?

Short Term Actions	Watershed scientists monitor river gauges and weather radar alerts through Alberta River Basins and through an email notification. EPCOR maintains a Flood Emergency Response Plan as part of EPCOR's EMS Flood-berm construction around WTP sites to withstand up to a 1:500-year flood event. EL Smith and Rossdale WTPs will be fully protected by end of 2027 Adding outfall gates to prevent backflow into the plant and drainage system during high water events. Store temporary/movable flood barriers, sump pumps and other supplies to help protect low lying areas of Water Treatment Plants during high river level events.
Long-Term Planning	Updating climate-change modelling which uses regional climate projections to adjust flood-frequency analyses and design standards. Flood protection and recovery risk assessment underway at the Gold Bar WWTP to address flood risk. Investigating dam-operation coordination with TransAlta to reduce flood peaks. Continuing to conduct tabletop and field exercises with City of Edmonton, Alberta Emergency Management Agency, and internal teams to validate flood-response protocols. Continue to work with regional partners to create emergency response plans and demand management protocols.

Source: City of Edmonton Archives

MANAGING OUR IMPACTS TO PROTECT THE WATERSHED

EPCOR manages stormwater and wastewater impacts to Edmonton's creeks and the North Saskatchewan River using a total loadings approach. By capping and balancing pollutant contributions across wastewater and stormwater, we optimize treatment and controls to meet regulatory limits, protect aquatic habitat, maintain water quality and prevent overland flooding. We do this using a mix of green and grey infrastructure alongside education, monitoring, and maintenance programs. This is done on two main scales: City wide and for urban creek watersheds, which experience impacts differently.

MANAGING OUR IMPACTS TO PROTECT THE WATERSHED: CREEKS, AND THE NORTH SASKATCHEWAN RIVER

City of Edmonton

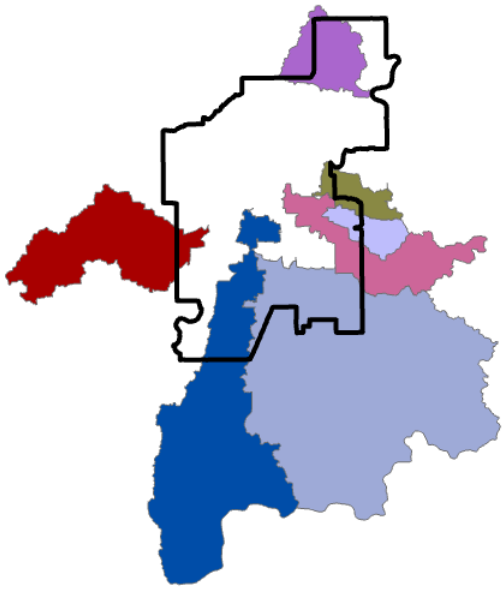
Within the City of Edmonton boundary, EPCOR is responsible for managing the effects of wastewater (WTP residuals, combined sewer overflows, and wastewater effluent) and stormwater. This includes working collaboratively with the City of Edmonton and ARROW to manage the cumulative impact through capping total loads of key parameters even as the City of Edmonton grows. From a wastewater perspective, the Gold Bar and ARROW Wastewater Treatment Plants manage human and industrial wastewater while returning over 90% of the water withdrawn from the NSR daily.

Within the City boundary, the stormwater collection system comprises a land area of almost 400 km^2 of the total City area of 783 km^2. This collection area drains to creeks, the NSR or into Big Lake in the very Northwest of Edmonton. Land within the stormwater area is 60% impervious (roofs, pavement, and roads) and that means over half of the rain that falls within the City of Edmonton runs off and needs to be managed. This results in altered local stream hydrology, leading to local overland flooding, and affecting water quality in the NSR. In comparison, a natural system with no development is estimated to have less than 5% runoff.

EPCOR aims to hold contaminant loads steady to ensure that water chemistry in the NSR is not altered from baseline conditions

Urban Creek Watersheds

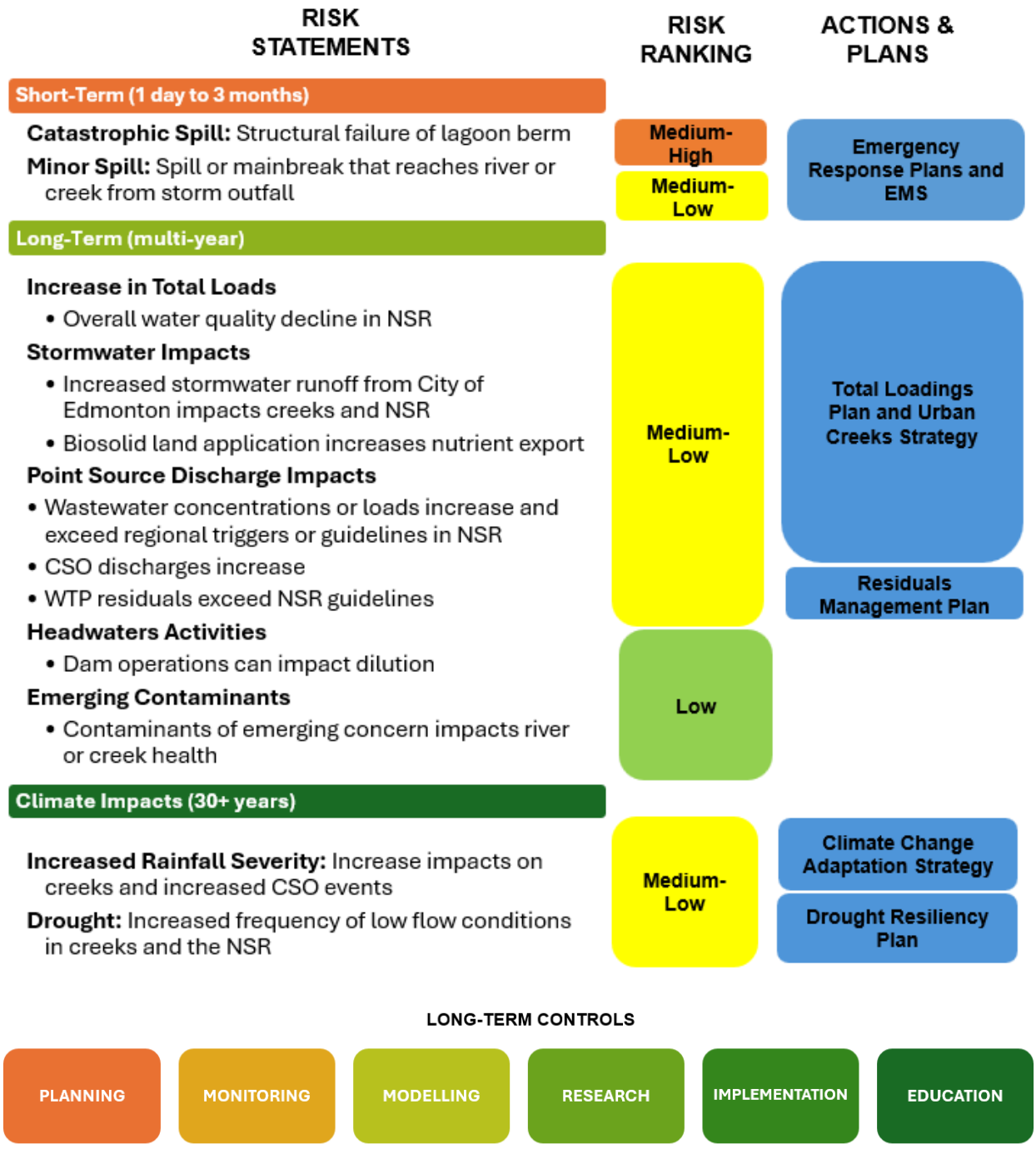
As the stormwater manager for the City of Edmonton, EPCOR has a shared responsibility with the City of Edmonton and adjacent municipalities to manage impacts on urban creeks - creeks which drain into the NSR within the City of Edmonton boundary. Urban creeks are facing a well-known phenomenon of 'urban creek syndrome' which refers to the degradation of stream ecosystems caused by urbanization and characterized by flashier flows, increased pollutants, and reduced biodiversity. As cities expand, impervious surfaces like roads and rooftops prevent natural water absorption, causing stormwater to flow into creeks with greater volume and velocity, eroding channels and disrupting aquatic habitats. This rapid runoff also carries contaminants - such as nutrients, heavy metals, and oils - leading to poor water quality and dominance of pollution-tolerant species. EPCOR sees these impacts on Edmonton's urban creeks and is working collaboratively to improve their health over time.



EPCOR's Urban Creek Strategy is a guiding document that aims to creek health for Blackmud, Whitemud, Wedgewood, Gold Bar, Horsehills, Fulton and Mill Creeks, largely through stormwater management initiatives. The combined watershed area for these creeks within the City of Edmonton is 295 km^2. Of that 40% (111 km^2) of the land is connected directly to the creek through the stormwater system and its 85 outfalls. Creek watersheds extend beyond the City of Edmonton boundary and a total of 1186 km^2 lies outside of Edmonton.

EPCOR aims to improve hydrology and aquatic health in creeks within Edmonton through our Urban Creeks Strategy

Risk 2: River or creek water quality and aquatic ecosystem health degrades because of EPCOR's operations



This risk table describes the environmental risk to urban creeks and the NSR, including those risks modified by climate. The subsequent section summarizes the risks and discusses the total cumulative impact of each major EPCOR source: stormwater, wastewater, combined overflows, and water treatment plant residuals.

SHORT-TERM (1 day to 3 months)

Spills

Lagoon breaches at Clover Bar and chemical truck spills at WTPs sites are EPCOR's largest spill related concerns that would impact the NSR and are considered medium-high risk. Other small spills across the system are managed within the EMS protocols.

RISK RANKING

Medium-High

Spills that reach waterbodies through outfalls either on EPCOR plants sites or through our stormwater system are medium-low risks due to their low volumes and transient nature.

RISK RANKING

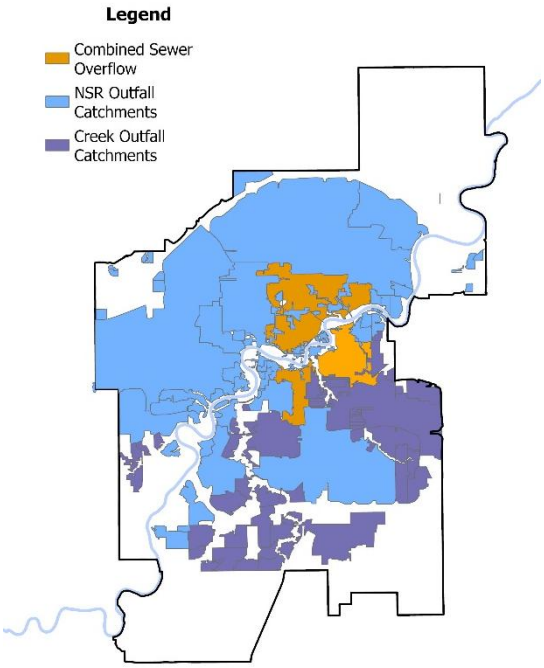
Medium-Low

How is EPCOR managing these risks?

Short Term Actions	Catchbasins have containment where contaminants are trapped and then removed by vacuum trucks. Water from mainbreaks is dechlorinated through the use of SBS pucks before reaching the stormwater system. Lagoon berms are inspected regularly and biosolids are inventory is kept low through land application
Long-Term Planning	All spills are managed through EPCOR's Environmental Management System, which includes Standard Operating Procedures which are intended to avoid spills and Emergency Response Plans to mitigate harm and recover in the event of a major or minor spill Biosolids Management Plan to reduce inventory. Asset management plans are in place to ensure mains remain in good condition.

LONG-TERM (multi-year)

Increases in total loads which degrades NSR water quality



RISK RANKING

Medium-Low

To keep the NSR healthy, it is important to manage for the total loads of a city because water quality is shaped by the cumulative impact of all sources. This includes urban runoff, industrial discharge, wastewater, and natural inputs. Currently runoff and waste from the City of Edmonton 783 km^2 footprint enters the NSR and its tributaries via EPCOR's ~400 km^2 stormwater system, 22 km^2 combined system, and through Gold Bar's and ARROW's WWTPs. EPCOR is aiming to cap the cumulative loads of indicator parameters so that water quality downstream of Edmonton does not degrade as the City grows. If EPCOR and the City do not work collaboratively to manage the total mass of pollutants discharged to the NSR, water quality would continue to decline.

How is EPCOR managing this risk?

Short Term Actions

A series of operational management tools are used across the system to manage total loads. These include EPCOR and City programs such as catch-basin cleaning, street sweeping, spill containment, installation of low impact development features and use of Storm Water Management Facilities. They also include Operations Plans at the Gold Bar WWTP that minimize bypasses and ensure end of pipe limits are met.

Long-Term Planning

Total Loadings Plan (TLP): Regional impacts on the NSR are managed through the Total Loadings Plan which aims to hold loads of indicator parameters to historical benchmarks. ARROW Wastewater loads are included in the TLP. Annual reports on loading targets are submitted to AEPA.

Total Loadings Plan Targets

Parameter	Total Phosphorus	Ammonia	Nitrate +Nitrite	Chloride	*E. coli*	TSS
TLP Target						

no 5-year ↑ trend · monitor closely · plan · collaborate

Stormwater Impacts

RISK RANKING

Low

Stormwater runoff happens when rain or melting snow flows over hard surfaces, picks up pollutants as it moves, and enters a storm sewer system that ultimately drains into nearby rivers and creeks. Instead of soaking into the ground like in a natural system, this runoff often carries pollutants such as oil, sediment, nutrients, and sometimes garbage directly into nearby waterways. This influx of contaminants can degrade water quality, harm aquatic life, and disrupt natural ecosystems. Additionally, the rapid flow of stormwater can cause erosion, increase sedimentation, and lead to more frequent and severe flooding events. EPCOR operates just under 400 km^2 of stormwater system discharging through 175 main outfalls. Of that, 110 km^2 discharges into urban creeks and 126 km^2 flows through stormwater management ponds. As the City grows the storm system will expand, and stormwater will need to be managed to offset those additional impacts.

How is EPCOR managing this risk?

Short Term Actions

Since the early 1970s stormwater ponds have been key to reducing flooding and attenuating pollutants. Edmonton now has 289 SWMF: engineered wet ponds, constructed wetlands and dry ponds managing an area of 126 km^2. The wet facilities are designed to attenuate peak runoff, trap sediments, and facilitate pollutant uptake by aquatic vegetation and microbial communities.

EPCOR has installed over 100 green Infrastructure/Low Impact Development (LID) features such as soil cells, rain gardens, and box planters which reduce the volume and slow the flow of stormwater.

Sediment traps in catch-basins, oil and grit separators, and real-time controlled storage tunnels have also helped manage stormwater runoff.

Long-Term Planning

EPCOR's **Total Loadings Plan** is based on a 'no further degradation' policy for the NSR and strives for pollutant loads to be capped even as the City grows.

EPCOR's **Stormwater Integrated Resource Plan** (SIRP) is the long-term strategy for managing stormwater, outlining how to reduce local flooding risks and minimize the impact of runoff on downstream rivers and creeks.

EPCOR is also updating its **Green Infrastructure Strategy** to increase the uptake of low impact development across the City, which maximizes co-benefits and reduces long-term costs. This includes continued promotion of a lot of storage through residential and commercial programs such as EPCOR's RainWise.

EPCOR is scoping the use of Smart Pond technology to increase storage and attenuation of pollutants particularly in urban creek basins.

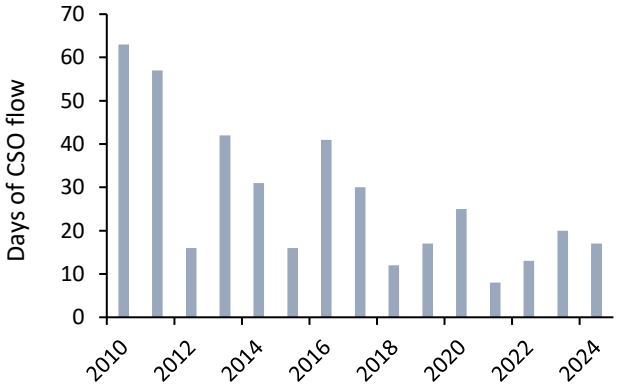
Implementation of EPCOR's Urban Creek's Strategy to mitigate the impacts on urban creeks in Edmonton from stormwater runoff.

Combined Sewer System Overflows

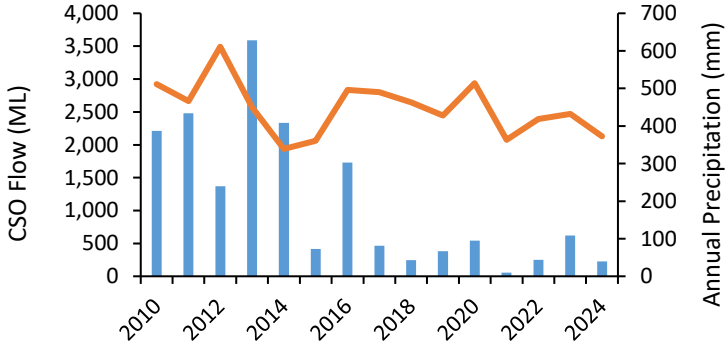
RISK RANKING

Medium-Low

The combined sewer area makes 3% of the land area of the City of Edmonton and its system conveys both stormwater (rain and snowmelt) and sanitary wastewater in the same network of pipes. This approach was adopted before 1960 as a cost-effective alternative to constructing separate storm and sanitary sewers. During light to moderate precipitation events flows in the combined sewers are routed to and treated at the wastewater plant. In heavy storms when inflow exceeds pipe capacity, excess mixed flows bypass treatment and discharge directly into the North Saskatchewan River and in some cases, Mill Creek. The combined sewers carry a complex mix of untreated sanitary sewage and urban runoff that together degrade water quality when released.



Each combined sewer overflow (CSO) event's frequency and volume are tracked and reported to both Alberta Environment and Protected Area and federal regulators. Continuous improvements have decreased CSO events significantly in the last ten years. Edmonton's two drinking-water intakes at E.L. Smith and Rossdale are located upstream of all overflow outfalls, ensuring municipal drinking water remains unaffected by CSOs.



Climate change could increase storm intensities and increase CSO overflows and the risk is classified medium-low.

How is EPCOR managing this risk?

Short Term Actions

In 1999, the city launched a 16-year Combined Sewer Overflow Control Strategy (2001–2016) with a 1999 cost estimate of $150 million. The following actions were completed that reduce overflows:

- Installation and use of movable real-time control gates in existing pipes that capture an additional 323,000 m³ of wet weather flow annually, cutting overflow volumes.
- Enhanced primary treatment upgrades at Gold Bar Wastewater Treatment Plant and a tunnel under the river to convey CSO flows from Rat Creek to Gold Bar for treatment.
- Opportunistic separation of combined sewers during capital works such as dry pond installations.

Long-Term Planning

EPCOR's Stormwater Integrated Resource Plan focuses on slowing stormwater entering the CSOs using green infrastructure (e.g., rain gardens, permeable pavements).

EPCOR is updating the Combined Sewer System model which predicts discharge events to inform future infrastructure projects.

Gold Bar Wastewater Treatment Plant

RISK RANKING

Low

Gold Bar WWTP serves as Edmonton's primary line of defense against untreated sewage entering the North Saskatchewan River by capturing and treating combined and regular sewer flows through a multi-stage process. Its enhanced primary treatment intercepts extreme wet-weather inflows that enter from the remaining combined system. Following primary and secondary treatment, which eliminates solids and oxidizable organic matter, the effluent undergoes tertiary filtration and high-intensity ultraviolet disinfection over an 18-hour treatment cycle before safe discharge, ensuring regulatory compliance and protecting aquatic ecosystems. Biosolids are collected, held in lagoons, and then land applied.

How is EPCOR managing this risk?

Short Term Actions

Under Alberta Environment and Parks Approval to Operate No. 639-03-06, the Gold Bar WWTP must meet stringent concentration limits. A focus on operational excellence has driven concentrations much lower.

Total suspended solids and residual organic matter are removed to very low levels resulting in a visually clear effluent.

FINAL EFFLUENT CONCENTRATIONS AND APPROVAL REQUIREMENTS

Parameter	Mean Concentration (mg/L)	Approval Requirement (mg/L)
Total Phosphorus	0.29	1
Ammonia	2.07	5 to 10
Total Suspended Solids	4.4	20
E. coli	11	126

	Gold Bar WWTP reduces phosphorus loads by >95% with final effluent around 0.5 mg/L (requirement of <1 mg/L) and ammonia loads by >90% compared to raw sewer influent. Pathogen indicators (*E. coli*) are inactivated by high-intensity ultraviolet light before the effluent is discharged to the North Saskatchewan River Gold Bar WWTP applies biosolids to ensure beneficial outcomes for agricultural land including restoring organic matter, increasing crop yields, and increased water holding capacity reducing downstream runoff.
Long-Term Planning	**Total Loadings Plan**: With a 'no further degradation' policy in place for the NSR and a continually expanding collection system, EPCOR is focused on innovative solutions to not increase wastewater loads of key parameters such as nitrate plus nitrite. A plan to reduce nitrate plus nitrite will be completed in 2028 and submitted to the regulator.

Water Treatment Plant Residuals

RISK RANKING

Low

Residuals generated from drinking water treatment are released back to the NSR. They consist of solids and metals that occur naturally in the river, plus alum, polymer, and at times powdered activated carbon, that are added for water treatment. Residuals can have local (TSS and metals) and regional (aluminum) impacts to the NSR. Work is underway to improve knowledge of the magnitude and timing of these impacts. Steps have also been taken to minimize the generation of residuals, such as direct filtration during winter; however, Edmonton remains one of the few waterworks systems in Alberta authorized to direct discharge water treatment plant residuals to a receiving stream without treatment. We are therefore looking for ways to further manage residuals. EPCOR is currently developing a strategy to evaluate all options to minimize the impact of residuals on the NSR.

How is EPCOR managing this risk?

Short Term Actions	EPCOR has implemented an effluent water quality and flow monitoring program to measure impacts on the NSR from episodic discharge events. EPCOR has also completed over a decade of toxicity testing to test impacts of effluent on fish species. The WTPs operate in direct filtration in winter months which optimizes chemical usage and reduces residuals discharge significantly. The target is 120 days of direct filtration per year. Both Edmonton WTPs had sodium bisulfite systems installed to dechlorinate residual discharge to the river and these systems are monitored 24/7.
Long-Term Planning	EPCOR is developing a Residuals Management Strategy to continuously monitor and reduce water treatment plant residuals.

LONG-TERM CONTROLS

Longer-term controls are broad initiatives and programs that bridge across multiple risks. These include planning, watershed science, implementation, and educational programs that EPCOR has invested in for, in many cases, over 30 years.

COLLABORATIVE WATERSHED PLANNING

Strategic Goal 1: Work alongside watershed planning partners to protect drinking water source quality and manage cumulative effects

Action: Support the North Saskatchewan Watershed Alliance

As the Watershed Planning and Advisory Council under *Water for Life*, the NSWA leads State of Watershed reporting and develops the Integrated Watershed Management Plan for the basin. EPCOR has been actively involved with the NSWA since its inception through board participation, project collaboration, and funding. This partnership ensures ongoing collaborative and effective watershed management, emphasizing source water protection principles.

Action: Support the Urban Creeks Collaborative

The Urban Creeks Collaborative is an initiative initiated by EPCOR and now led by the North Saskatchewan Watershed Alliance aimed at restoring the natural hydrology and improving water quality of creeks within the City of Edmonton. The primary purpose of the *Collaborative* is to bring together relevant stakeholders from various sectors, including municipal governments, regional organizations, government agencies, environmental organizations, community groups, and research to work collectively towards the restoration of urban creeks within Edmonton.

Strategic Goal 2: Understand and support regulatory initiatives that work to ensure source water quality is preserved and cumulative effects from our operations are effectively managed

Action: Align with the Surface Water Quality Management Framework for the North Saskatchewan River

Alberta Environment and Protected Areas has developed a Surface Water Quality Management Framework for the North Saskatchewan River that works to maintain or improve water quality on the North Saskatchewan River upstream of Edmonton at Rocky Mountain House and Devon. This provides a level of assurance that source water quality will not degrade from municipal or industrial activities without some level of action. The Surface Water Quality Management Framework uses twenty-one indicator parameters each with limits and triggers where the trigger is a deviation from historical water chemistry. EPCOR has aligned its Total Loadings Plan and monitoring plans with this initiative.

Action: Be an engaged and active member of the Industrial Heartland and Capital Region Water Management Framework

The Industrial Heartland – Capital Region, northeast of Edmonton along the North Saskatchewan River, is a key industrial hub with strong potential for growth in areas like bitumen upgrading and petrochemical processing. Since 2007, the EPA and stakeholders have collaborated on

cumulative effects management, guided by the Water Management Framework. Current efforts focus on monitoring effluent and stormwater to support future water quality planning. The WMF aligns with broader regional goals to manage cumulative impacts, promote sustainable development, and protect river health through science-based collaboration. This initiative is led by the GoA and includes industry, municipalities, municipal water and wastewater treatment facilities (EPCOR and ARROW), and the NSWA. EPCOR continues to be an engaged and committed partner.

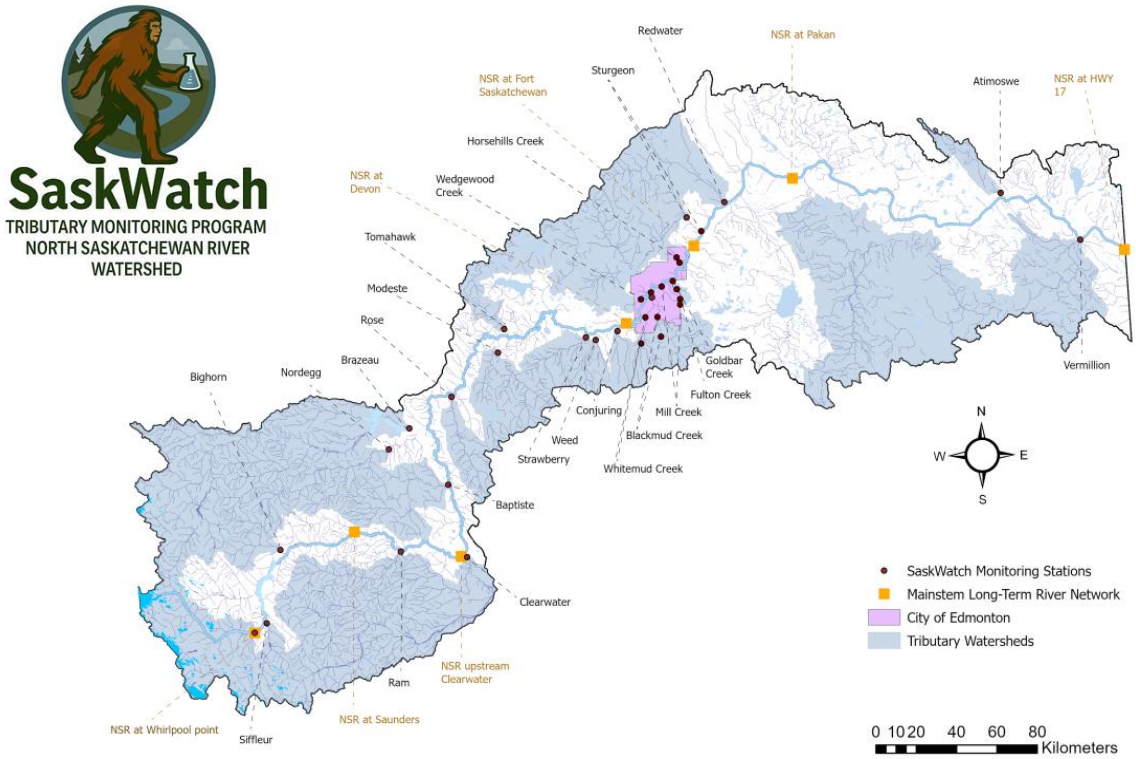
WATERSHED SCIENCE: MONITORING, MODELLING, AND RESEARCH

Strategic Goal 3: Support and invest in monitoring, modeling, and research to assess watershed health, identify trends, evaluate impacts, and communicate results.

Action: Implement and sustain comprehensive, timely monitoring of water quality and quantity in the North Saskatchewan River and its tributaries

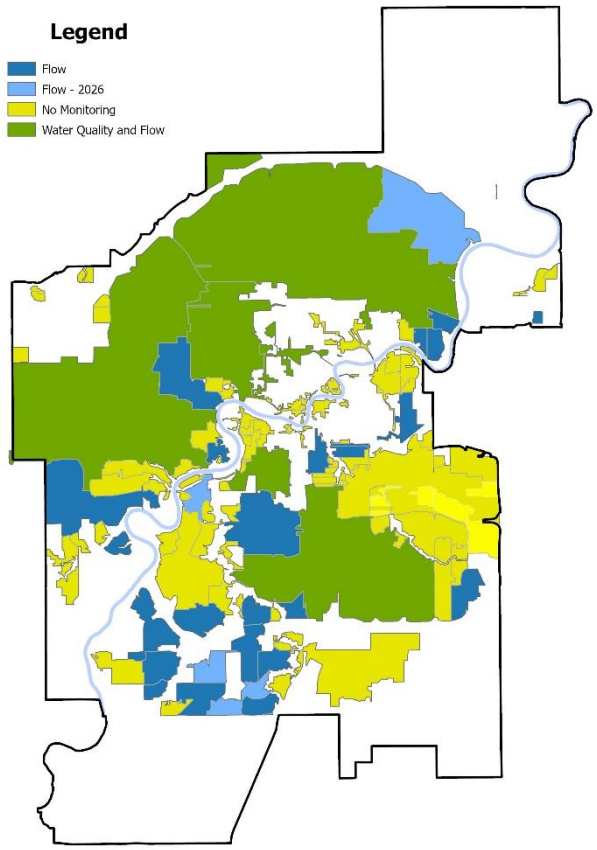
MONITORING

EPCOR watershed scientists review and report on changes in watershed conditions, water supply, and water quality. EPCOR runs a comprehensive raw water intake monitoring program and makes data publicly available on DataStream. EPCOR also supports the **SaskWatch Program** which is a one-of-a-kind partnership between EPCOR, Alberta Environment and Protected Areas, North Saskatchewan Watershed Alliance, CreekWatch and the City of Edmonton to monitor water quality and flow measuring stations on 27 tributaries throughout the NSR watershed.



Action: Implement, sustain, and improve monitoring and assessment of impacts from EPCOR's water treatment plants, stormwater outfalls, and wastewater systems

Accurate load estimations from stormwater and wastewater are essential for understanding the cumulative impacts of urban runoff on the North Saskatchewan River and its tributaries. These estimates help identify sources of pollutants like nutrients, sediments, and pathogens, which can degrade water quality and aquatic ecosystems.



Since the early 1990s five main stormwater outfalls equating to 202 km^2 of area and 50% of stormwater service area, have been monitored for both flow and water chemistry. EPCOR is continually improving load estimations by:

- **Enhancing Outfall Monitoring:** In 2023-2025 EPCOR added flow monitoring to 20 more outfalls adding 60 km^2 of monitored area. In 2026, another 23 outfalls and 35 km^2 of stormwater drainage area will be added. This means 76% of the stormwater system will be directly monitored for flow. Water quality will also be added to two new outfall sites to better capture how ponds attenuate flow and pollutants in new developments.

- **Enhancing Creek Monitoring:** In 2024 and 2025 EPCOR installed flow stations on Wedgewood Creek, and Gold Bar Creek which added to the existing stations on Mill Creek and Whitemud/Blackmud Creek. This means that all the urban creeks are now monitored continuously for flow. Additional flow sites upstream on Mill Creek and Horsehills Creek will be added in 2026.

Action: Implement and sustain modelling that allows the impact of growth and climate change scenarios on source water supply and impacts of stormwater runoff and wastewater.

MODELLING

Urban Creek Modelling

To help restore these creeks within Edmonton, EPCOR is undertaking modelling that investigates how creeks flowed before development - called pre-disturbance hydrology. By understanding the natural flow patterns of urban creeks, we can design solutions that bring balance back to these vital ecosystems. This modelling will continue to investigate which stormwater management strategies are most effective in restoring creeks over the long-term.

Stormwater Modelling

EPCOR is using modelling software to predict total stormwater runoff as the City grows with different stormwater implementation strategies. This modelling work is ongoing and informs overall stormwater planning.

Climate Change Modelling

EPCOR has funded Prairie Adaptation Research Collaboration (PARC)'s review of the natural hydroclimatic variability and future climate scenarios for the NSR since 2020. The PARC team used tree ring growth correlated with precipitation records to extend the existing gauge recorded for the NSR from mid-11th century (1063) to the end of the 21st century. The City of Edmonton built on this work and looked at local climate impacts as well as the effect of climate change on flood magnitudes. This work was integral in understanding risks to source water supply over the long-term.

Basin-wide Modelling

EPCOR regularly funds and provides input/data to watershed and river models that are developed at the basin scale. This includes the Water Smart's hydrological model that was developed in partnership with the NSWA in 2025. It also includes supplying loading data to inform the Government of Alberta's EFDC river model for the river within Edmonton.

Action: Support research programs that advance our understanding of impacts to watershed health and source water

RESEARCH

EPCOR funds water research through the Water Research Center and matching funding through Alberta Innovates, NSERC or Mitacs programs. Research programs are adaptive and ongoing. Current projects include an Alberta Innovates funded Urban Hydrology Research Project titled "Building water security and climate resilience into the City of Edmonton through innovative watershed management

practices" and a project is being developed with University of Alberta researchers on mitigating the impacts of carp in stormwater ponds, understanding fish populations in urban creeks, and pollutant attenuation in storm ponds. Previous work has included scoping alternative groundwater sources of water, investigating the prevalence and impact of 6PPD-quinone in stormwater, understanding invertebrate diversity in storm ponds, understanding atmospheric deposition of contaminants in headwaters through ice-core analysis, and ongoing climate modelling research.

IMPLEMENTATION OF PROGRAMS

Strategic Goal 4: Implement programs to manage impacts at watershed scales

Action: Continue to manage stormwater through placement of green Infrastructure such as constructed ponds and low impact development features throughout the City of Edmonton

- EPCOR embeds Low Impact Development (LID) across its design and construction standards, using green infrastructure - rain gardens, bioretention basins, box planters, tree soil cells, and absorbent landscaping to mimic natural hydrology, capture and treat runoff at its source, reduce peak flows, and filter out pollutants before they enter the storm sewer network.
- EPCOR is scoping future work in the stormwater system in high priority storm basins to improve creek water quality.

SUPPORTING WATERSHED EDUCATION

Strategic Goal 5: Bring awareness to importance of watershed stewardship and the role that we all play in protecting our drinking water source and managing our collective impacts to the NSR and tributaries

Action: Continue to promote the importance of protecting the NSR and urban tributaries

When residents recognize that the North Saskatchewan River (NSR) supplies every glass of water, they become active stewards rather than passive consumers. This connection transforms everyday choices, like proper disposal of household chemicals or support for green infrastructure, into powerful actions that directly protect water quality and public health. This also translates into understanding of our collective impacts on the environment. EPCOR develops internal education initiatives as well as supporting partners, like the City of Edmonton, RiverWatch, and NSWA, on their watershed education initiatives.

Glass of the Sask is a public engagement campaign that celebrates Edmonton's tap water sourced from the North Saskatchewan River, promoting environmental stewardship and pride in local water quality. Through partnerships with restaurants, festivals, and hydration stations, it encourages sustainable habits like using reusable bottles while showcasing the river's vital role in the city's identity.

A River Runs Through Us: The Story of the North Saskatchewan River documentary film is a science-based exploration of the North Saskatchewan River's ecological systems, water quality, and watershed. It uses data, research, and community science to deepen understanding of how the river supports biodiversity, sustains drinking water, and responds to environmental pressures

The Healthy River Ecosystem AssessmenT System THREATS: This watershed dashboard allows the public to track pollution sources, flow rates, and land use to understand the state of the watershed.

SUMMARY

This Healthy Waters: Integrated Watershed Management Strategy sets the roadmap for how EPCOR will continue to understand and mitigate risks to the NSR and urban creeks. Over 25 years of watershed protection programs and partnerships and our long-standing Source Water Protection Plan have set the foundation for ensuring our source water remains safe and secure into the future. This Healthy Waters builds on that work by also focusing on EPCORs role in managing our cumulative impacts to watershed.

SUMMARY FACTS

Water quality in the upstream of Edmonton has not significantly changed over the last 30 years

Spring runoff conditions are shifting to be earlier and longer which can impact treatment costs

Early prediction of spring runoff is improving due to SaskWatch cameras and availability of watershed data

Pipeline breaks and spills on bridges are the largest unmitigated risks to source water

There will continue to be enough water supply to meet EPCOR's water needs even under future climate scenarios

Forest fires impacts are expected to be minimal and short-lived even if a large portion of the watershed burned

Urban creek restoration is a priority and will require collaborative focus

EPCOR is committed to ensuring that total loads from stormwater and wastewater do not increase over time such that river water quality degrades

Stormwater management through green infrastructure and smart pond technology are key implementation tools and implementation needs to be a priority

EPCOR is ensuring monitoring, modelling, and research are in place to quantify and mitigate impacts

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