PROVIDING MORE EPCOR

Water IRP Report to Utility Committee – October 2, 2020

Report Purpose – Discussion

This report is presented for discussion purposes at Utility Committee to summarize the long-range Water Integrated Resource Plan (WatIRP) for municipal potable water management in Edmonton. EPCOR Water Services Inc. (EWSI) has successfully utilized the Integrated Resource Plan (IRP) long-range planning approach for the identification and implementation of capital improvements to the water system (beginning in 1997) and the Gold Bar wastewater treatment facility (first published in 2015) within the city of Edmonton. Recently, EWSI has introduced a Stormwater Integrated Resource Planning (SIRP) approach for stormwater management in Edmonton (2019), and work is currently underway on the development of the Sanitary Integrated Resource Planning (SanIRP) approach for sanitary sewer management.

The report provides an abridged summary of the 2020 WatIRP. It summarizes the IRP approach, provides key assumptions and insights that drove the development of the recent update of the long-range plan, outlines observations by asset, highlights key capital projects required for system resiliency and growth, and illustrates EPCOR's public engagement and alignment with the City of Edmonton's (CoE) strategic planning process and *City Plan* (City of Edmonton, 2019) values.

1. Background

EWSI produces, treats and supplies potable water to city of Edmonton residents and provides wholesale water supply to regional customers. Its prime objective is to reliably supply sufficient potable water while ensuring that the quality exceeds public health requirements.

EWSI's regulated water services are supported by an integrated waterworks infrastructure system to provide the following:

- Regulated water services for city of Edmonton customers (in-city customers) under a franchise agreement and water rates regulated by Edmonton City Council pursuant to provisions of performance based regulation;
- Regulated water services for the Regional Water Customers Group (RWCG) related to the sale of bulk water to regions adjacent to the city of Edmonton. This service is provided pursuant to water supply agreements entered into between EWSI and each of the water service commissions and communities surrounding Edmonton. The water rates charged to the RWCG are regulated by the Alberta Utilities Commission (AUC) and determined annually on a cost of service basis.

IRP is the iterative long-range planning approach used by EWSI for regulated water operations in the city of Edmonton. Integrated Resource Planning takes a holistic approach that integrates environmental and social externalities; operational choices, planning and infrastructure responses; risk assessment and management; financial analysis; and an open participatory

process that incorporates continuous improvement. This is summarized below in Figure 1: The Integrated Resource Planning Approach.

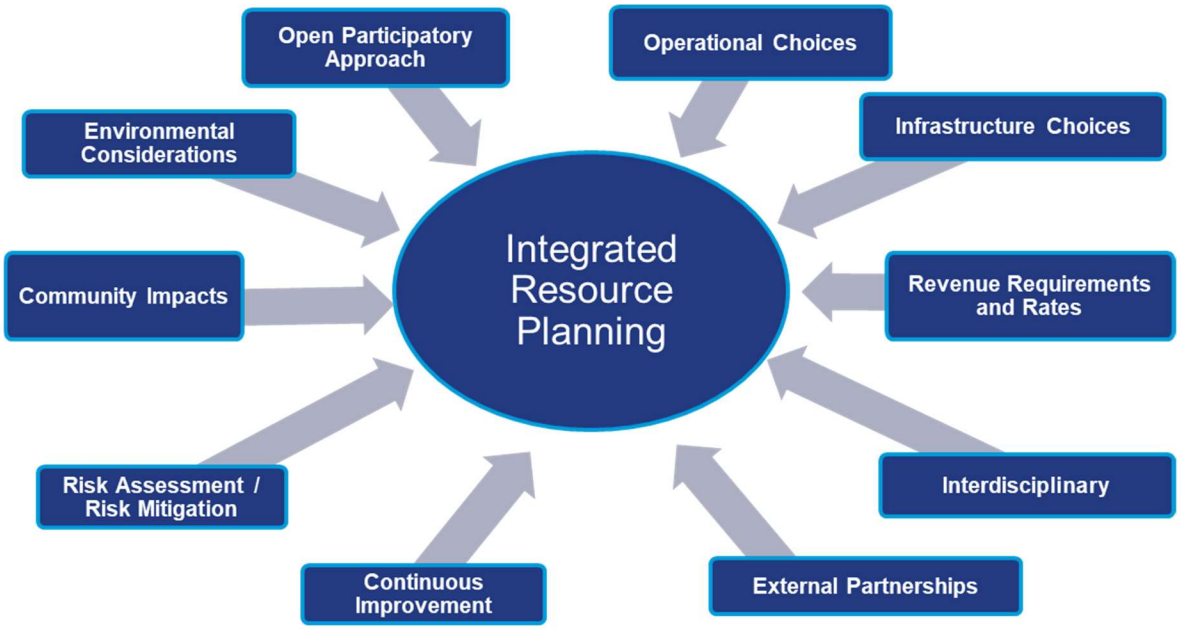

Figure 1: The Integrated Resource Planning Approach

The WatIRP focuses on the identification of capital upgrades over a fifteen-year planning horizon. Variability in regulation, impact of climate change and extreme weather, customer demand patterns, and private development activity decreases the accuracy and value of longer-term master plans. The recently formed One Water Planning Group (2019) has a 20-50 year outlook and will bridge and synchronize the various IRP plans within EPCOR (WatIRP, Goldbar IRP, SIRP, and SanIRP). The WatIRP initiates and informs the capital plan for each five-year performance based regulation (PBR) rate application period.

1.1. What is the Edmonton Water IRP?

In a global context, climate change and extreme weather, population growth, and rapid urbanization pose challenges to water management. The WatIRP examines the status of these global issues in the Edmonton service area and presents a summary of projects and strategies for the safe and reliable provision of services to accommodate growth while explicitly addressing the need for greater resilience to current and emerging threats.

The Edmonton WatIRP analyzes municipal water supply (North Saskatchewan River source, water treatment plant (WTP) production, transmission main capacity, and reservoir capacity), evaluates and projects future demands, and also monitors external factors such as future regulation, customer consumption trends, etc. and their influence on long-range plans (Figure 2: Water IRP Planning Components).

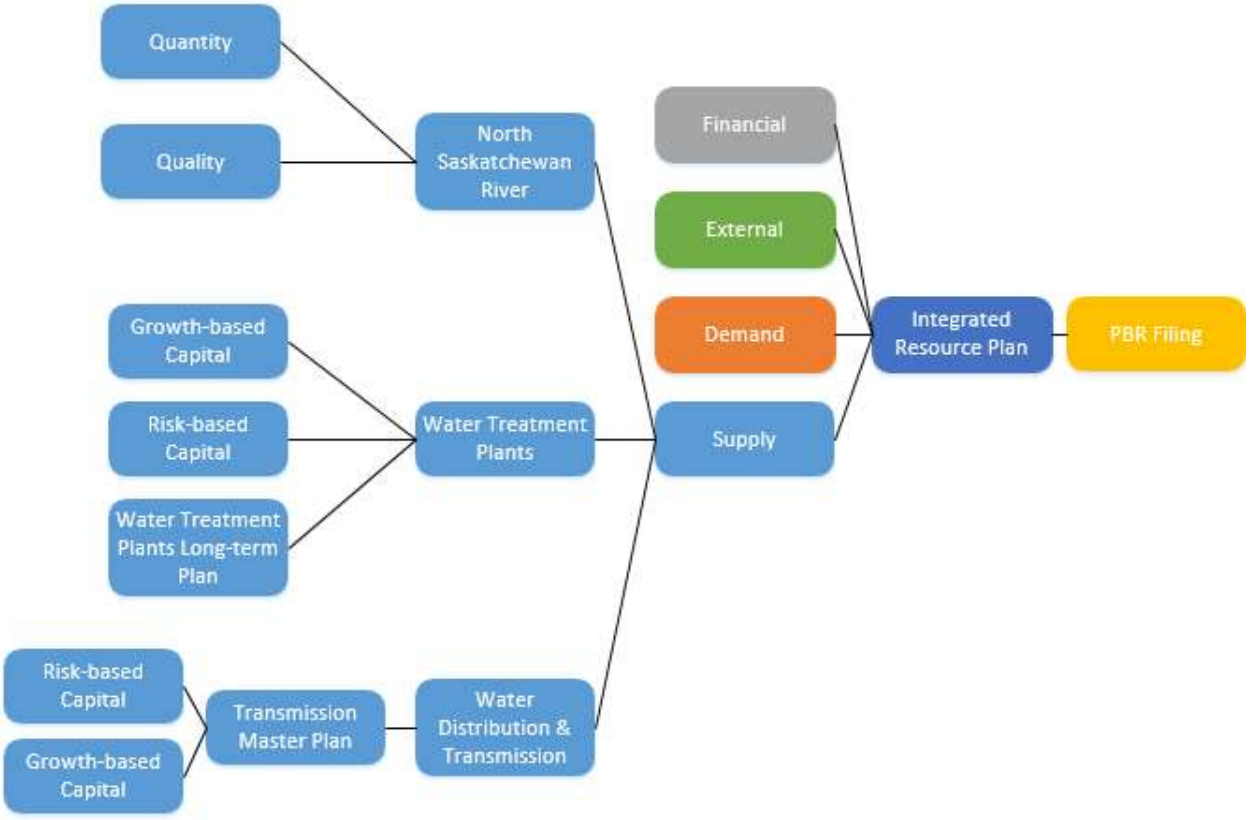

Figure 2: Water IRP Planning Components

1.2. 2020 Water IRP Summary

The 2020 WatIRP presents an update of the previous IRP completed in 2015. The identification of projects is balanced to:

- manage future growth needs;
- minimize risk throughout the entire system (and increase reliability, resiliency and sustainability);
- meet or exceed regulatory/HSE requirements; and
- achieve efficiency/performance improvements.

Resilience has always been a priority for EWSI due to the significant public health impacts that can result from the interruption of municipal water service. In the past, EWSI has successfully maintained operations in a range of extreme events. Resiliency has been demonstrated during

periods of extreme heat, cold, dry and wet weather and a range of river conditions, while successfully expanding services to meet the demand of the rapidly growing population.

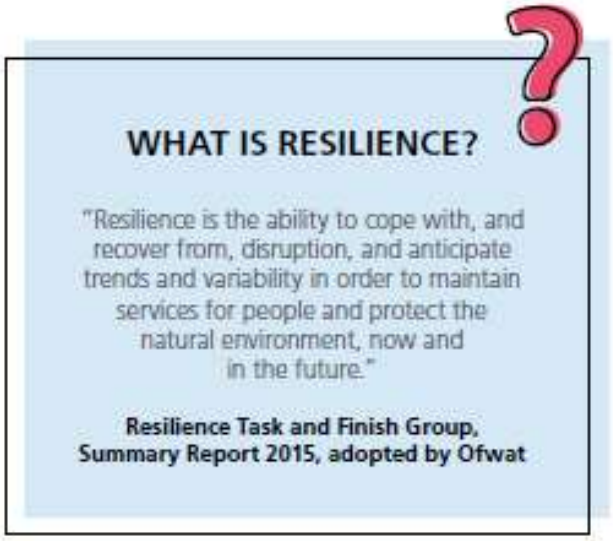

Figure 3: Resilience Definition

Effects of climate change and extreme weather (particularly fluvial flooding) bring uncertainty to the planning process and resiliency of the municipal water supply system. Extreme weather events are likely to increase and would reduce EWSI's resiliency without intervening action and mitigation. The water treatment and distribution and transmission systems are facing similar infrastructure challenges. Some assets and systems have become so critical to EWSI's operations that taking them out of service for inspections, preventative maintenance and capital upgrades is extremely difficult. The increase in extreme weather events exacerbates the risk and extent of service-level impacts due to unplanned failures of critical infrastructure. The uncertainty of a changing future requires that EWSI be adaptive and agile in managing internal and external risks.

Historically, plant upgrades have been mainly driven by projected production vs. demand shortfalls, however this is not a key driver for the next PBR application term (2022-2026). Due to increased water use efficiency of EWSI's customer base and slower population growth projections due to the combined effects of COVID-19, low oil prices and the subsequent recession, increasing demands are not projected to be the primary driver of capital expenditures in the near term.

In PBR 5 (2022 – 2026), a variety of upgrades to the water treatment plants and water distribution and transmission system are proposed to reduce the risk of failure and ensure increased reliability, resiliency, and sustainability of the municipal water system. One notable risk concerns shutdowns at the E.L. Smith WTP, which provides the majority (65%) of water supply in Edmonton. There is a limited window to accommodate the planned E.L. Smith plant shutdowns required to upgrade aging infrastructure, and the risk that customer flows and pressures are compromised increases further when unplanned shutdowns occur.

EWSI will continue to optimize proactive risk based asset management across the water treatment plants and the water distribution and transmission system to drive capital planning and to support sustainable water system operation into the future. EWSI's infrastructure is aging and this increases the risk of service level disruptions. The Rossdale WTP was constructed in 1947 (Plant 1) and 1955 (Plant 2) and the E.L. Smith WTP was constructed in 1976. Both plants have seen various upgrades and expansion over the years, with the most recent upgrades to portions of E.L. Smith completed in 2008. However, there are assets that have not been inspected or upgraded since their original construction. The construction of the transmission and distribution

system has occurred in pace with development trends, and some mains are remaining in service from the early 1900s. EWSI requires a variety of inspections of critical infrastructure to better assess current condition and likelihood of failure. While these inspections will require major shutdowns and operational investment, they are required to properly assess risk and develop comprehensive asset management plans (AMP).

1.3. Our Water System at a Glance

EWSI is in the fortunate position that future water supply is not a primary driver for capital investment. Unlike many utilities worldwide dealing with the implications of water scarcity, EWSI has abundant raw water available from the sole supply source, the North Saskatchewan River (NSR). EWSI withdraws less than 3% of the total daily flow of the NSR annually (and rarely withdraws above 6% on any given day), and returns more than 90% of this volume through the wastewater treatment plants. Figure 4: Water IRP Components, illustrates the major components examined for growth and resiliency in the 2020 WatIRP.

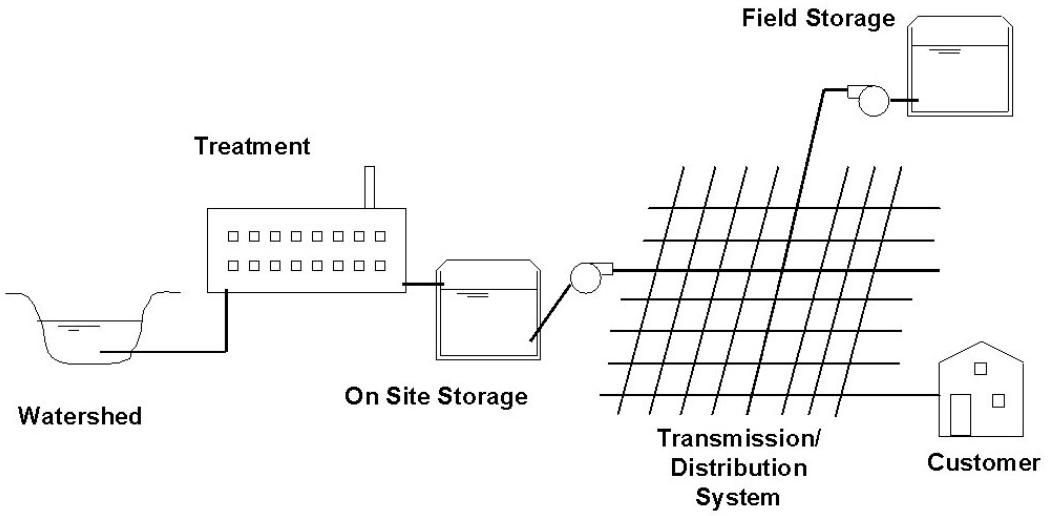

Figure 4: Water IRP Components

EWSI's municipal water supply system consists of two water treatment plant facilities (Rossdale and E.L. Smith), supported by 13 reservoir sites, 7 booster (pumping) stations, over 4,100 km of distribution and transmission mains, and thousands of valves and hydrants (Figure 5: EWSI Service Area, WTP's, Reservoirs and Booster Stations). This infrastructure network provides both retail services to city of Edmonton customers (residential, multi-residential and commercial) and wholesale services to regional water customers (Figure 6: Edmonton Region Water Service Area) surrounding Edmonton through a number of supply points primarily located at city of Edmonton boundaries.

Water quality in the NSR varies considerably throughout the year (turbidity, colour, pH, temperature, pathogens, etc.). High concentrations of some parameters (i.e. turbidity and colour)

occur during periods of high flow and runoff. The water quality primarily dictates the mode of treatment and directly affects the WTP's production.

The WTPs operate in two treatment modes – conventional treatment (coagulation with alum addition, flocculation, settling, and dual media filtration) and direct filtration (DF). The WTPs operate in conventional treatment during the spring and summer months when the river water quality is variable. During periods of good river water quality in the fall and winter when turbidity and colour are low, the WTPs convert to direct filtration operation. If river conditions allow, extended DF (EDF) can occur into the spring and fall months. DF requires substantially lower chemical treatment usage and results in the environmental benefit of significant reduction in the amount of solids discharged to the NSR.

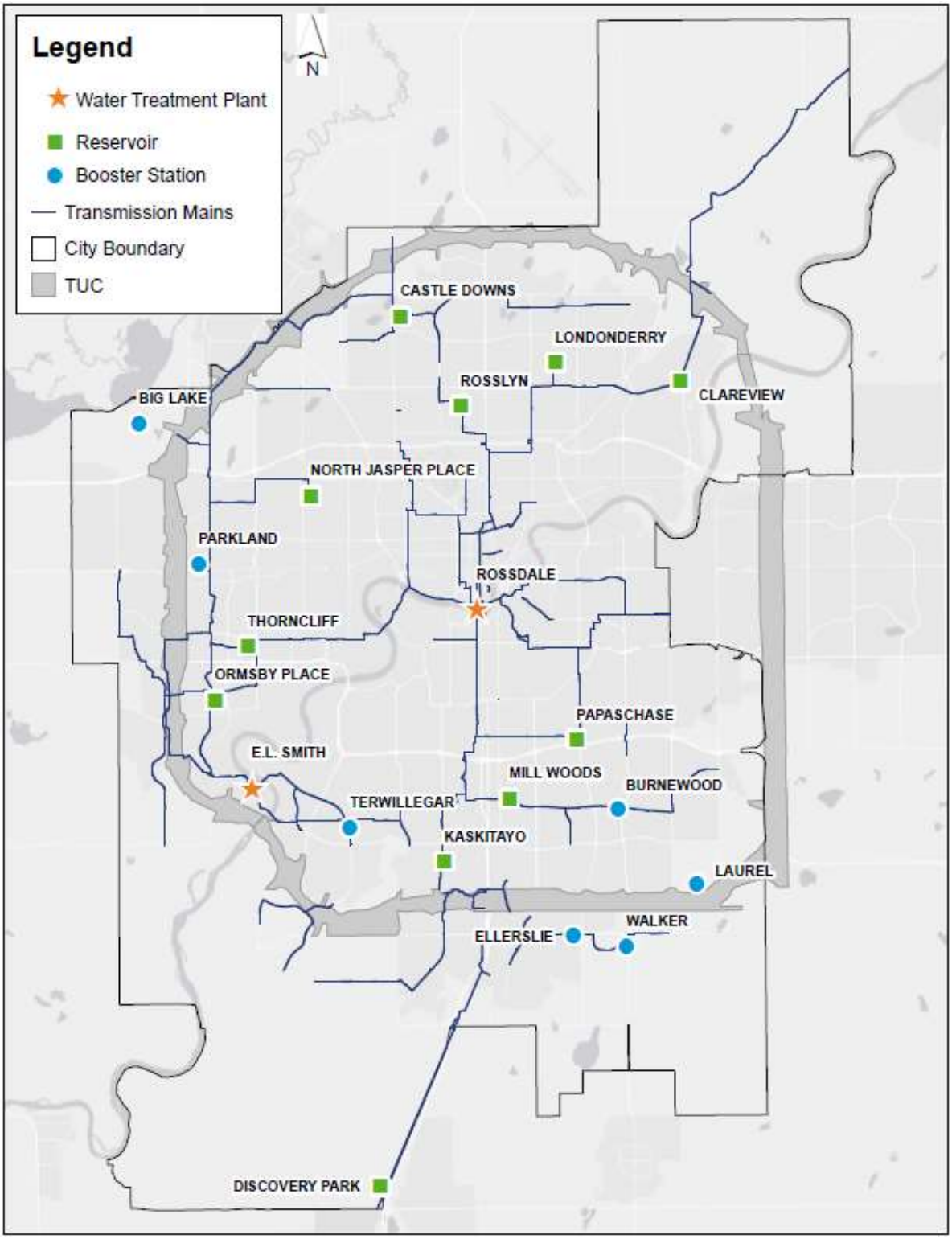

Figure 5: EWSI Service Area, WTP's, Reservoirs and Booster Stations

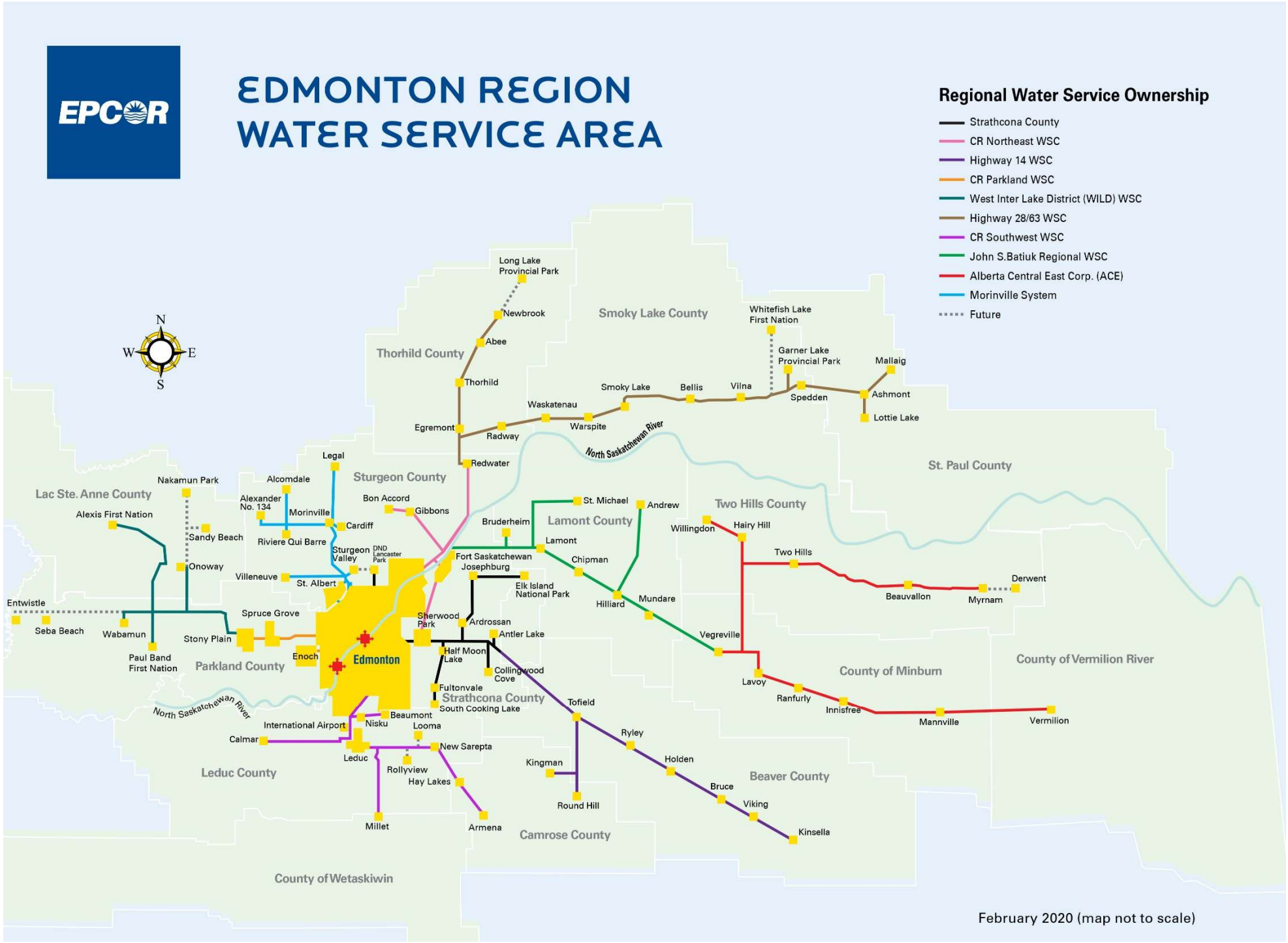

Figure 6: Edmonton Region Water Service Area

2. Key Insights Driving the WatIRP

The below insights are informed by a thorough analysis of the operational status of the municipal water supply system, impact of future regulation, trends in utility management, research, water system current and future demands, alignment with CoE programs and policies, and EWSI's over 100 years of experience operating utilities across Canada and the USA.

2.1. Insights on Regulation

The drinking water regulatory environment in Canada is complex, with the Federal Government setting aspirational Guidelines and the Provincial Government translating Guidelines into legal, enforceable Standards. At this time EWSI remains engaged at both the Federal and Provincial levels in terms of monitoring when regulatory changes may be coming as well as determining how best to meet future Standards and Guidelines.

EWSI has consistently exceeded the goals set for water quality, and performs to higher standards than those set by federal and provincial governments. Other than residuals (waste streams from the treatment process), lead and aluminum, there are no foreseeable changes in regulation or industry trends that are likely to result in major shifts to municipal water treatment and delivery in Edmonton.

2.1.1. Approval to Operate

EWSI's *Approval to Operate* and *Stewardship Agreement* is issued by Alberta Environment & Parks (AEP) under the *Environment Protection and Enhancement Act*. In 2019, EWSI was informed that the EnviroVista Approval Program was being discontinued by AEP and that EWSI's Edmonton approval would transition to a regular approval when it is renewed in May 2021. Discussions for the 2021 approval renewal began in February 2020 and will remain on-going until a new Approval to Operate is issued by AEP.

As part of EWSI's *Approval to Operate*, EWSI continues to take a source-to-tap approach to ensure safe, secure water by managing risks through EWSI's Drinking Water Safety Plan (DWSP). A DWSP is a proactive way of assessing risks to drinking water quality. It considers such things as the source of the water, how it is treated, how treated water is stored and distributed, as well as potential impacts to the customer. The Drinking Water Safety Plan and the associated action plan informs capital planning for the Edmonton water systems. For example, the risks related to flood and lead at the tap were both identified in the DWSP and both have resulted in significant capital programs.

A commitment within the *Approval to Operate* and *Stewardship Agreement* is to strive to reduce the impact of WTP residuals streams to the NSR by implementing a long-term residuals management program of continuous improvement. Currently the WTP's direct filtration operation has been successful in maintaining excellent treated water quality in winter months and significantly reducing residuals discharged to the NSR.

2.1.2. Guidelines for Canadian Drinking Water Quality

Health Canada continuously reviews and updates the *Guidelines for Canadian Drinking Water Quality*. EWSI keeps track of guidelines under review and proposed for review and proactively works to ensure its operations are meeting current and expected future public health regulations. The changes to the lead guideline (2019) and aluminum (under public consultation) are discussed below.

Lead

The most significant revision has been the reduction of the maximum acceptable concentration of lead in drinking water from 10 µg/L to 5 µg/L. In addition to this reduction, the guideline identifies the point of compliance to be at the customer's tap (as opposed to points in the distribution system).

EWSI's Lead Mitigation Strategy to reduce lead at the tap includes:

- Implementing the addition of lead corrosion inhibitor (orthophosphate) at each WTP,
- Accelerating the completion of high priority lead service line (LSL) replacements over a five-year period, and
- Continuing to provide point of use water filters as an interim measure of protection.

Aluminum

On June 28, 2019, Health Canada released the Aluminum in Drinking Water Guideline Technical Document for public consultation. If the aluminum guideline is finalized as proposed, EWSI may need to consider strategies to meet the operational guideline value of 0.05 mg/L. This may include constructing facilities to allow for pH adjustment in coagulation (i.e. acid and/or caustic addition). The timing will be determined by if and when AEP interprets the operational guideline as an approval requirement. Given that AEP has not yet engaged utilities on discussions about aluminum, any firm regulatory requirements would likely be more than five years away. The impacts and upgrades at the WTPs to meet the aluminum operational guideline have not been included in the current WatIRP, and aluminum regulatory requirements will be monitored for future IRP updates.

2.2. Insights on Climate Change

2.2.1. Climate Change Strategy

In 2018, the EWSI *Climate Change Adaptation Strategy* was developed to address the risks to the Edmonton municipal water assets and operations associated with climate change. This strategy identifies the NSR as the sole source of water for the WTPs and highlights the impacts to the NSR from the WTPs, distribution and transmission system, wastewater treatment plant, and drainage operational activities. Climate change is assessed as a modifier of existing operational risks and is addressed in long term business and capital planning for the WTPs.

By the year 2050, climate change models for the NSR watershed predict that air temperatures will increase by 1.3 °C to 4.9 °C and average annual precipitation will increase by 5.9% to 43.8%. High-intensity storms are predicted to become more frequent. Increased precipitation will occur

during the winter and spring and decreased precipitation will occur in the summer and fall. More precipitation will fall as rain as opposed to snow. Spring runoff will arrive sooner and winter will set in later. Warmer and drier conditions will increase the risk of forest fire, decrease forested areas and promote grasslands.

These predicted changes in climate are anticipated to have a number of impacts on the NSR in Edmonton. Flows will be higher during the winter and spring with earlier spring runoff or multiple spring runoff periods. Flows will be lower during the summer and fall. Droughts and floods may become more common. Water quality in the NSR is expected to change, with more frequent episodes of high concentrations of colour, turbidity and nutrients as they are directly linked to precipitation patterns and river flows. Elevated and sustained NSR high-colour events occurred in August 2016, July 2019 and May through July 2020. During these events, colour increased to levels that caused temporary inability of the WTPs to produce drinking water in sufficient quantity to meet demand during conventional treatment operation.

The predicted changes will have direct impacts to the WTP's, affecting the quality and treatability of water in the NSR. Warmer and drier conditions will increase consumer demand for water, potentially leading to challenges meeting the demand. Rapid fluctuations of temperature during winter months may prevent the WTPs from operating in direct filtration, and may increase the frequency of water main breaks.

Of all known risks associated with climate change, NSR flooding has been determined to pose the greatest risk to EWSI operations, since both WTPs are located in the NSR floodplain. NSR flood events have occurred in Edmonton in the past, and climate change-induced increases in the frequency and severity of floods are anticipated. A flood disaster in Edmonton has the potential to impact the province of Alberta greatly on a socioeconomic scale, and it is therefore necessary to take steps to improve Edmonton's WTP flood resiliency.

2.2.2. Edmonton WTPs Flood Plan

The 2013 flooding in southern Alberta prompted a vulnerability assessment of the Edmonton WTPs vulnerability to a NSR flood. Submersion risks to critical equipment and risks of structural damage to on-site treated water reservoirs and chemical holding tanks have been identified as a result of the assessment, as conducted by EWSI's insurance provider. In addition, recent rainfall flooding events in Edmonton have been drivers to document a Stormwater Integrated Resource Plan, where it was identified that the Rossdale WTP is situated in a high-risk (A) sub-basin, and the E.L. Smith WTP is situated in a medium-high risk (E) sub-basin.

Since the Edmonton WTPs supply water to nearly a third of the population in the Province of Alberta, a flood disaster has the potential for major detrimental impacts on a socioeconomic scale. It is therefore necessary to take steps to improve Edmonton's WTPs flood resiliency. Two government initiatives have committed more than $11 million of grant funding to complete this work: the Provincial Alberta Community Resilience Program (ACRP), and the Federal Disaster Mitigation and Adaptation Fund (DMAF). The Provincial ACRP funding does not encompass the full scope of mitigation initiatives, while the Federal DMAF funding does.

During a 1:180 year return period flood event, similar to the Edmonton flood event in 1915 (Figure 7: Historical Photo of the 1915 Edmonton Flood at the Low Level Bridge (1:180 year return period)), river flood water would enter the water treatment plants through overland flows and the underground waste stream/overflow piping systems that discharge to the river.

Figure 8: Unmitigated 1:180 (1915) Flood Impact Projection at Rossdale WTP shows that the electrical systems at the low lift pumphouse are in imminent danger of flooding and that overland flooding is a structural concern for the underground reservoirs.

Figure 9: Unmitigated 1:180 (1915) Flood Impact Projection at E.L. Smith WTP illustrates impacts to a low lift pumphouse and critical WTP electrical assets.

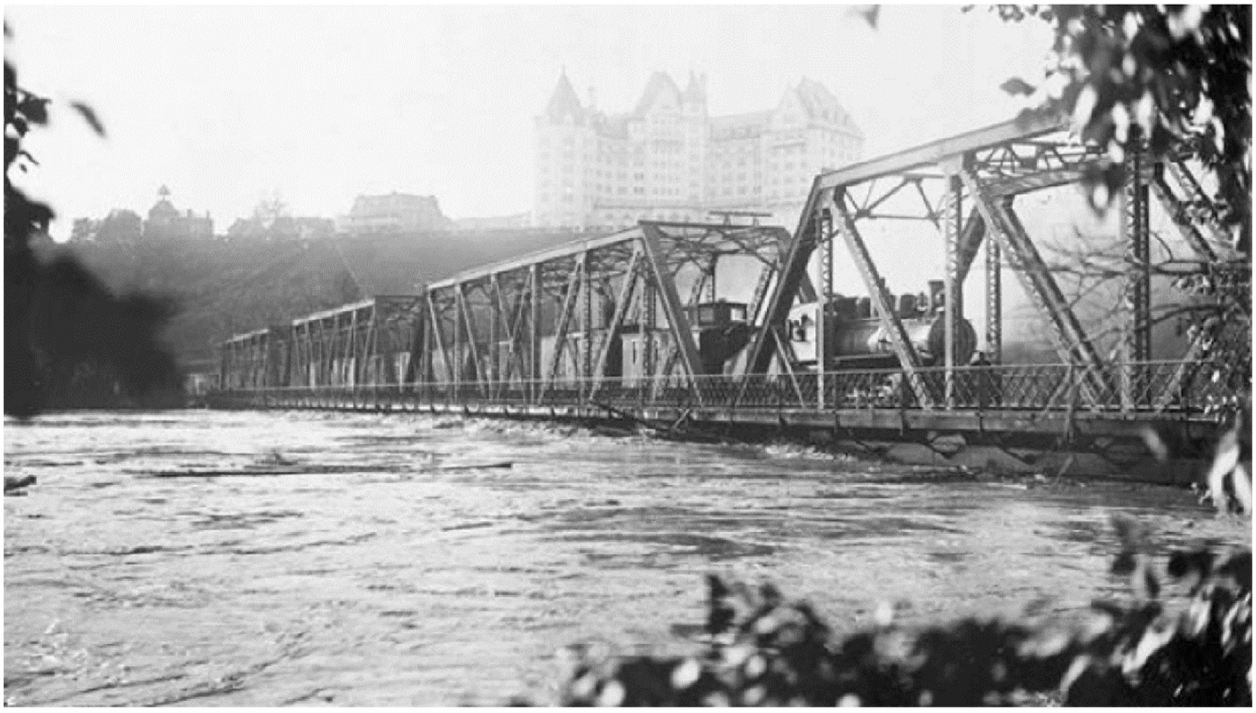

Figure 7: Historical Photo of the 1915 Edmonton Flood at the Low Level Bridge (1:180 year return period)

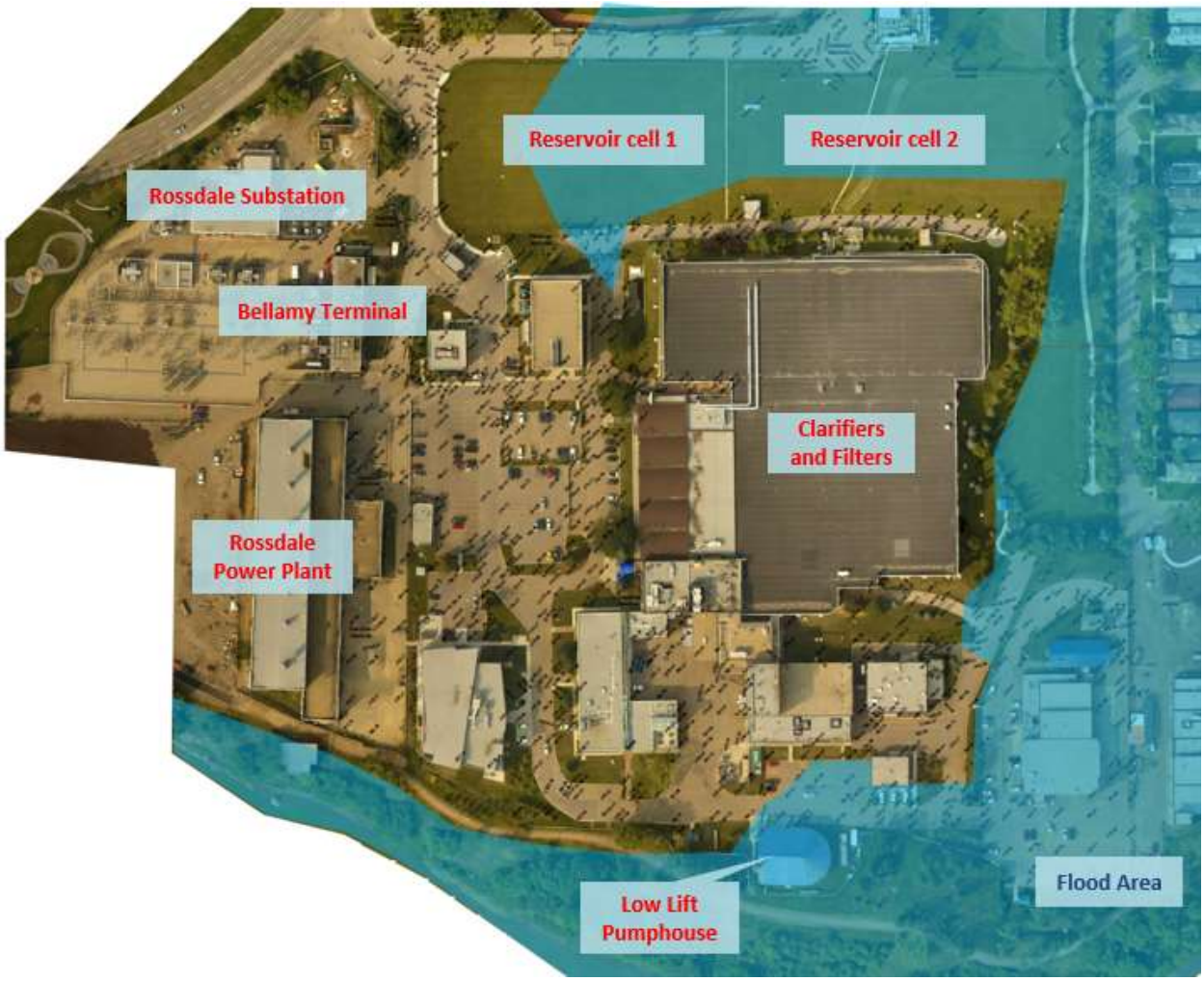

Figure 8: Unmitigated 1:180 (1915) Flood Impact Projection at Rossdale WTP

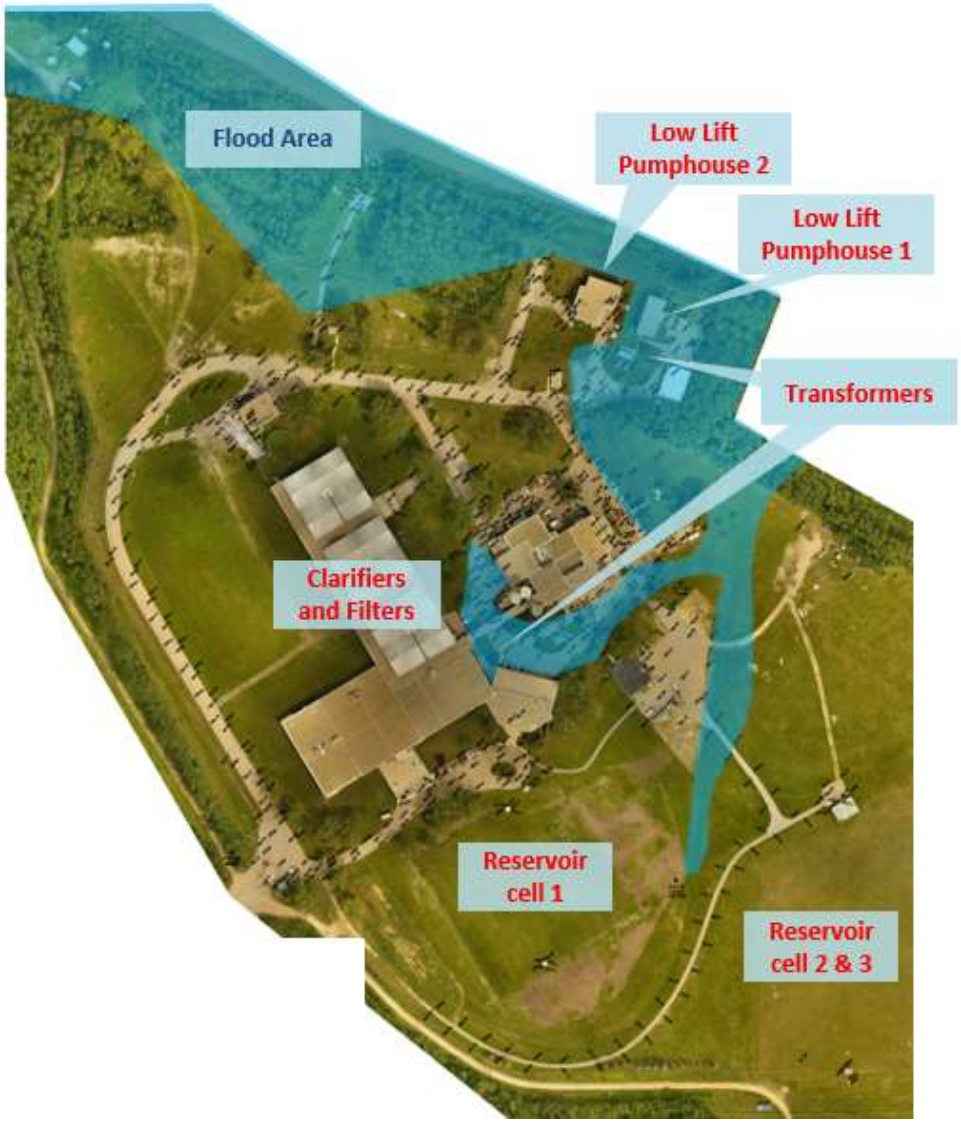

Figure 9: Unmitigated 1:180 (1915) Flood Impact Projection at E.L. Smith WTP

The two key objectives to address WTPs flood resiliency are:

- To reduce the likelihood of catastrophic damage to the WTPs during a NSR flood, and
- To resume potable water treatment as quickly as possible afterwards.

The WTPs flood plan and upgrades plan address three major flood mitigation categories:

- Critical asset protection or relocation
- Backflow prevention from waste stream outfalls
- Embankments to connect existing high ground around the WTPs or around vulnerable essential equipment to mitigate flood levels that result in the NSR overtopping its banks.

These flood protection improvements at the WTPs will be completed in alignment with Federal Disaster Mitigation and Adaptation Fund Program and Provincial Alberta Community Resilience Program granting timelines. Table 1: High-Level Schedule of Project Phases and Durations below outlines the flood protection schedule that indicates work commencing in PBR 4 (2017-2021) and completing in PBR 6 (2027-2031).

Table 1: High-Level Schedule of Project Phases and Durations

2.3. Insights on Water Use Trends

EWSI produces, treats and supplies water to over 1.3 million people in the city of Edmonton and greater Edmonton region. How EWSI's customers use water in their homes and businesses, and growth of the customer base are key inputs of the Water IRP process.

In order to assess the long-term ability of the municipal water system to meet future demands, EWSI considered the population growth forecasted by the City, and resulting water demand with observed peaking factors.

2.3.1. Population Growth

The city of Edmonton has experienced steady population growth for the past six decades and reached a population of 972,223 people in 2019. The city of Edmonton population increased by 72,776 people from the previous 2016 municipal census, reflecting an average annual growth rate of 2.6%.

The city's population is forecast to increase from approximately 972,000 to 2 million over the 2019 to 2065 period, representing an average annual growth rate of 1.5% (Watson & Associates, 2019). This growth rate was used to forecast long-term water demand.

2.3.2. Demand and Per Capita Trends

Historically, water use in Edmonton grew proportionately with population and economic growth. This trend has been broken, as Edmonton residents have been using less water per person each year. In-city demand is roughly what it was in the late 1970s, even as the city has added a half million people (Figure 10: Edmonton Water Usage – Effects of Efficiency).

Two key metrics used to measure and monitor municipal water use include total per capita water use and residential per capita water use. Total per capita water use is typically calculated on a

per day basis and is the volume of water delivered through the water distribution system divided by the municipality's population. Residential per capita water use considers only the water consumption of the residential and multi-residential sector again divided by the municipality's population.

In 2019, total per capita consumption was 271 litres per person per day. Residential average per capita water use in Edmonton in 2019 was 176 litres per person per day, however per capita use in some of the newest developing neighbourhoods is below 150 litres per person per day. Efficient fixtures and appliances (primarily high-efficiency toilets and washing machines) have contributed to significant water reductions in indoor residential water usage and there remains much potential for additional savings.

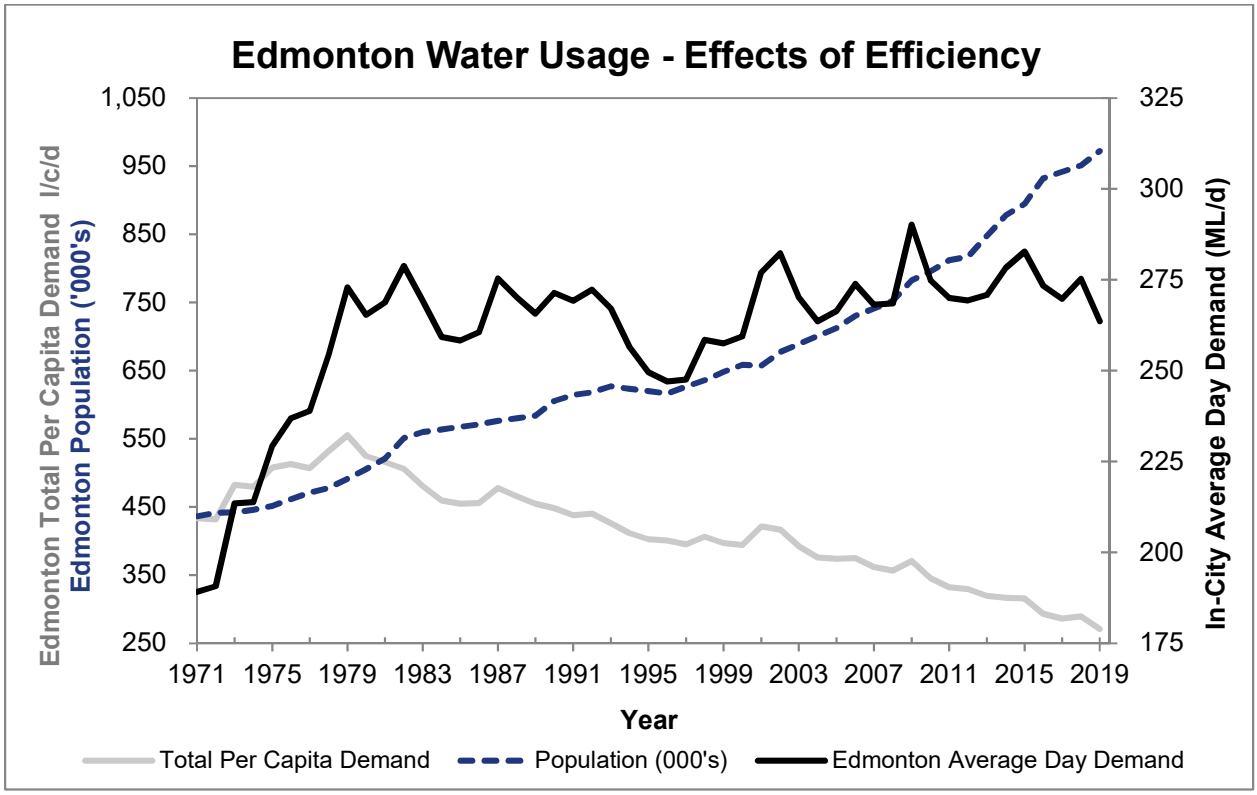

Figure 10: Edmonton Water Usage – Effects of Efficiency

Long-range master planning for future water treatment, transmission infrastructure and reservoirs will be influenced by declining per capita consumption trends. Per capita water consumption and sewage generation design standards, used to design water transmission and sanitary trunk sewers will be updated in 2020 to reflect a more water efficient customer base. Going forward, EWSI will continue to monitor water use trends and their impact on design.

Despite water use efficiency improvements, EWSI will continue to experience increases in total water demand that must be planned for. Of EWSIs total water demand, approximately 70% is used within Edmonton for residential, multi-residential and commercial purposes, and around 30% is used in the surrounding greater Edmonton regional service area. Combining Edmonton and

regional demand shows the total daily water demand for the Edmonton region (Figure 11: Edmonton In-City and Region Average Day Demand). It is clear that the segment representing in-city water demand has stayed relatively flat since the 1980s, whereas the regional demand component has shown continual growth. When combined, the result is an increasing water demand. Over the last 20 years, total water demand has grown by 7%.

While it is expected that total system demand growth may slow due to increased efficiency of EWSI's customer base (in-city and regional) and slower population growth projections due to the combined effects of COVID-19, low oil prices and the subsequent recession, increased demands will be a reality in the future as the City reaches their long range strategic plan population of 2 million people.

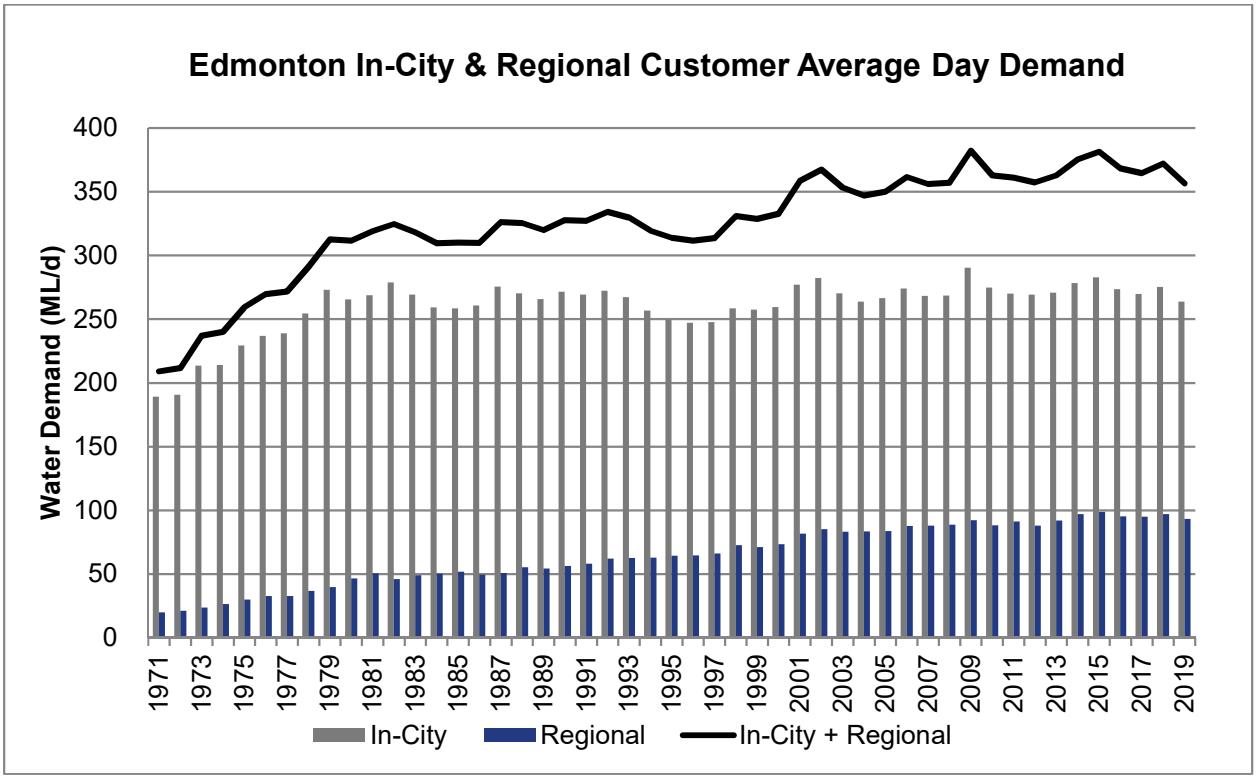

Figure 11: Edmonton In-City and Region Average Day Demand

2.3.3. Water Consumption Trends

Each of EWSI's water customers are classified into one of four categories: residential, multi-residential, commercial, and regional.

Figure 12: Edmonton and Area Water Consumption by Customer Category shows the water consumption trends in EWSI's four customer categories. Total residential, regional, and multi-residential water consumption has increased in Edmonton, while commercial consumption shows a decreasing trend.

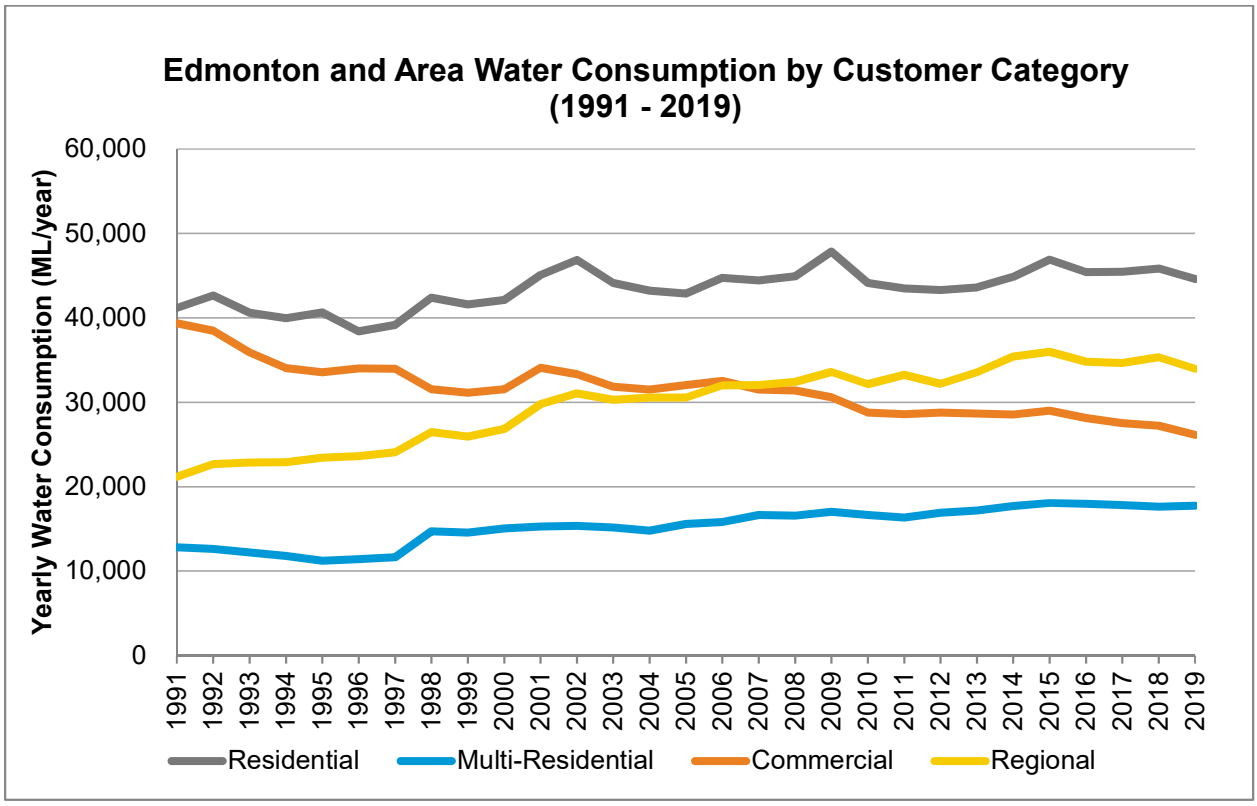

Figure 12: Edmonton and Area Water Consumption by Customer Category

2.4. Insights on Future Water Demand

EWSI carefully monitors total demand to ensure that the Rossdale and E.L. Smith Water Treatment Plants have sufficient capacity to provide service to maximum demands on the system as well to provide service when planned and unplanned outages occur.

Moving forward, EWSI's near-term focus is to enhance system resilience in the WTP's, while ensuring water treatment plant capacity is sufficient to meet expected short and long-term demands. While overall demand levels have remained fairly static, EWSI designs and upgrades the facilities to meet both average day consumption, as well as demand peaks. EWSI also must ensure that planned shutdowns (for capital upgrades, maintenance and inspections) and unplanned shutdowns can be accommodated while achieving levels of service.

The short-term water demand forecast is based on ten years of historical data, and projects a monthly average day, and a high five-day demand that could reasonably be experienced in the near term. This forecast is used to evaluate supply vs. demand when both plants are operational, and in the event of various full and partial WTP shutdowns.

The long-term water demand forecast is used to determine EWSI's future plant capacity and river extraction needs. Low, medium and high forecasts are created based on historical growth rates, and projected consumption per customer decreases for the residential, commercial, and multi-residential customer classes.

2.4.1. Short-Term Demand Forecast versus Plant Capacity

EWSI uses the daily demand averaged over the highest five consecutive days as a measure of short-term peak demands for water treatment design. EWSI's operational philosophy includes supply balancing from the reservoirs for short periods. This means during a supply shortage from the WTPs, water stored in reservoirs is used to meet customer demands. High five-day demands can be highly variable from year-to-year, depending on weather conditions.

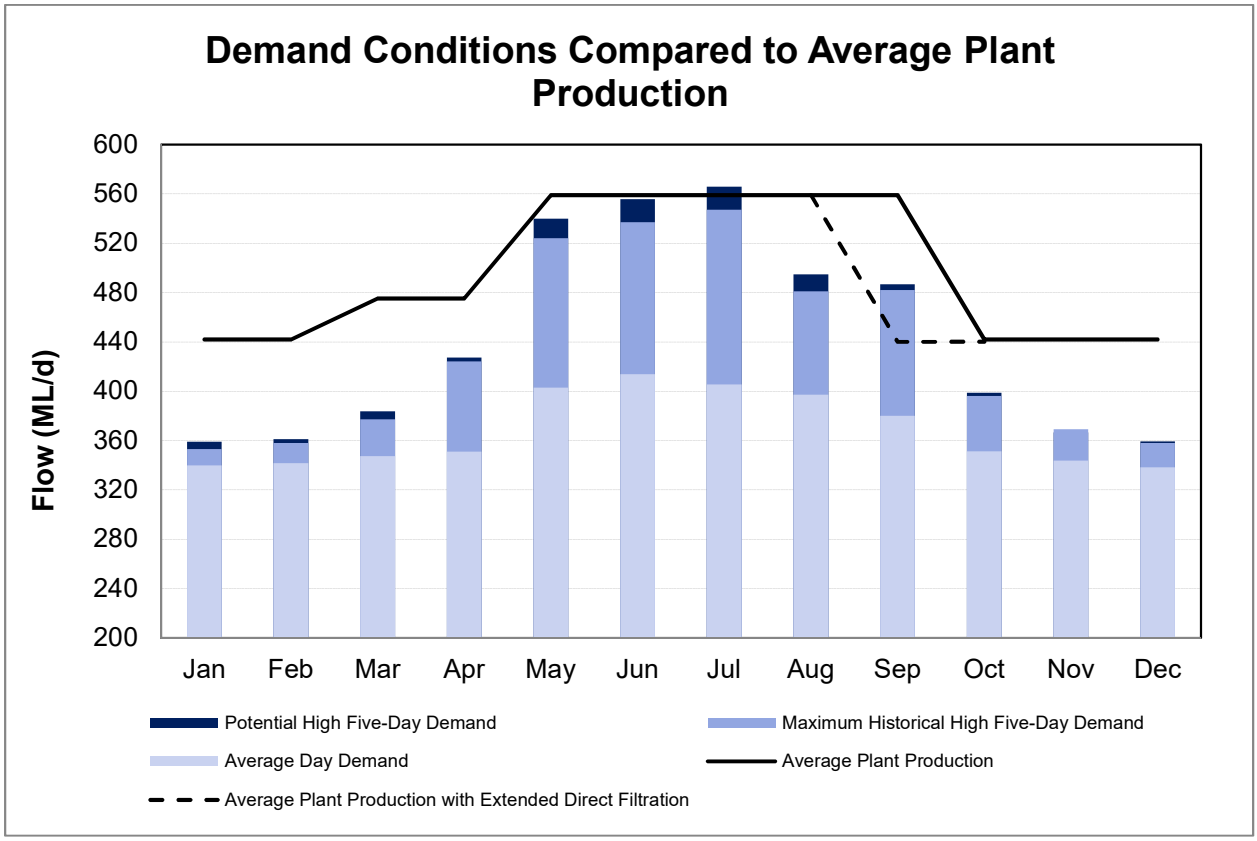

Figure 13: EWSI Water Demand Conditions Compared to Average Plant Production

Figure 13: EWSI Water Demand Conditions Compared to Average Plant Production provides a comparison of average and high five-day demands (maximum historical and potential) compared to average water treatment plant production in total for the E.L. Smith and Rossdale plants. Average plant production reflects that:

(i) plants are operating in conventional mode during summer months and direct filtration mode for remainder of the year which results in lower capacity levels;

(ii) average production can vary with varying raw water quality conditions, particularly during spring and summer months and plant outages; and

(iii) transition to extended direct filtration in the fall has not occurred since 2014 due to water quality issues, therefore this has been shown as a dotted line in Figure 13.

Based strictly on monthly average day demands, plant production is sufficient throughout the year. However, this assumes favorable river water quality conditions for treatment and there are no plant shutdowns. If maximum production capacities cannot be achieved, reservoir storage is relied on to mitigate risk and under some scenarios may fall to levels triggering demand management measures.

Looking at the potential high five-day demand, future shortages are projected in the month of July. A combination of reservoir storage and/or demand management will mitigate the impact in the near term. To address the seasonal supply issues, deep bed filter conversion at E.L. Smith will increase plant capacity, however this is not planned until PBR 7 (2032-2036). Filter structural upgrades must first be performed in PBR 4 – 6 (2017-2031).

Conversion to extended direct filtration in September in future years will be difficult as maximum historical high five-day demand exceeds production, even if river conditions are favorable.

Planned plant shutdowns to accommodate maintenance, asset inspections, and construction projects, also impact the ability to meet customer demands. This is discussed in more detail in the Sections 2.4.2 and 3. The ability to meet demands during these activities is a key driver of the resiliency focus of this WatIRP.

2.4.2. Meeting Demand During Plant Shutdowns

On an average daily basis, E.L. Smith provides 65% of the EWSI system water demand, and Rossdale supplies 35%. This production split alone highlights the importance of the long-term resiliency of the E.L. Smith WTP. Compounding the disproportionate production split is the fact that E.L. Smith cannot be operated via two primarily independent treatment trains like Rossdale (Rossdale has Plant 1 and Plant 2). This affects the ability of E.L. Smith to accommodate extended shutdowns.

Full and partial WTP shutdown scenarios were analyzed during seasonal river water conditions. The analysis indicated that a full Rossdale shutdown has a maximum duration of 36-44 hours and a full E.L. Smith shutdown has a maximum duration of 21-33 hours. Rossdale has two treatment trains, therefore the frequency of full plant shutdowns is less compared to E.L. Smith. This lack of redundancy is concerning as the scenarios explored do not account for unplanned shutdowns and reduced plant production events due to poor river water quality. These events may occur more frequently in the future as treatment infrastructure ages and climate change and extreme weather impacts river conditions.

It is recommended to establish two independent treatment trains at E.L. Smith by investigating the ability to split the existing plant infrastructure, or installing additional treatment capacity elsewhere in the system to allow for extended E.L. Smith shutdowns. Creating two treatment trains at E.L. Smith will need to happen in phases over many years as design requirements, capacity needs, construction sequence and associated shutdown and commissioning plans all need to be carefully considered. The capital plan includes projects, outlined in Section 4.2.1 which will support the creation of two trains. Aspects of the plant expansion upgrades completed in 2008 also paved the way for two trains.

2.4.3. Long-Term Water Demand Forecast

The long-term water demand forecast informs NSR water supply planning as well as long-range WTP upgrades (Section 3.1.3). The forecast takes into account the increased efficiency of the in-city and regional customer base, as well as a range of customer growth projections.

The long range forecast is updated annually to ensure capital decisions are being based on most recent trends.

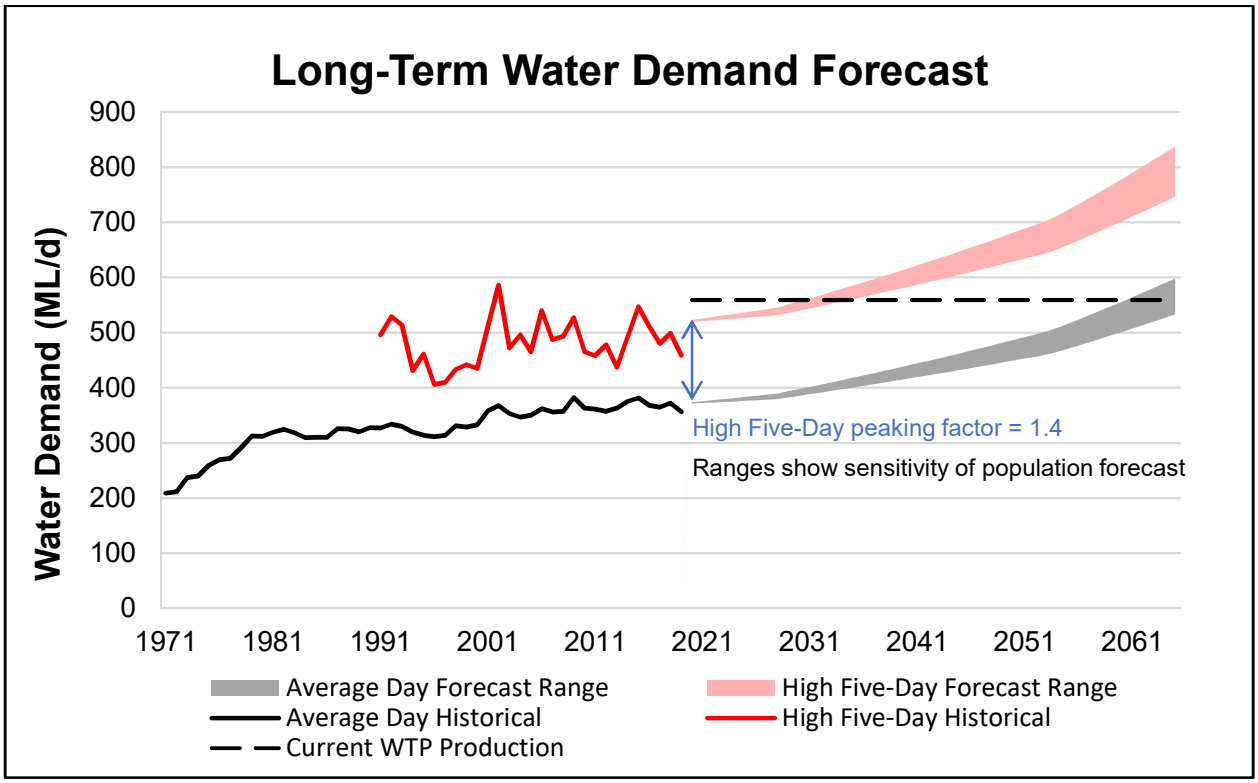

Figure 14: Long-Term Water Demand Forecast

3. WatIRP Component Highlights

3.1. Water Treatment Plants

The Rossdale WTP consists of two plants that can operate as two independent treatment trains. Plant 1 which allow for operational flexibility to shut down equipment and processes and still allow WTP production. The E.L. Smith WTP consists of one treatment train, Plant 4. All three plants have had numerous modifications since construction to ensure water demands are met and the quality of water produced meets EWSI's *Approval to Operate*. With all the modifications and upgrades completed to date, some of the original assets at both plants remain in service. For example, large concrete structures such as clarifiers, stilling basins, and conveyance channels and major mechanical components. The most recent expansion was completed in 2008 at the E.L. Smith WTP to meet increasing customer water demands and improve operational flexibility.

3.1.1. Existing Edmonton WTP Vulnerabilities

The primary vulnerabilities of both the Rossdale and E.L. Smith WTPs are related to single points of failure and aging infrastructure. Resolution of these vulnerabilities will require significant rehabilitation and upgrades, involving partial or full plant shutdowns. These shutdowns must be carefully planned and staged over time to enable continued water production.

There are many common single points of failure components at both WTPs related to filtration, conveyance of treated water, and process waste streams for clarification and filtration. Planned outage or failure of any of these components would result in a complete WTP shutdown and can significantly reduce production.

The WTPs are currently achieving regulatory water quality requirements and meeting customer demands, but the existing plant reliability is declining due to the age of the plants. Based on the original construction dates, the Rossdale Plant 1 is over 70 years old, Plant 2 is over 60 years old and E.L. Smith WTP is over 40 years old. In general, most structural and mechanical piping and equipment have an asset life ranging from 30-50 years. Both WTPs have assets in operation that are near or beyond their asset life. There are many operating assets at both WTPs with unknown condition. Determining asset condition has been challenging due to operational production priorities, scheduling process isolations and shutdowns and ability to safely access the asset for inspection.

Historically, Rossdale WTP has been the aging plant under continuous rehabilitation. The majority of rehabilitation upgrades have been structural in nature, such as clarifier upgrades after failure of a structural support system, joint work in flumes and basins to address water leakage, and outfall upgrades to recommission process waste systems. In recent years, significant structural deterioration and joint leakage of process tanks, conveyance flumes and waste streams have been discovered at E.L. Smith WTP that requires immediate rehabilitation. The asset condition of mechanical and structural single points of failure that are from the original E.L. Smith WTP construction are becoming a concern for failure.

As the WTPs age, the risk of asset failure increases which may result in unplanned plant shutdowns. Shutdown planning and process isolations at the E.L. Smith WTP are becoming more complicated because the time needed to perform work for the isolation, maintenance repairs and capital construction is more than the 24 hour shutdown window currently permitted. Full E.L. Smith WTP shutdowns that extend beyond this time would have significant business and customer impacts.

The E.L. Smith WTP expansion upgrades increased the capacity and reliability of the WTP by building a new river intake, building a second low lift pumphouse, retrofitting an existing clarifier, adding six more filters, improving chemical storage, upgrading a transmission main and adding infrastructure to allow future upgrades for more treatment capacity. These plant capacity upgrades also provided the ability to split the treatment processes and conveyance to create independent treatment trains from the low lift pumphouses, clarifiers and the filters. However, the existing treatment processes and conveyance beyond the filters to the onsite reservoirs cannot

operate as independent treatment trains. There are also single points of failure related to conveyance infrastructure for the clarifiers, filters, ultraviolet (UV) disinfection system, reservoirs and high lift pumphouse (see Figure 15: E.L. Smith WTP Existing Treatment Train and Options for Independent Treatment Trains).

3.1.2. Resilience of the WTPs

Resiliency of the WTPs is required to ensure reliable essential services to customers despite challenges such as climate change, extreme weather, aging infrastructure and growth. The ongoing development of risk based Asset Management Plans (AMPs), improve treatment resiliency for variable river water quality and shutdown forecasting and planning are required to enhance WTP system resilience into the future.

The WTPs are continuing to enhance their AMPs to ensure that the full useful life of assets are achieved and facilitate prudent capital planning. Developing and maintaining up to date AMPs will continue to be a priority for the WTPs as assets continue to age and to facilitate WTP resiliency, coordination of projects, and capital planning. This will involve prioritizing initiatives for compiling condition of existing assets and planning major inspection of equipment and infrastructure over a five to ten year time horizon.

The WTPs convert from conventional treatment (coagulation with alum addition, flocculation, settling and dual media filtration) to direct filtration (DF) operation during periods of good river water quality normally in the fall and winter. DF requires substantially lower chemical treatment and results in the environmental benefit of significant reduction in solids discharged to the NSR. DF operation has been more challenging in recent years due to variable seasonal river water quality including early spring runoff and sustained high colour through winter months. EWSI continues to explore opportunities to improve residual management for further residual reduction at the WTPs to meet regulatory expectations. Pilot studies have been completed that have shown that converting filters to deep bed could extend the DF season at the E.L. Smith WTP.

Historically, shutdowns at WTPs occur in the winter, particularly at the E.L. Smith WTP. However, non-winter WTP shutdowns are increasing in frequency. Over the past several years, the trend has been an overall increase in the number and duration of shutdowns due to maintenance, condition inspections and capital project work requirements. From 2012-2016, there was an average of around sixteen planned plant shutdowns each year compared to over twenty-two each year from 2017-2019. Based on WTPs asset condition and capital planning, there will be more shutdowns of longer duration required in the future. Shutdown planning is critical to ensure seasonal WTP production and transmission meet customer demand.

The imminent focus is to address and improve operational resiliency and provide for future growth at the E.L. Smith WTP since the plant production provides for a majority of customer demand. The capital plan for the WTPs is based on the following objectives:

1. **Improve Production Resiliency at E.L. Smith:**

It is difficult to support current and future asset management, maintenance, and capital upgrade activities with the restrictive shutdown duration timelines at the E.L. Smith WTP. The main issues are single points of failure and aging infrastructure. It is recommended to continue with process upgrades to improve the redundancy, mitigate single points of failure, and establish operational flexibility. This can be achieved by establishing two fully independent treatment trains to provide additional plant capacity that will enable extended shutdowns to complete rehabilitation upgrades at the E.L. Smith WTP.

Figure 15 illustrates conceptually the two options that are being considered.

Option 1 is to assess the feasibility of splitting the existing WTP processes and infrastructure and identify the additional process upgrades required for two treatment trains. There is potential that existing production demands, shutdown duration restrictions and infrastructure condition will make construction challenging.

Option 2 is to create a new parallel treatment train with proposed newer process technology such as ballasted clarification and membrane filtration. This proposed new train would tie into the existing low lift pumphouses and reservoirs. The new parallel train aligns with the plan for future process technology enhancements and additional capacity upgrades at the WTP.

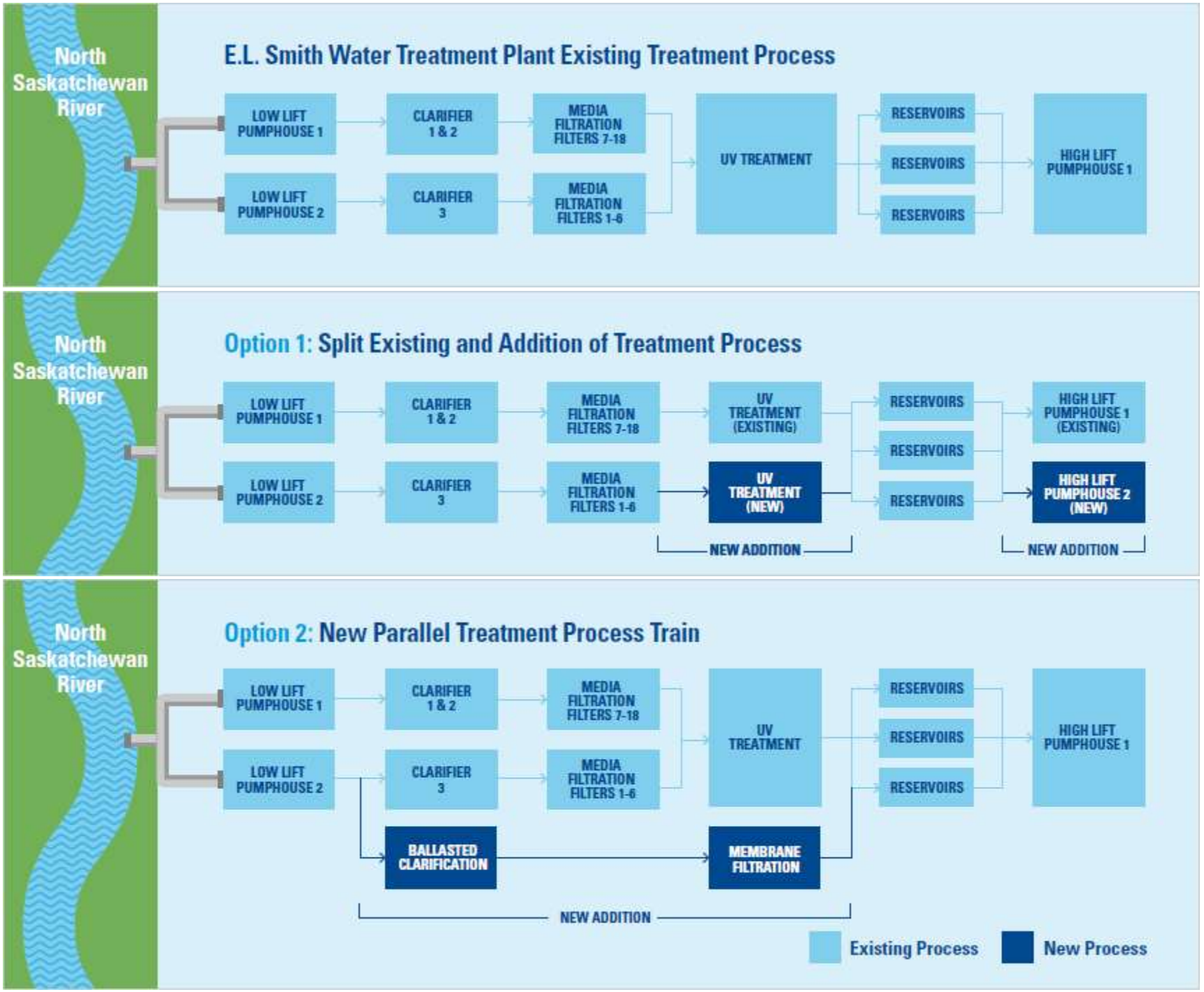

Figure 15: E.L. Smith WTP Existing Treatment Train and Options for Independent Treatment Trains

2. **Improve Production and Treatment Resiliency During Direct Filtration at E.L. Smith WTP:**

Convert existing filters at E.L. Smith WTP to deep bed. Conversion to deep bed filters will allow increased filtration over the entire filter media depth. This will increase filter capacity by extending filter run times and reduce losses due to long filter to waste durations to bring the filter online and frequent filter backwashes. Filter effluent quality will also be improved. Prior to converting filters to deep bed, structural rehabilitation of the 12 older filters (constructed in 1976 and 1984) is required due to existing deteriorating concrete condition and to support the additional media depth.

3. **Improve Energy Efficiency and Environmental Resiliency with Green Energy at E.L. Smith WTP:**

Pending approval, addition of a new solar farm and battery energy storage system (BESS) to generate and store green energy to help power the water treatment and distribution processes at the E.L. Smith WTP. The peak generation capacity of the solar farm is twelve megawatts and its operation will reduce greenhouse gas emissions. A BESS with a capacity of four megawatts will store energy generated by the solar farm and be capable of releasing energy to supply power to the WTP. The BESS will be integrated with the solar farm at the site together with intelligent management controls and is being supported by funding from Natural Resources Canada as part of their Green Infrastructure program.

3.1.3. Long-term Future and Technology Upgrades of the WTPs

In 2018, a Long-term Plan (LTP) was outlined for the Rossdale and E.L. Smith WTPs. This LTP primarily focused on production growth of the WTPs to meet future drinking water demands and water quality challenges to the year 2060. The WTP LTP (Stantec, 2018) was developed based on review of existing WTP operation process capacities, redundancy and site footprint. Future WTP criteria was established by reviewing historical river water quality, assessing the existing plant operation, and anticipating future regulatory, operational, and treatment requirements. The LTP also identified concerns related to plant resiliency and future impacts of climate change on water quality.

This Edmonton WTP's LTP is an input to the WatIRP and helps with projecting the long-term progression of improvements to the WTPs and provides guidance to ensure the WTPs short-term objectives meet current operational and future requirements. The LTP proposed capital upgrades and new technologies at both WTPs. It also outlined a decision tree that includes staged process upgrades with milestone decisions to confirm and align actual customer demand growth to establish capital upgrades over the next 40 years. Additional process upgrades are also needed to increase redundancy, address single points of failure, and improve the resiliency of treatment processes to be robust for the variability of river water quality.

Table 2: Future E.L. Smith and Rossdale WTPs Process Technology Upgrade Options summarizes the existing treatment process and proposed technology upgrades to achieve short-

term and LTP plant treatment objectives. Proposed process technology upgrades such as deep bed filtration and ballasted clarification are being assessed and pilot testing planned for treatment resiliency. Ballasted clarification and membrane filtration are also conceptual treatment processes as part of the option for a new parallel treatment train at the E.L. Smith WTP. Any planned production upgrades at the WTPs will be aligned with corresponding transmission upgrades through the IRP process.

Table 2: Future E.L. Smith and Rossdale WTPs Process Technology Upgrade Options

Existing Treatment Process	Technology Upgrade Options	Type of Improvement	Objective	WTPs Plan
Conventional Clarification	Ballasted Clarification	Capacity	• Increase clarification capacity within existing footprint	• PBR 4 and PBR 5 • Plan for pilot testing at the E.L. Smith WTP to assess treatment resiliency under variable river water quality • Conceptual new process for new parallel treatment train at E.L. Smith WTP
		Technology	• Ability to treat high turbidity	
	Dissolved Air Flotation (DAF)	Technology	• Secondary clarification for protection in event of oil spill in the river and colour removal	• Potential new future process
Conventional dual media filters	Deep Bed Filters (E.L. Smith)	Technology	• Improve and increase duration of DF operation	• PBR 7 • Deep bed filter conversion at the E.L. Smith WTP planned upon completion of filter (Filters 1-12) structural upgrades in PBR 4 – 6
		Capacity	• Additional filtration capacity within existing footprint	
	Conventional Filters (Rossdale)	Capacity	• Additional filtration capacity by retrofitting the stilling basin with new conventional filters	• Potential future expansion of media filters
	Membrane	Capacity	• Maintain existing nine filters • Additional filtration capacity by retrofitting existing filters or new system	• Potential new future treatment process • Conceptual new process for new parallel treatment train at E.L. Smith WTP
Powder activated carbon (PAC)	Advanced Oxidation Processes (AOP)	Technology	• Improve taste and odour control during runoff and to address future regulations changing raw water	• Potential new future treatment process
Residuals Management	New Residuals Treatment Facility	Technology	• Potential future provincial regulatory requirement	• Triple bottom line study didn't justify construction of residual treatment facilities • Treatment facilities are not in current plan • Continue to assess the impacts of the discharges on the river

3.2. System Reservoirs and Booster Stations

EWSI's customers rely on 13 reservoir locations and 7 booster stations throughout the city to ensure adequate water storage and pumping capacity for all of the different pressure zones within the system. EWSI has evaluated water storage and determined that the Edmonton water system currently has adequate storage to meet fire, emergency and daily balancing needs for the utility.

3.2.1. Growth

A number of new reservoirs and booster stations will be required in the future. Future reservoirs are planned to service developments in the southeast (PBR 6), southwest (future PBR) and northeast (future PBR) Edmonton regions outside Anthony Henday Dr. to meet growth and reliability needs. New booster stations are planned to service future development in west Edmonton, and possibly northeast Edmonton. The timing of this infrastructure will be driven by the pace and direction of development.

3.2.2. Life Cycle / Reliability

The reservoirs and booster stations are an essential part of the transmission network and play an important role in maintaining service reliability during high demand periods, fire fighting, plant shutdowns, transmission main breaks, and for maintaining the overall water quality of the system. A majority of the existing reservoirs and booster stations have been operational for more than 30 years. Condition inspections and rehabilitation are necessary to ensure asset and system reliability. It is challenging to take these facilities out of service for extended periods of time for maintenance and upgrades. There is currently a 10-year planning cycle for reservoir shutdowns, asset maintenance and major upgrades.

In the upcoming PBR 5, EWSI is continuing with asset management condition inspections and plans to prioritize reservoir rehabilitation. A majority of the reservoir upgrades planned are for structural rehabilitation and roof replacements to extend asset service life and mitigate leakage of contaminants into the reservoirs. Based on available asset management information, E.L. Smith WTP Cell 2 reservoir is high priority for roof replacement and structural rehabilitation. There are also various upgrade programs to address end-of-life equipment replacement, efficiency and reliability improvements of electrical, mechanical, and site facilities.

3.3. Water Transmission System

The existing water transmission system in Edmonton consists of approximately 553 km of water mains, which range in size from 350 mm to 1500 mm in diameter. The vast majority of these mains were installed after 1950 and consist of a wide variety of materials, with shifting standards and installation methods used throughout the years.

3.3.1. Growth

EWSI's Transmission Master Plan (TMP) for the transmission system expansion included the City's recent south annexation (2019) and was aligned with recent *City Plan* population projections. Expansions to the transmission system in greenfield areas are funded by the Private Development Transmission Mains capital program. While growth of the transmission and

distribution system may be affected by reduced private development activities due to current market conditions in Edmonton in PBR 5, this is not considered a long-term trend.

Transmission extension based on greenfield construction is planned in the west, southeast, southwest and northeast, primarily outside Anthony Henday Drive for PBR 5. A notable project is the proposed construction of a new transmission main in southeast Edmonton (QE2/41 Ave. SW Transmission Main Crossing project). This transmission main will provide zone redundancy, reduce risk of transmission failure, improve fire flows and peak hour pressures, and provide a foundation for growth of the annexation area east of Highway 2 and south of 41 Ave. SW.

3.3.2. Life Cycle / Reliability

Transmission main breaks generally have a higher consequence of failure as compared to distribution mains, due to the larger volume of water that would be expected to escape from a ruptured pipe. Other impacts include longer repair times based on failure mode and familiarity with the pipe material, greater potential impact to customers and hydraulic impacts to the water network and higher potential for flood damage and environmental impact due to a large volume release of chlorinated water. As EWSI's transmission facilities age and reach end of service life, it is anticipated that more main breaks will occur.

To mitigate the risk of transmission main failure, a risk based AMP evaluating likelihood of failure (LoF) and consequence of failure (CoF), was completed for all transmission infrastructure (Figure 16: Transmission Risk Map). The LoF assessment was completed using deterioration models based on historical break data. The CoF assessment compared the impact of a pipe failure on six categories (health and safety, environment, reputation, regulatory, financial, and operational), with environmental and operational impacts having the highest weighting. An overall risk ranking for each transmission main was then calculated by combining the LoF and CoF scores, which resulted in a risk ranking prioritization of 1 (low) to 5 (high).

This risk ranking allowed the prioritization of capital and operating expenditures by focusing spending on the highest-risk mains. Capital programs to mitigate the risk of transmission main failure include programs to inspect, rehabilitate, and replace transmission mains. Operational programs to mitigate risk include optimization of the critical spare parts inventory, preventative maintenance, operational best practices, and the development of emergency response plans.

The investment in existing transmission mains will become more targeted based on the findings of the AMP and a proposed Critical Transmission Main Inspection program in PBR 5. This new program will complete inspections of high risk mains to proactively identify deteriorated sections. The proposed Transmission Mains and Appurtenances program will fund the rehabilitation and replacement of the deteriorated mains identified by the inspection program.

Investment is also required to ensure EWSI can meet its Franchise Agreement driven water main relocations for the City. EWSI's LRT Relocations program is proposed to be continued for the 2022-2026 term to continue to accommodate water relocations to accommodate the track for the west phase of the LRT.

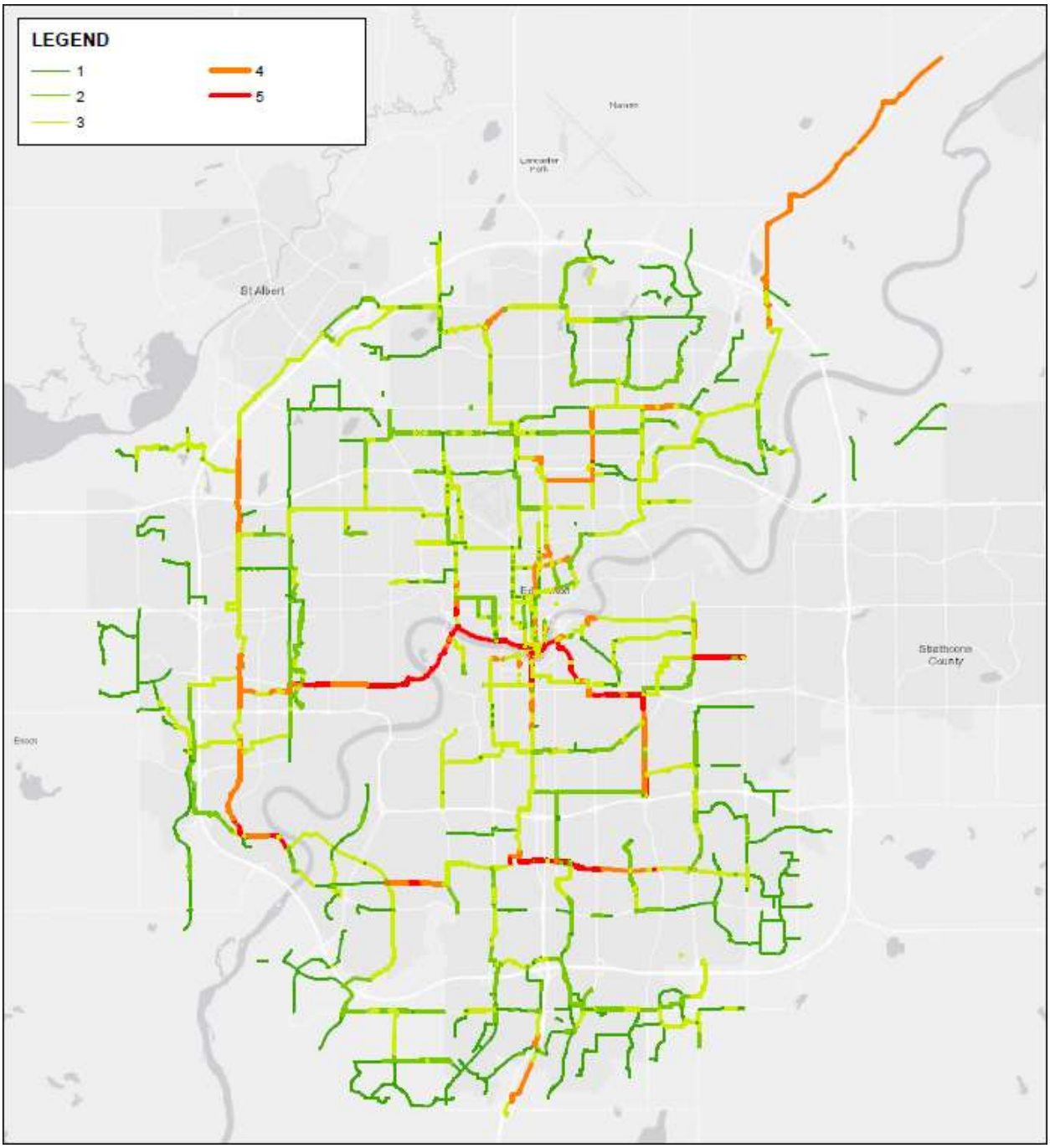

Figure 16: Transmission Risk Map

3.4. Water Distribution System

The existing water distribution system in Edmonton consists of approximately 3,613 km of water mains, which range in size from 20 mm to 300 mm in diameter.

3.4.1. Growth

Growth of the distribution system is facilitated by the Private Development Construction Coordination program (PDCC), Water Main Cost Sharing program (WMCS) and the Infill Fire Protection program (IFFP). The PDCC program is managed by EWSI to cover internal costs relating to engineering drawing reviews, consultant and developer meetings, private development inspections, and other administrative work related to private development. WMCS program is managed by EWSI to provide a rebate to developers for a portion of water main material costs for water mains with diameter 300 mm to 400 mm.

Historically, infill developers have provided all of the water infrastructure required to serve a new development or upgrade an existing area. IFFP is based on a cost share approach and recognizes that some upgrades that improve fire protection in established areas benefit the entire neighbourhood. The agreement provides a methodology to share costs between infill developers, ratepayers, and the City's Fire Rescue Services department. EWSI worked closely with the City of Edmonton and the Infill Development in Edmonton Association (IDEA) in developing this cost share approach, which was presented to City Council's Urban Planning Committee on June 25, 2019.

A pilot project for the IFFP was implemented for 2020 and 2021 by allocating funds from existing infrastructure renewal programs ($1.2 M for each of the pilot program years) to accommodate this pilot project. In PBR 5, $10 M has been proposed for this program.

3.4.2. Life Cycle / Reliability

Approximately 90% of all water main breaks occur on the cast iron portion of the distribution system. Due to investment into cast iron water main replacement, and changing weather patterns, cast iron main breaks have been drastically reduced. EWSI has replaced or rehabilitated approximately 50% (570 kilometers) of the cast iron water main within Edmonton. After reaching a seven-year high of 585 breaks in 2009 (Figure 17: Historical Cast Iron Water Main Breaks), in recent years that number has significantly dropped to less than half of the peak.

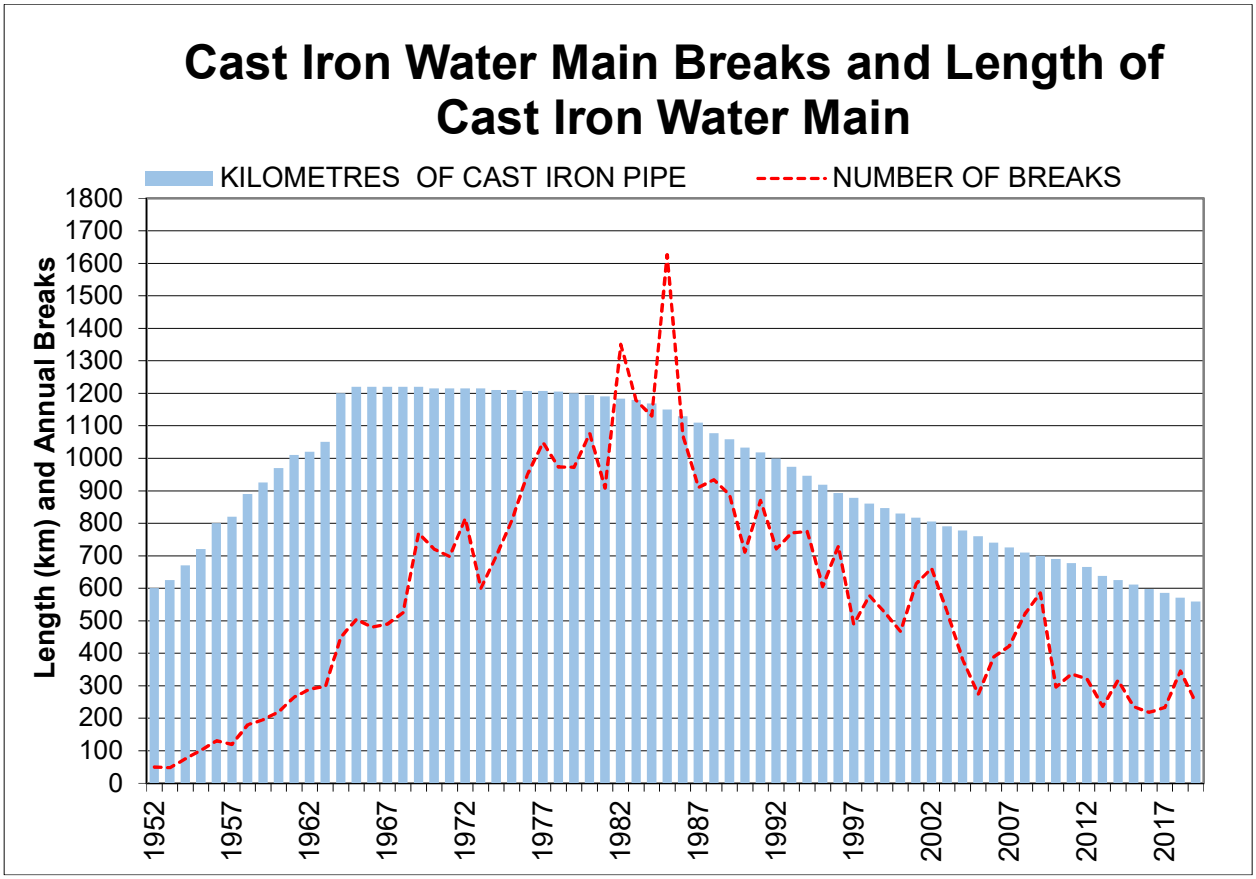

Figure 17: Historical Cast Iron Water Main Breaks

An AMP based on calculating risk of failure by assigning LoF and CoF for each distribution main in the system was also completed (Figure 18: Distribution Risk Map). This risk prioritization has informed the distribution main renewal programs in PBR 5 and beyond. The majority of the highest risk distribution mains are cast iron mains clustered in the core and mature areas of the city.

The consolidation of the PBR 4 distribution renewal programs based on CoE paving programs, end of life and risk based renewals into the Risk Based Renewal program, is proposed in PBR 5. This will ensure that distribution renewal capital is optimized to replace the deteriorated mains which are the highest risk of failure. Coordination with the City's Building Great Neighbourhoods will continue to be a selection criteria consideration of the Risk Based Renewal program, however only those mains at end of service life will be eligible for replacement.

To reflect the current low distribution breaks, reduced spending for the Risk Based Renewal program has been proposed for PBR 5.

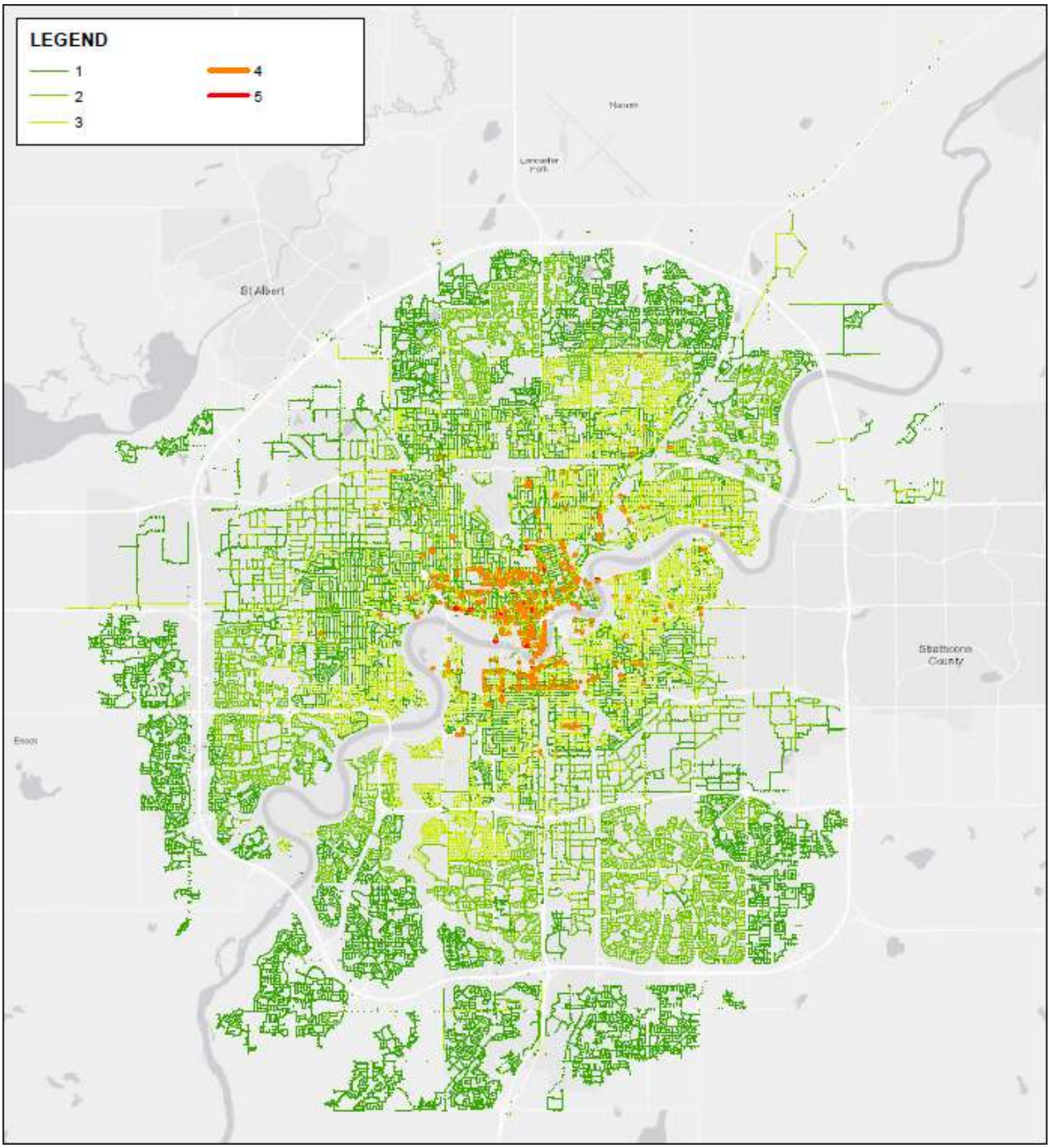

Figure 18: Distribution Risk Map

3.5. Services

The Water Services Replacement and Refurbishment program has been expanded to replace lead services to residences that test above Health Canada's new lead maximum acceptable concentration (MAC) of 5 µg/L. Accelerated lead service line replacements are a component of EWSI's Lead Mitigation Strategy.

3.6. Metering

Currently there are two different technologies used to obtain meter reads for customer water consumption. These technologies are manual reads via a touchpad device and radio frequency reads. Both of these technologies necessitate the requirement of a meter reading team that completes routes via walking or driving on a daily basis to ensure up to date consumption for billing. These processes are both manual and inefficient. The current equipment and software systems used for meter reading are at end of life and there is a high and ever increasing risk that these systems could fail. Additionally, meter readers face a number of safety risks on a daily basis as they enter into private premises and incidents are common.

Due to the current unreliable and unsafe state of meter reading, EWSI analyzed a number of different technologies to determine the best strategy to ensure safe, reliable, and accurate meter reading. Through thorough qualitative and quantitative analysis, EWSI is proposing moving to Advanced Metering Infrastructure (AMI) as EWSI's meter reading strategy and will result in an AMI deployment project in EWSI's PBR 5. AMI technology is already used by EPCOR Distribution & Transmission Inc. (EDTI) and EWSI will leverage EDTI's existing infrastructure.

4. Proposed Projects

4.1. Capital Plan Overview

EWSI's capital plan will continue to include investments to ensure the continued supply of safe and reliable water services and to allow the water plants and distribution and transmission system to reliably meet customer demands now and into the future.

Overall, total gross capital expenditures for PBR 5 are proposed to be lower than the PBR 4 period. EWSI has prioritized and selected the most critical upgrades for PBR 5 during the economic downturn in order to mitigate rate impacts to customers. This is not without risk as postponing upgrades to aging infrastructure could result in higher risk of asset failure, higher future upgrade costs, and higher operational costs. Risk based asset management will continue and reprioritization of the capital portfolio to address high risks will occur during the 2022-2026 period.

There will be a continued focus on Reliability / Life Cycle requirement-driven projects in PBR 5 (Figure 19: Proposed Capital Expenditure by Category before Contributions (PBR 5)). The Reliability / Life Cycle category accounts for 49% of total planned PBR 5 capital expenditures and reflects the increasing number of existing capital assets projected to reach end of life.

It should be noted that the PBR 5 capital expenditures are forecasted numbers. The capital plans for PBR 5 will be filed as part of EWSI's 2022-2026 PBR Application in early 2021 and therefore are subject to change.

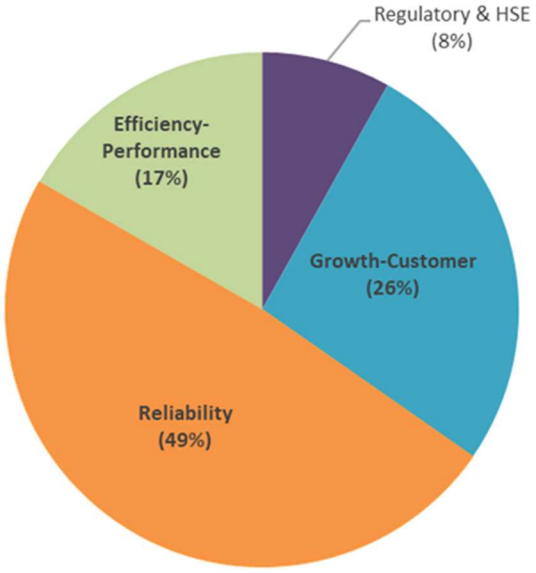

Figure 19: Proposed Capital Expenditure by Category before Contributions (PBR 5)

4.2. PBR 5 (2022-2026) Capital Highlights

Relative to the PBR 4 period, a larger proportion of total gross PBR 5 capital expenditures have been allocated to WTP projects given the increasing age and criticality of the facilities, along with the inability to perform further repair and/or maintenance activities on an increasing number of WTP assets.

Highlights from the draft PBR 5 capital plan are presented below.

4.2.1. Water Treatment Plants

The imminent and future capital plan is focused on improving resilience at the E.L. Smith WTP:

- The initiation of the E.L. Smith Two Train Upgrade project ($9 M in PBR 5 and $24 M in total in future PBRs) to increase operational redundancy to meet short and long term treatment capacity requirements, including future plant expansion.
- The initiation of the E.L. Smith High Lift Pumphouse ($5 M in PBR 5 and $31 M in total) and 5 kV Upgrades/Electrical Room Expansion projects ($5 M in PBR 5) to improve plant reliability, resiliency, and to support future plant expansion.
- The completion of the E.L. Smith Stage 1 Filter Structural Upgrades project ($14 M in PBR 5 and $17 M in total) to address significant structural concrete deterioration within the filter underdrain slab and column, which is at end of life.
- The initiation of the E.L. Smith New Power Feed project to provide redundant power supply from the new Riverview substation ($1 M in PBR 5 and $ 5 M in total in future PBRs).
- The continuation of E.L. Smith and Rossdale Flood Protection projects ($23 M in PBR 5 and $36 M in total) to improve Edmonton's Water Treatment Plant flood resiliency. Two government initiatives have committed grant funding to complete this work: the Provincial

Alberta Community Resilience Program, ACRP, and the Federal Disaster Mitigation and Adaptation Fund, DMAF.

- The completion of the E.L. Smith Solar Power System and Battery Energy Storage System (BESS) projects in early 2022 ($1 M in PBR 5 and $ 43 M in total).

4.2.2. Water Distribution and Transmission

- An Advanced Metering Infrastructure project ($62 M in PBR 5) to more efficiently, timely and safely obtain customer meter reading data. This project will consist of the deployment of AMI devices on all water meters within the city of Edmonton. EWSI's water meter change out program will be eliminated for the lifetime of the AMI deployment project as installations will be done concurrently. The project will also eliminate the ongoing need for the replacement of current meter reading equipment that has reached end of life and is no longer manufactured.
- The distribution Risk Based Renewals program has been proposed to consolidate the PBR 4 distribution renewals programs (based on CoE paving programs, end of life and risk based renewals). Due to low distribution water main breaks, a significant total reduction to the PBR 5 program budget has been proposed ($29 M in PBR 5 vs. $117 M in PBR 4).
- The Water Services Replacement and Refurbishment program has been expanded to include all accelerated lead service replacements, more of which are expected to be completed within the PBR 5 period ($25 M in PBR 5 vs. $16 M in PBR 4). Accelerated lead service line replacements are a component of EWSI's Lead Mitigation Strategy.
- The QE2/41 Ave. SW Transmission Main Crossing project is proposed ($14 M in PBR 5) to allow for growth of the annexation area, provide zone redundancy and reliability, and provide improved fire flows and peak hour pressures.
- A Critical Transmission Main Inspection program ($7 M in PBR 5) has been created to proactively identify deteriorated sections of transmission mains that have been prioritized as high risk. Transmission renewal capital will be focused on the repair/replacement of these identified mains.

4.3. Long-Range Capital Highlights

Total projected gross capital expenditures for future PBR 6 ($679 M) and PBR 7 ($723 M) are expected to be higher than the PBR 5 period due to a combination of moderately-increased customer growth projections beginning in the PBR 6 period (when compared to the PBR 5 period) and the need to complete additional reliability/life cycle projects that were deferred from the PBR 5 period.

5. Community Alignment

Stakeholder understanding and support is critical. EWSI aims to engage in collaborative, transparent and respectful planning that results in permitting, building and operating critical infrastructure in a way that is aligned with the interests and priorities of the communities EWSI operates in, and that meets the needs of society more broadly.

5.1. Public engagement associated with our plans

In order to deliver projects in alignment with the community, we engage the public generally to understand their values related to their utility service but also on specific projects to determine the merit of a project and how we can implement it in a manner that reflects community interests.

5.1.1. High-level Engagement

Stakeholder engagement work associated with the Edmonton Water Treatment Plants focuses on five Shared Outcomes developed with community league committee members. The achievement of the following shared outcomes are a key objective of the Water IRP. The shared outcomes include:

1. **Quality of life:** The plants are operated, maintained and updated in a way that reduces impacts to stakeholders and improves quality of life including noise and enjoyment of parks and recreation.
2. **Safety:** Community, public and worker safety and health are protected.
3. **Relationship**: An honest, transparent, trusting, responsive, supportive and respectful long-term relationship is developed between EWSI and stakeholders.
4. **Environment:** Pollution is prevented and community beautification is considered.
5. **Reliable, Responsible & Sustainable:** Plants are designed, maintained and operated in a prudent and responsible manner.

To refresh EWSI's understanding of the Shared Outcomes above, engagement with stakeholders on their values and concerns is ongoing as part of the PBR 5 application renewal process. Detailed engagement conversations with a range of stakeholders helps EWSI understand what matters to them regarding operations and will help to inform choices around investment going forward. Groups EWSI engages with specifically include but are not limited to: community league groups, Indigenous Communities, large industrial customers, community advisory panels, regional customers, River Valley Alliance, Developers, Infill Development in Edmonton Association, Urban Development Institute and the Edmonton Fire Department.

5.1.2. Project-specific Engagement

EWSI's approach to project-specific public engagement varies based on the initiative. Levels of community engagement are modeled after the CoE's Public Engagement Spectrum (C593) by specifying the level of public influence and commitment from EWSI for various scenarios. Communication is an important factor and is integrated into all levels of the Community Engagement Framework.

EWSI plans to engage stakeholders during the next PBR on a series of proposed projects to inform our project work and approach including:

Risk Based Transmission Main Projects

A variety of transmission main monitoring and rehabilitation projects to reduce risk of failure will be initiated base on criticality. Given stakeholder impacts are expected to be minimal for this work, stakeholder engagement will most likely include reaching out to stakeholders to confirm this

limited impact and then seeking their advice on any further communication or mitigations. If more significant impacts are anticipated, increased stakeholder involvement will occur as early as 2021 during the pre-design phase.

Flood Protection for Water Plants and Assets

As part of the *Climate Change Adaptation Strategy*, EWSI is committed to further protecting water treatment infrastructure from severe river flooding events. EWSI will plan public engagement for surrounding communities depending on results of future assessments and the scope of work required at the sites. If the work is predominantly within existing buildings, engagement will primarily be focused on notification. If the work involves new structures or earth moving, the public will be involved earlier to seek their advice on a range of possible designs or work collaboratively to create potential solutions. Early engagement with indigenous communities associated with this initiative has begun.

E.L. Smith Plant Upgrades

To continue to optimize the function of EWSI's existing assets, a series of upgrades at E.L. Smith WTP are planned, which will include stakeholder engagement starting in early 2021. Two treatment trains, high lift pumphouse expansions, along with a new electrical room, will ensure continued asset management improvements at the plant.

EWSI is working to provide early notification of projects and establish a protocol for involvement of community members in archeological investigations or ground disturbance activity that could impact historical resources at the site.

Rossdale Plant Upgrades

As part of EWSI's work with the CoE to enhance public access to green space in the Rossdale area, EWSI is developing solutions to provide access to green space on top of the underground reservoirs at the north end of the plant. EWSI plans to work with the City and its engagement team to understand what community preferences would be for pathways through this green space while keeping in mind the criticality of the infrastructure beneath it i.e. treated water supply for the city of Edmonton and greater Edmonton region.

E.L. Smith Solar Farm

The proposed E.L. Smith Solar Farm project is part of a broader program by EPCOR to reduce energy needs while at the same time, transitioning to a diverse portfolio of energy sources. It is designed to directly green EPCOR operations with smart grid technology, enhance biodiversity on the project site, and connect Edmontonians to renewable energy and clean water. The solar farm will produce 21,500 MWh of clean electricity, 23% of EWSI's power consumption and reduce its GHG emissions by 20%. The project has been approved by the Alberta Utilities Commission (AUC) and is scheduled for public hearing with the CoE in the fall of 2020.

EWSI conducted a comprehensive public engagement program that met and exceeded the City's Public Engagement Policy and the AUC's Participant Involvement Program. The engagement program notified stakeholders within 2,000 meters of the plant and also included community

workshops, archeological participation and one-on-one interactions. EWSI started to engage the public and indigenous communities on the project in June 2017 and continues to do so.

Lead Mitigation Strategy

The 2019 approval of EWSI's enhanced lead mitigation strategy brings with it a need to coordinate with stakeholders to facilitate efficient lead service line removal from properties. EWSI's lead engagement plan began in 2020 and includes informing customers of the enhanced lead service line removal process and collaborating with them on roll-out plans for their property to make the process as seamless as possible. EWSI is connecting with these specific residents in a number of formats. Virtual home visits, phone calls, door knocking and in-home appointments are being leveraged to discuss and coordinate plans in 2020 and we will look to extend these interactions in 2021 during information sessions and CoE led neighbourhood renewal open houses.

5.2. Alignment with the City of Edmonton's Strategic Plan & Values

The CoE has defined a vision for physical growth within the municipality to accommodate an increase in its physical size and a doubling of the population (2 million) through higher density development in redevelopment areas at nodes and along corridors. The Edmonton WatIRP aligns with this vision and also the **City Plan's Values to live, thrive, preserve**.

Table 3: The City Plan Values

City Plan Value and Outcome	Intention	How We Align
Value: Live. 2.3 Edmonton's growth and development mutually benefit the city and region.	Intention 2.3.1: Promote opportunities to accommodate growth through the compact development of new and existing neighbourhoods.	Direction 2.3.1.4: Strategically expand infrastructure capacity to enable future redevelopment and intensification in alignment with priority growth areas. **WatIRP Projects:** Infill Fire Protection Program, Risk Based Renewal Program, Transmission Mains & Appurtenances Program
	Intention 2.3.2 Ensure that growth is managed with regard to long term fiscal impacts and full lifecycle costs of infrastructure and services	Direction 2.3.2.1: Align the capital and operation budget with growth priorities and budget planning **WatIRP Projects:** Network Private Development Transmission Mains, QE2/ 41 Ave. Transmission Main Crossing
Value: Live. Outcome 2.4: Edmonton is a leader in efficient, sustainable	Intention 2.4.2: Ensure public building and infrastructure are sustainable and resilient	Direction 2.4.2.1: Manage the impacts of climate change on assets in the design,

and resilient community design, development and living.		maintenance and retrofit of buildings and infrastructure Direction 2.4.2.2: Enable green energy generation and distribution systems **WatIRP Projects:** Flood Protection for Water Treatment Plants, Solar Power and BESS at E.L. Smith WTP
Value: Thrive. Outcome 3.1: Edmontonians acknowledge and celebrate Indigenous heritage while honoring the diverse cultures, perspectives and experience residents bring from around the world	Intention 3.1.1 Support the ability of First Nations Metis and Inuit peoples to celebrate, grow and flourish	Direction 3.1.1.2: Integrate the perspectives on Indigenous peoples through community engagement and reduce barriers to participation **Water IRP Projects:** Engagement work associated with E.L. Smith and Rossdale Plant Upgrades along with Flood Protection for Water Treatment Plants
Value: Preserve Outcome 5.4: Edmonton's natural and physical systems provide security and resilience against extreme weather events and other environmental hazards.	Intention 5.4.1: Ensure the safety and security of Edmonton's water supply, food systems, infrastructure and natural systems to support long term resilience to flooding, drought and extreme weather events.	Direction 5.4.1.2: Improve flood resilience through ongoing risk management, infrastructure planning and operation, financial analysis and stakeholder engagement. Direction 5.4.1.3: Manage and protect the watershed and water supply to maintain the quality of Edmonton's drinking water supply **Water IRP Projects:** Integrated Watershed Management Strategy and Source Water Protection Plan, Watershed Monitoring Program, Climate Change Adaptation Strategy, Flood Protection for Water Treatment Plants

6. Conclusion

The Edmonton municipal water system has been reliable in providing potable water despite the highly variable water quality in the sole supply source, the North Saskatchewan River. Moving forward, a heightened focus on resiliency is required as aging infrastructure and more frequent and extreme weather events could impact our operation. EWSI will be closely monitoring the municipal water supply system, the environment and our community to be adaptive and agile in our ever-changing environment.

7. References

City of Edmonton, 2019. Draft City Plan.

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Water Research Foundation, 2016. Risk Governance: Achieving Value by Aligning Risk Governance with Other Business Functions in Water Utilities.

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Appendix A: Acronyms

Acronym	Description
ACRP	Alberta Community Resilience Program
AEP	Alberta Environment & Parks
AMI	Advanced Metering Infrastructure
AMP	Asset Management Plan
AOP	Advanced Oxidation Processes
AUC	Alberta Utilities Commission
BESS	Battery Energy Storage System
CoE	City of Edmonton
CoF	Consequence of Failure
DAF	Dissolved Air Flotation
DF	Direct Filtration
DMAF	Disaster Mitigation and Adaptation Fund
DWSP	Drinking Water Supply Plan
EDF	Extended Direct Filtration
EDTI	EPCOR Distribution & Transmission Inc.
EWSI	EPCOR Water Services Inc.
HSE	Health, Safety, and Environment
IDEA	Infill Development in Edmonton Association
IFFP	Infill Fire Protection
IRP	Integrated Resource Plan(ning)
LoF	Likelihood of Failure
LRT	Light Rail Transit
LSL	Lead Service Line
LTP	Long-term Plan
MAC	Maximum Acceptable Concentration
NSR	North Saskatchewan River
PAC	Powdered Activated Carbon
PBR	Performance Based Regulation
PDCC	Private Development Construction Coordination
QE2	Highway 2
RES	Reservoir
RWCG	Regional Water Customer Group
SanIRP	Sanitary Integrated Resource Plan
SIRP	Stormwater Integrated Resource Plan
SW	Southwest
TMP	Transmission Master Plan
USA	United States of America
UV	Ultraviolet
WatIRP	Water Integrated Resource Plan
WMCS	Water Main Cost Sharing
WTP	Water Treatment Plant